Oct. 26, 1954 E. M. SMITH 2,692,446

DRIVE MECHANISM FOR ENDLESS CHAIN DITCH DIGGERS

Filed May 9, 1949 5 Sheets-Sheet 1

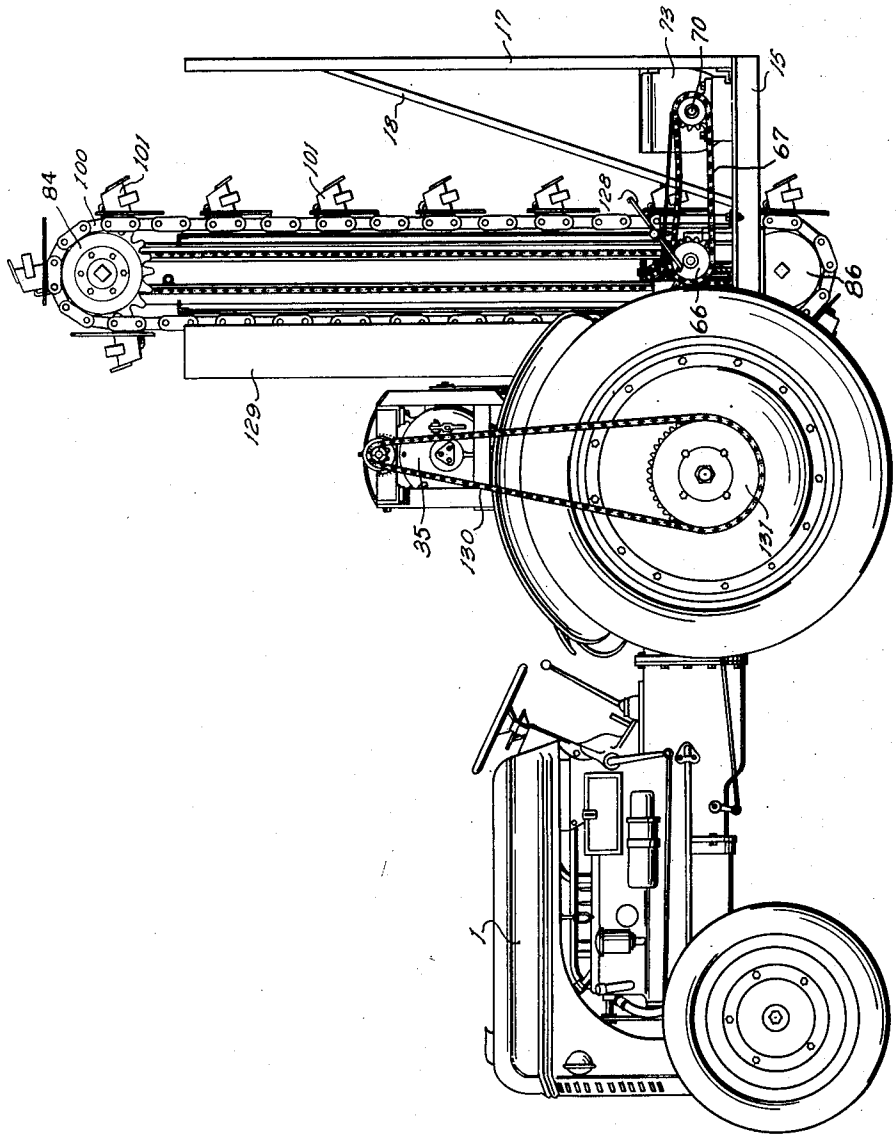


Fig. I

INVENTOR.
ESTILL M. SMITH
BY
Howard E. Moore
ATTORNEY

Oct. 26, 1954 E. M. SMITH 2,692,446

DRIVE MECHANISM FOR ENDLESS CHAIN DITCH DIGGERS

Filed May 9, 1949 5 Sheets-Sheet 2

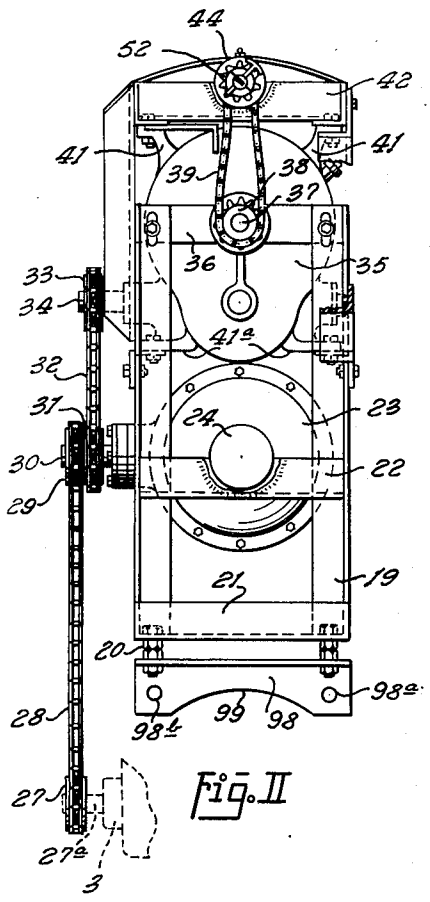


Fig. II

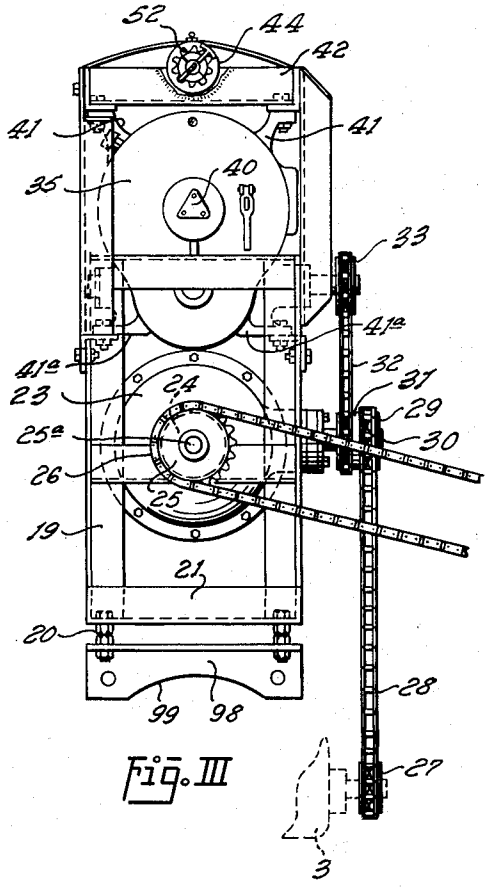


Fig. III

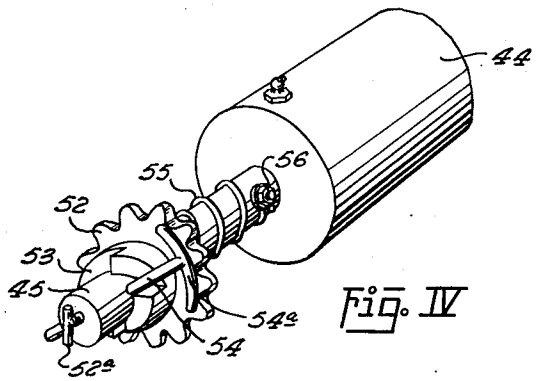


Fig. IV

INVENTOR.
ESTILL M. SMITH
BY
Howard E. Moore
ATTORNEY

Oct. 26, 1954 E. M. SMITH 2,692,446

DRIVE MECHANISM FOR ENDLESS CHAIN DITCH DIGGERS

Filed May 9, 1949 5 Sheets-Sheet 3

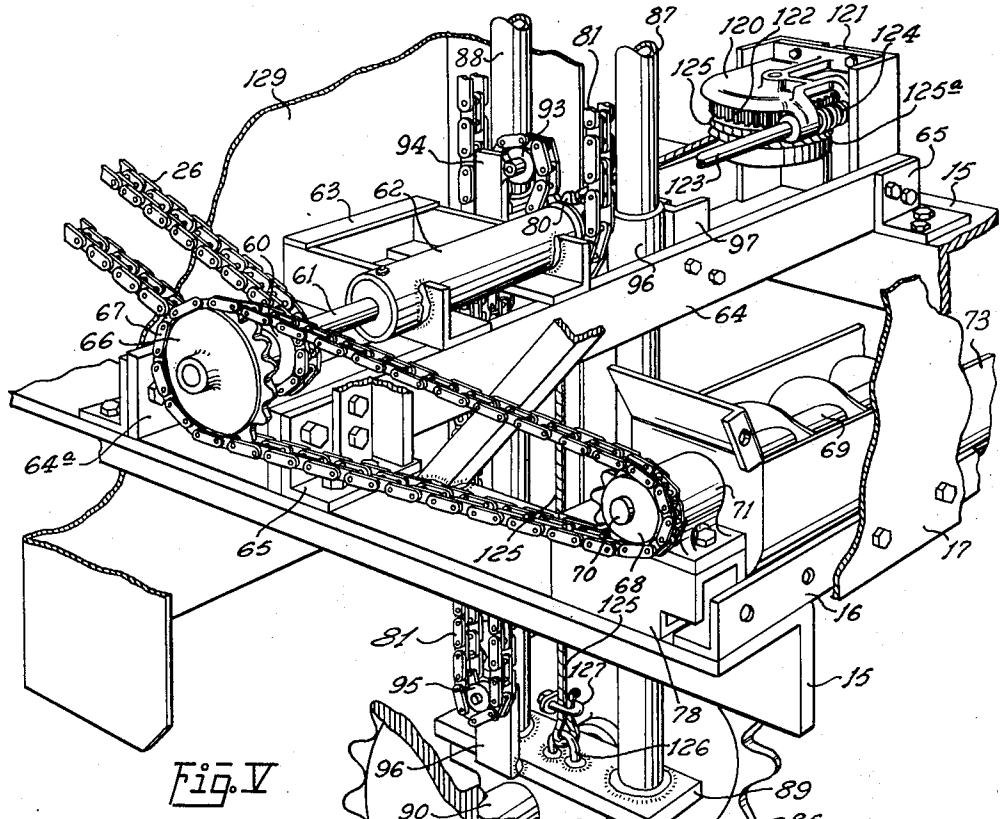


Fig. V

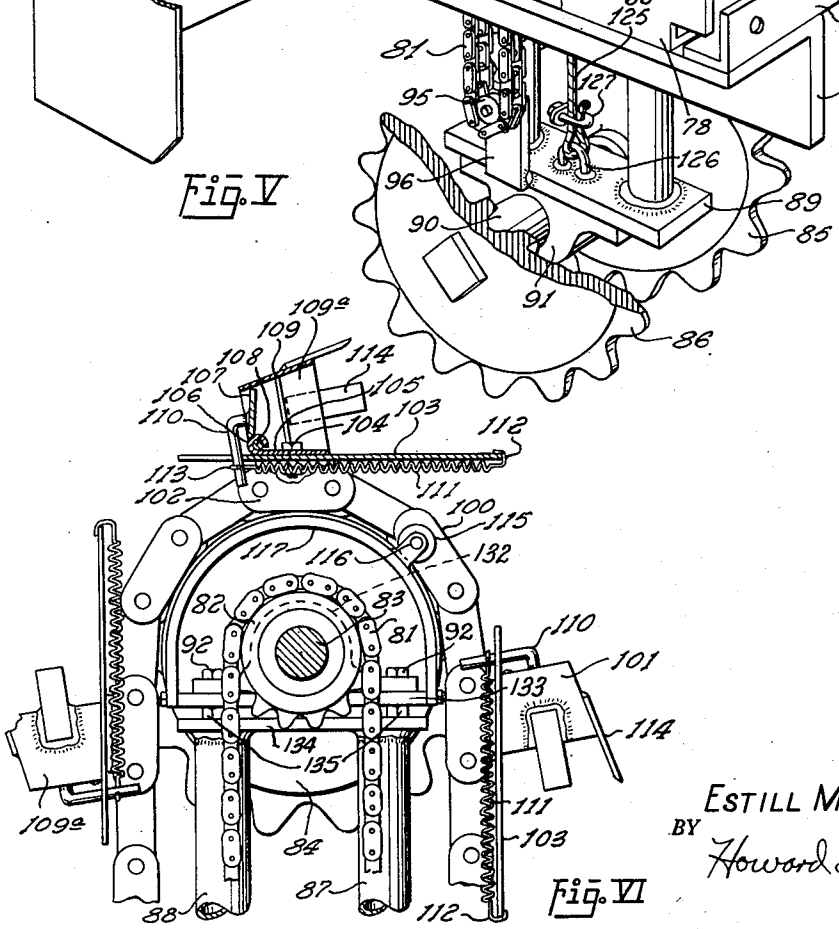


Fig. VI

INVENTOR.
ESTILL M. SMITH
BY Howard E. Moore
ATTORNEY

Oct. 26, 1954 E. M. SMITH 2,692,446

DRIVE MECHANISM FOR ENDLESS CHAIN DITCH DIGGERS

Filed May 9, 1949 5 Sheets-Sheet 4

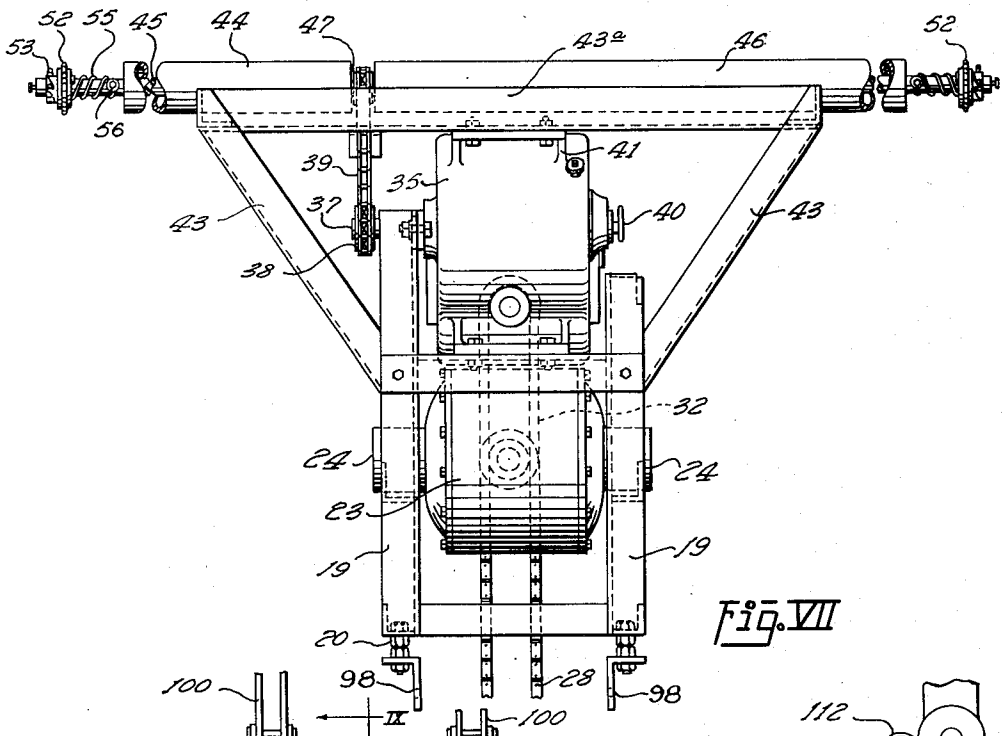


Fig. VII

Fig. VIII

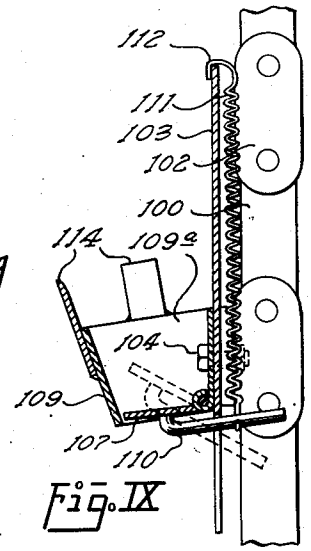


Fig. IX

INVENTOR.
ESTILL M. SMITH
BY
Howard E. Moore
ATTORNEY

Oct. 26, 1954 E. M. SMITH 2,692,446

DRIVE MECHANISM FOR ENDLESS CHAIN DITCH DIGGERS

Filed May 9, 1949 5 Sheets-Sheet 5

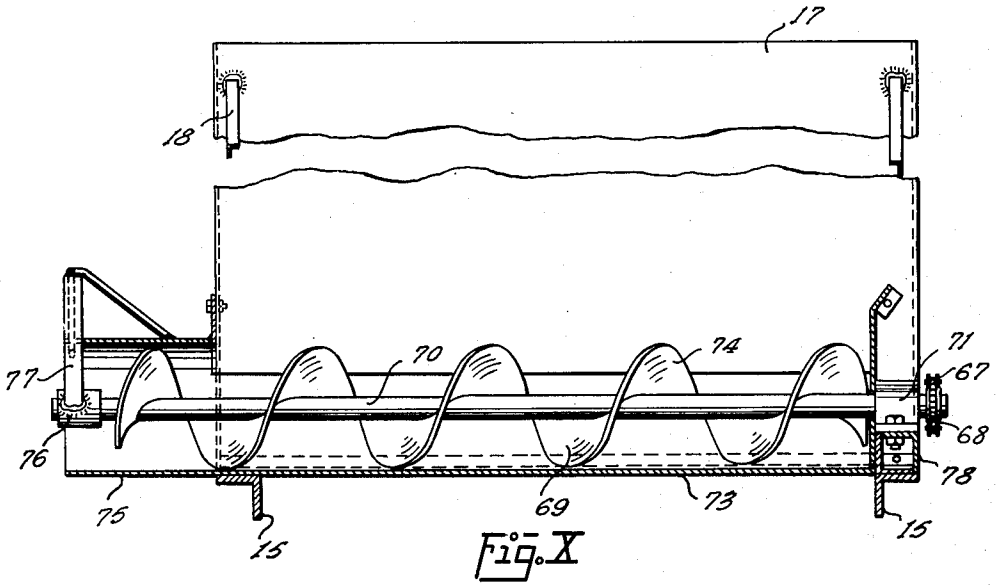


Fig. X

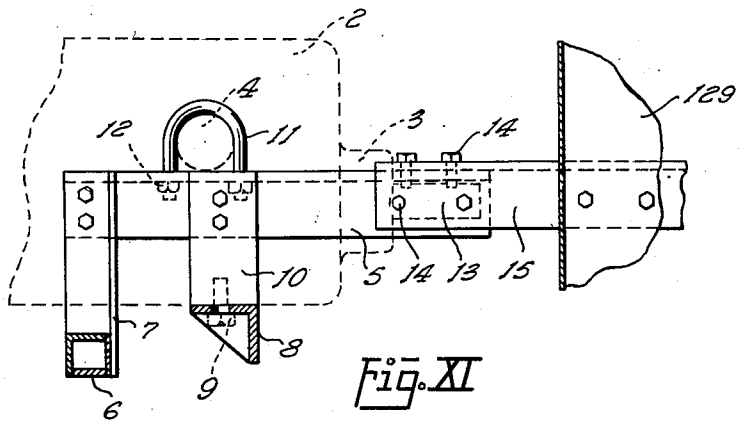


Fig. XI

INVENTOR.
ESTILL M. SMITH
BY Howard E. Moore
ATTORNEY

Patented Oct. 26, 1954

2,692,446

UNITED STATES PATENT OFFICE

2,692,446

DRIVE MECHANISM FOR ENDLESS CHAIN DITCH DIGGERS

Estill M. Smith, Dallas, Tex.

Application May 9, 1949, Serial No. 92,160

4 Claims. (Cl. 37—86)

1

This invention is concerned with a ditch digger and particularly with the bucket type of ditch digger, which may be detachably mounted to a standard tractor or other vehicle adapted to carry it.

Ditch diggers which have previously been known and used in this art have usually been comprised of a bucket-carrying conveyor mounted on a frame, which frame is pivotally mounted on the vehicle carrying the ditch digger, so that the buckets were maintained in digging position by virtue of the frames swinging about the pivot point by force of gravity, thus allowing the buckets to maintain contact with the ground being dug. As a result, the frame, and the buckets carried thereby, swung in an arc, and the digging mechanism was not maintained in a true vertical position.

Another feature usually found in these old type ditch diggers was a conventional sprocket or pulley provided for rotation of the conveyor mechanism, carrying the buckets, which sprockets were operatively connected to the power take-off of the machine carrying the ditch digging mechanism by means of a cable or belt, so that when the ditch digger was raised or lowered, it was necessary to raise and lower the driving sprocket and the chain with it, with the consequence that it disturbed the tension of the chain and caused the ditch digger to operate defectively.

These old devices are ordinarily cumbersome and unwieldly.

The present invention is intended to overcome these defects in prior devices and to provide a simple and compact ditch digging machine which may be detachably mounted to any standard tractor, and may be driven from the rear power take-off of the tractor.

Among the objects to be realized by this invention, in addition to the foregoing, may be found the following:

1. To provide ditch digging mechanism adapted to be detachably mounted on the back of a tractor, driven by the power take-off of the tractor and maintained in true vertical position at all times while it is being lowered during a ditch digging operation.

2. To provide means whereby the driving chain, which drives the drive sprocket and drive chain for the bucket carrying conveyors in a ditch digger, is not displaced and is maintained at the same tension while the bucket carrying conveyor mechanism is being raised and lowered.

3. To provide mechanism and means for allowing the raising and lowering of the bucket-carrying conveyor mechanism in a ditch digger, together with the drive chain or pulley for such mechanism, without moving or disturbing the driving mechanism which rotates the bucket-carrying conveyors.

2

4. To provide mechanism and means in a ditch digger whereby the power take-off of a tractor, which drives the bucket-carrying conveyors of the ditch digger, is also geared through proper gearing arrangement with the rear wheels of the tractor, or other vehicle carrying the ditch digger, whereby the forward or rearward movement of the tractor may be properly synchronized with the rotation of the bucket-carrying conveyors. This is provided for the reason that the lowest driving gear of a tractor is too fast for the proper speed of rotation of a ditch digger. A ditch digger must necessarily move relatively slow in order to dig the ditch at a proper depth.

5. To provide such a gearing arrangement whereby the driving force for the rear wheels of a tractor is transmitted through a transmission having a clutch associated therewith, whereby the rear wheels of a tractor may be thrown out of gear or the gear ratio driving same may be changed, and the rotation of the bucket-carrying conveyors will not be disturbed, and whereby the tractor may be made to move in reverse and not affect the rotation of the ditch digger.

6. To provide ratchet mechanism in connection with the driving mechanism for the rear wheels of the tractor to permit the tractor to turn while digging a ditch and not disturb the rotation of the bucket-carrying conveyors of the ditch digger.

7. To provide a digging bucket in a ditch digger with a pivotally mounted bottom therein adapted to be automatically pushed inward at the top of its rotation to expel dirt from said bucket.

Other and further objects of this invention will become apparent by referring to the drawings and the detailed description thereof, which follows hereinafter.

A preferred embodiment of my invention is shown in the attached drawings in which:

Fig. I is a side elevational view of my invention attached to a standard tractor.

Fig. II is a side elevational view of the gear reduction box and auxiliary transmission, with the driving means associated therewith.

Fig. III is a side elevational view taken from the opposite side of Fig. II.

Fig. IV is one of the driving sprockets, with

the ratchet associated therewith, which drive the rear wheels of the tractor.

Fig. V is a perspective view, partially cut away, of the lower end of the bucket-carrying conveyors and driving means therefor, showing the winch provided for raising the bucket-carrying conveyor mechanism, and the spirial conveyor which carries dirt to the side of the ditch while the ditch digger is in operation.

Fig. VI is a fragmentary, partially sectionalized, view of the upper portion of the bucket-carrying conveyor, with the drive chain therefor, and showing one of the buckets and the mounting therefor, in cross section.

Fig. VII is a rear elevational view of the gear box and auxiliary transmission and also showing the drive shaft, with sprockets attached thereto, which drive the rear wheels of the tractor.

Fig. VIII shows a front elevational view of one of the digging buckets with the mounting plate therefor attached thereto.

Fig. IX is a cross sectional elevation of a bucket, showing the bottom side tripping mechanism therefor.

Fig. X is a side elevational view of the spiral conveyor used to convey the dirt to the side of the ditch being dug, with the casing therefor being sectionalized.

Fig. XI is a fragmentary, partially sectionalized, elevational view of the means for detachably mounting the ditch digger to the rear end of a tractor.

Numeral references are used to designate the various parts of the invention illustrated in the drawings, and like numerals are used to designate like parts.

The numeral 1 designates a standard tractor which is suitable for attachment of the invention thereto. The tractor 1 has a rear differential housing 2, and a power take-off 3 extending from the rear of such housing. The tractor 1 also has a rear axle housing 4, which extends laterally from each side of the housing 2.

A mounting frame 5 is positioned on each side of the differential 2, which mounting frame takes the form of an angle member, and provides means for attaching the ditch digging frame to the tractor. The box-shaped member 6, which extends underneath the differential housing, is attached to the transverse member 5 on each side of such housing by means of a vertical angle bracket member 7. There is also an angle member 8 which extends underneath the differential housing 2 and is securely held to the underside of the housing by means of the machine bolts 9, and is joined to the members 5 on each side of the differential housing 2 by means of the vertical angle members 10.

The U-bolt 11, of which there is one on each side of the differential housing 2, extends around the rear axle housing 4 and is secured to the angle member 5 by means of the nuts 12, which hold the U-bolt to the angle member 5.

All of the above recited construction provides a mounting to which the frame for the ditch digger may be detachably mounted.

A coupling 13 is provided between the mounting brackets 5 and the side frame members 15 for the ditch digging mechanism. This coupling 13 is made up by the sliding engagement of the angle members 5 and the side frame angle members 15, and the bolts 14 pass through the two members 5 and 15 and securely hold them together.

It is to be understood that the coupling 13 and the member 5 and 15 are duplicated on each side of the tractor. The horizontally disposed, rearwardly extending, members 15 provide a base frame for the ditch digger and the driving mechanism therefor. One of these angle members 15 extends from the coupling 13 on each side of the ditch digger to the rear thereof, and they are joined at their rear ends by the angle member 16. Attached to the cross member 16 is the shield plate 17, which extends up behind the dirt discharge conveyor 69 to a point near the top of the bucket conveyors, and is braced by the angle brace members 18 which are attached near the top thereof, and to the members 15 on each side of the ditch digger.

The shield deflector 17 deflects dirt expelled from the buckets 101 into the dirt expelling conveyor 73.

The frame for the gear reduction housing 23 and the auxiliary transmission housing 35 consists of four upright frame members 19, one of which is positioned at each corner of the frame making up the support for the gear reduction housing and auxiliary transmission housing, and these upright members 19 are joined together and braced by means of the transverse brace members 21, 22 and 36, which transverse members are duplicated on each side of the frame for the gear reduction housing and the auxiliary transmission housing. Said frame rests on, and is supported by the base members 98, on each side thereof by means of the bolts and nuts 20 positioned at each corner of the said housing.

The members 98 are cut out as indicated at 99, at the point where they rest on the lateral extensions of the rear differential housing for the tractor, so that the cut-out portion conforms to the shape of the rear differential housing extension, and thus provides a firm mounting for the gear box and auxiliary transmission mounting frame. The base frame members 98 are secured to the rear differential housing 2 by machine bolts (not shown) which pass through the holes 98*a* and 98*b* therein and through corresponding threaded holes provided in the sides of the rear differential housing 2.

A gear box housing or transmission 23 has appropriate gearing therein for the purpose of reducing the gear ratio between the rear power take-off of the tractor and the drive sprockets for the ditch digger mechanism. The gear box or transmission 23 is ordinarily designed to reduce the gear ratio, but it may also be designed to increase the gear ratio or to merely transmit power in the same ratio. This is a conventional gear box and it is not deemed necessary to illustrate the interior details thereof. This gear box housing 23 is supported on its frame by means of the circular extensions 24 on either side thereof, which circular extensions are welded, or otherwise suitably attached, to the cross braces 22 on either side of the frame.

A suitable shaft 30 extends into this housing for the purpose of turning the gears therein.

The shaft 25*a* extends into the housing 23 and is attached to, and turns, the sprocket 25, which sprocket 25 in turn drives the chain 26. The chain 26 drives the bucket conveyor mechanism in the manner which will be hereinafter described.

Returning to the initial driving mechanism, the sprocket 27 is secured to a drive shaft 27*a*, extending from the rear power take-off 3 of the tractor, and is adapted to turn with the said drive shaft when it is rotated. The drive

sprocket 27 drives the drive chain 28 which extends around it, which drive chain also extends around the sprocket 29. The sprocket 29 is rigidly attached to the rotatable shaft 30, which shaft extends into the gear reduction housing 23, and thus turns the gears therein and thereby the shaft 25a and sprocket 25.

Another sprocket 31 is attached to the shaft 30 and drives the chain 32, which chain in turn extends around the sprocket 33 and drives same. The sprocket 33 is secured to the shaft 34 and rotates it. The shaft 34 extends into the auxiliary transmission 35 and rotates a gear disposed on the inner end thereof (not shown).

The auxiliary transmission housing 35 is secured to, and supported by, the transverse supporting braces 36, which supporting braces are secured at either end to the upright frame members 19, and are duplicated on each side of the frame for the gear box and auxiliary transmission. The auxiliary transmission is further held and supported to the frame therefor by means of the brackets 41 at the top, which are duplicated on each side of the frame; and said auxiliary transmission is further secured to the frame thereof by means of the lower brackets 41a, which brackets are duplicated on each side of the frame.

The axle 37 extends from the auxiliary transmission housing on one side thereof, and the gear 38 is attached thereto and adapted to rotate therewith. The gear 38 and the chain 39, drive the sprocket 47, which sprocket 47 is attached to the shaft 45 and rotates it.

A suitable gear shift 40 is provided for the auxiliary transmission 35, so that the auxiliary transmission is provided with three forward speeds, and a reverse, or it may be entirely disengaged by the gear shift so that the shaft 45 will not rotate, and forward or rearward movement of the tractor will be stopped.

This auxiliary transmission is provided so that the forward or rearward movement of the tractor is driven off of the same power take-off of the tractor that the ditch digging mechanism is driven from. In this manner the forward or rearward movement of the tractor may be synchronized with the speed of rotation of the ditch digger. The slowest forward gear, and the reverse gear of a standard tractor is too fast for the proper speed of rotation of a ditch digger.

A ditch digger ordinarily has to rotate relatively slow, and should not be moved forward or in reverse very fast, in order to dig a ditch to proper depth. Thus, this auxiliary transmission is provided so that the forward or rearward movement of the tractor may be slowed down through proper gear reduction ratios, and so that the forward or rearward movement may be regulated, and also so that the tractor may be entirely stopped.

The clutch and gear shift mechanism in the auxiliary transmission are conventional in construction, and it is not believed necessary to illustrate them in detail.

The transverse supporting members 42 on the top side of the frame for the gear reduction box 23 and auxiliary transmission 35 are cut out on the upper sides thereof to provide a mounting and support for the cylindrical bearing casing 44 for the driving axle 45. The outer ends of the cylindrical casing 44 are further supported by the angle braces 43 which are attached at their lower ends to the frame members 19 and are attached at their upper ends to the transverse supporting brace 43a.

The shaft 45 is rotatably mounted in the casing 44, and the sprocket 47 is secured to the shaft 45 and rotates same. The casing 44 provides an oil bearing for the rotation of the shaft 45.

On the outer extremities of the shaft 45 are provided the sprockets 52. The sprockets 52 are of special design and construction, the detail of one of which is shown in Fig. IV. As shown, the sprocket 52 has a series of ratchet teeth on the outer face thereof, and is rotatably supported on the shaft 45, so that it loosely slides on the said shaft.

The pin 54, having a winged outer end 54a, slidably passes through the shaft 45 and is secured therein by means of a winged set screw 52a, passing through the end of the shaft 45. The pin 54 protrudes from the shaft on each side thereof and engages the teeth 53 on opposite sides of the shaft 45. The pin 54 thus serves as a pawl for the ratchet-like teeth 53. The winged outer end 54a is conformable to the contour of the shaft 45.

A spring 55 is disposed around the shaft 45 and the inner end thereof is secured to the shaft 45 by means of a bolt passing through the shaft and a nut 56 positioned thereon.

This ratchet gear and spring arrangement is provided in order to compensate for the difference in speed of rotation of the rear wheels of the tractor when the tractor is caused to turn. When turning, the outside rear wheel of the tractor turns faster than the inside wheel. The sprockets 52 drive the sprockets 131 positioned on the outer side of the rear wheels of the tractor through the drive chain 130; and when the tractor is turned, as aforesaid, the outer wheel turns faster than the inner wheel, and the shaft 45 is allowed to be turned faster than the sprocket 52 driving the inner wheel, because the ends of the pin 54 may rotate with the shaft 45 and slide over the teeth 53 by pushing the sprocket 52 inward against the spring tension exerted by spring 55. When the tractor is again turned on a straight course and the rear wheels of the tractor are permitted to turn at the same speed, the shaft 45 and the sprockets 52 will again turn together. Thus, the tractor may be turned in either direction without it becoming necessary to vary the speed of rotation of the bucket-carrying conveyors of the ditch digger.

Should it be desired to disengage the sprocket 52 from the shaft 45, this may be done by pushing the sprocket 52 inward against the spring 55, loosening the set screw 52a, and pushing the pin 54 downward, so that the wing 54a will ride on the shaft 45, and hold the pin out of engagement with the teeth 53.

The sprockets 52 may also be used for rearward movement of the tractor by interchanging them on the shaft 45.

The drive chain 26, which is driven by the drive sprocket 24 attached to the rotating shaft 25a leading from the gear reduction box 23, passes around and drives, the driven sprocket 60 which is affixed to the axle 61. The axle 61 passes through the oil bearing casing 62, which oil bearing casing is mounted on and supported by the bracket 63, which bracket in turn is mounted on the two cross braces 64 and 64a carried by the base members 15 on either side of the frame for the ditch digging mechanism. The shaft 61 passes through the oil bearing 62 and has a sprocket 80 attached to its inner end,

the function and operation of which sprocket will be described later.

The sprocket 66 is secured to the outer end of the shaft 61 and drives the chain 67 when the shaft 61 is rotated. The chain 67 passes around the sprocket 68 and rotates it, driving the conveyor 69.

The conveyor 69 is of the spiral type and is provided to collect the dirt picked up by the digging buckets which will be hereinafter described, and convey the dirt to the side of the ditch being dug. The conveyor 69 has a shaft 70, which shaft has a bearing 71 supporting it at one end, and a bearing 76 supporting it at the other end. The bearing 71 is supported by the bracket 78 which is secured to the frame for the ditch digger and the bearing 76 is supported by the bracket 77, likewise secured to the frame for the ditch digger.

The conveyor 69 is mounted in a trough or housing 73. A cylindrical extension 75 is provided on the housing 73 at the side thereof for the purpose of causing the dirt to be conveyed out to the side of the ditch which is being dug.

Sprocket 80 drives the chain 81, which chain extends around the sprocket 82 at the top of the bucket conveyor mechanism, and thus turns the said sprocket 82. The sprocket 82 is secured to the shaft or axle 83 and rotates it. On each end of the axle 83 is secured a conveyor sprocket 84 (only one of which is shown).

In Fig. V, the bucket conveyor sprockets 85 and 86 are affixed to the outer ends of the shaft 90, which shaft 90 corresponds to shaft 83 at the upper end of the bucket conveyor. The tubular members 87 and 88 are vertically disposed and are connected at their outer ends by means of a connecting member 89 by being welded or otherwise rigidly attached thereto. The members 87 and 88 are shown as tubular, but they may be solid rods and may be of any desired cross-sectional shape. The shaft 90 connects the sprockets 85 and 86, as mentioned above, and intermediate the sprockets 85 and 86, the shaft 90 passes through an extension 91 on the bottom side of the connector member 89. This forms a bearing for the shaft 90. A bearing 132 is formed for the shaft 83 at the top of the bucket conveyor mechanism. As shown in Fig. VI the bearing member 132 is held to a supporting plate 133 by means of the cap screws 92, which extend through the plate 132 and are threaded into the connector member 134, which connector member connects, and spaces apart, the tubular members 87 and 88. The spacer nuts 135 are threaded on the cap screws 92 and space the member 134 from the plate 133.

The tubular members 87 and 88 slide through the sleeves 96, which sleeves are rigidly mounted on the frame for the ditch digger by means of the mounting bracket 97 extending between the transverse frame members 64 and 64a. Thus it may be seen that the tubes 87 and 88 are free to slide up and down through the sleeves 96 carrying with them the sprockets 85 and 86 and the corresponding pair of sprockets 84 at the top thereof.

The drive chain 81 passes over the top of the roller 93, which roller is rotatably mounted on a bracket 94. Bracket 94 is secured to the mounting bracket 63, which in turn is secured to the main frame for the bucket carrying mechanism. The chain 81 also passes under and around the roller 95 which roller is rotatably mounted on the bracket 96. Bracket 96 is secured to the connector piece 89. It should be observed that the roller 95 is mounted on a different frame from the roller 93, so that roller 95 is free to move up and down when the tubes 87 and 88 are moved up and down, and the roller 93 remains stationary during such up and down movement.

One conveyor chain 100 passes around, and is driven by, one sprocket 84 and sprocket 85, and another conveyor chain 100 passes around, and is driven by, the conveyor sprocket 86 and one of the conveyor sprockets 84.

Digging buckets 101, of which there are a plurality, are each secured to a plate 103. The plate 103 is attached to oppositely disposed links 102 of the chain 100 by means of bolts and nuts 104. The bolts 104 pass through the backside of the bucket 101 and thus secure it to the plate 103 and to the links 102. The bucket 101 has a back wall 105 and a bottom wall 107.

The bottom wall 107 is pivotally connected to the back wall 105 in any suitable fashion. As shown, a hinge is formed between the two balls by forming coinciding scrolls 106 on the edge of the two walls and passing a pin 108 through them. The bottom wall is thus adapted to rotate inwardly about the pin 108.

The bucket also has an outer wall 109 and the sidewalls 109a.

A tripping pin 110 is welded or otherwise securely attached to the bottom wall 107. As shown in Figs. VI and IX, the pin is in the shape of an L, the shorter leg of which is welded to the bottom wall 107. The longer leg extends outwardly beyond the back wall 105 of the bucket 101. The inner end of the tripping pin 110 is secured to about the middle of the bottom wall 107 of the bucket, and the outer end thereof protrudes through the slot 119, which slot is cut into the lower edge of the plate 103.

A spring 111 is extended behind the plate 103 between the upper side of said plate 103 and the outer end of the tripping pin 110. The spring is secured to the plate 103 by the hook 112, formed on the end thereof, and is secured to the tripping pin 110 by means of the hook 113 hooked thereabout. The tripping roller 115 is rotatably mounted on the housing 117 for the driven gear 82, and between the upper conveyor sprockets 84, by means of the mounting brackets 116, which brackets are secured to the housing 117.

Each of the buckets 101 has a plurality of cutting blades 114 thereon, which dig into the ground when they come into contact with it. These blades are secured to the sidewalls of the bucket and extend outwardly therefrom.

As the conveyor chains 100, carrying the buckets 101, are rotated, the buckets will be filled with dirt as they come into contact with the ground in which a ditch is being dug, and will be conveyed around and up to the top of the conveyor mechanism. As the bucket passes over the top of the conveyor, the outer end of the tripping pin 110 will come in contact with the roller 115 and cause the pin to be pulled backward, which will stretch the spring 111 and push the inner end of the tripping pin 110 inward, thus pushing the pivoted bottom wall 107 of the bucket 101 inward. In this manner the dirt in the bucket 101, when the bucket is tripped, is rapidly expelled from the bucket and the dirt hits the deflector plate 17 and is deposited in the conveyor trough 73, and conveyed to the side of the ditch.

The action of the tripping pin 110 is clearly shown in dotted lines in Fig. IX.

A winch arrangement is provided for the purpose of raising or lowering the bucket conveyor mechanism described above. This winch is designated as 120 in the drawing and is illustrated in Fig. V. It is supported by a mounting bracket 121 which is secured to one of the side frame members 16. The driven gear 122 is rotatably supported in the housing 120, which gear articulates with the worm gear 124 and is driven thereby upon rotation of the worm gear by turning the shaft 123, attached thereto. The shaft 123 extends to the outer side of the frame for the bucket conveyor mechanism and has a cross handle 128 thereon, provided for the purpose of turning the shaft 123.

The cable 125 is wound about the drum 125a positioned below the gear 122. The cable 125 extends over a pulley (not shown) which pulley is attached to the transverse frame 64a. This pulley is provided for the purpose of aligning the cable with the eye bracket 126, which bracket is welded or otherwise suitably attached to the cross connector piece 89. The end of the cable 125 is passed through the eye 126 and is secured therein by means of the U-bolt 127 extended therearound. Although the winch 120 is shown to be hand operated, it could, of course, be adapted to be operated by power from the tractor.

It may be seen that when the handle 123 is turned clockwise, thus turning the gear 122 and the drum 125a attached thereto, the cable 125 will be wound about the drum and will thus pull upward on the cable 125. The tubular members 87 and 88 will be caused to slide upward through the sleeves 96, carrying with them the entire bucket conveyor mechanism, including the two upper sprockets 84, the two lower sprockets 85 and 86, the chains 100, extending therearound, together with the buckets mounted thereon. When the bucket conveyor mechanism is thus raised, the driving chains 26 and 67 and their associated sprockets 66 and 60 and the shaft 61 are not disturbed in their horizontal or vertical alignment.

In other words, the bucket carrying conveyors and their associated mechanism may be moved upwardly and downwardly without disturbing the driving mechanism for them. Neither is the tension of the drive chain 81 disturbed in any way by moving the tubular members 87 and 88 up and down.

The bucket conveyor mechanism is maintained at true vertical position at all times while the ditch digger is digging a ditch. It is not necessary to tilt it.

My ditch digger may thus be used to dig a straight hole in the ground by disengaging the clutch in the auxiliary transmission and stopping the forward movement of the tractor.

One may also be enabled to dig a ditch to the desired depth up to, and immediately adjacent to, a pipe line or other obstruction in the ground, then by raising the ditch digger to go over the obstruction may then continue the digging of a ditch to the desired depth on the other side of the obstruction immediately adjacent thereto. This may be done by allowing the tractor carrying the ditch digger to stand still and dig the ditch to the desired depth and then throwing the auxiliary transmission for the tractor in gear and starting it in its forward motion. The ditch on each side of the obstruction will have a true vertical end to the bottom thereof.

In the old type ditch diggers described above, it was not possible to dig a straight hole, due to the fact that the digger mechanism was pivotally mounted to the back of the vehicle carrying it, and as the digger was lowered vertically, it was also varied from the vertical by being swung around the pivot point. Neither was it possible to begin or end a ditch with a true vertical end, with the old type equipment.

Of course, the bucket conveyor mechanism can be made of any width and the buckets thereon may be varied in width so that the trench dug by it may be varied in width.

The operation and function of my invention may be described as follows:

After it is suitably mounted to the tractor in the manner hereinbefore described, the rear power take-off of the tractor, through which this unit is driven, is thrown into gear which starts the rotation of the pulley 27 which in turn rotates the pulleys 29 and 31 attached to the shaft 30, protruding from the gear box 23.

The gear box 23 is for the purpose of reduction of the gear ratio between the power take-off of the tractor and the sprocket 25, which is driven through the gear reduction box 23. The chain 26 is thus driven by the sprocket 25 and therethrough the sprockets 60 and 66 are rotated. The sprocket 60 is attached to the shaft 61 and causes the said shaft to rotate, thus driving the sprocket 68 through the drive chain 67, and the sprocket 80 through the shaft 61.

The sprocket 68 is attached to the shaft 70 for the conveyor 69 and thus rotates it.

The sprocket 80, through the chain 81, drives the sprocket 82 and causes the rotation of the bucket conveyor sprockets 84 positioned on each side of the shaft 83, and sprockets 84 through the conveyor chains 100 drive the sprockets 85 and 86 at the lower end of the bucket conveyor mechanism.

When the buckets 101 are caused to rotate with the chains 100, the blades 114 come in contact with the ground at the lower end of the bucket conveyor mechanism and dig into the ground and the buckets 101 are filled with dirt. They are rotated upward and over the top of the bucket conveyor mechanism and after passing the top point the outer end of the tripping pin 110 thereon strikes the roller 115 and pushes the bottom door 107 inward and expels the dirt therefrom against the deflector plate 17 and the dirt is thereby deposited in the conveyor housing 73, and conveyed out to the side of the ditch being dug.

After the tripping pin 110 passes the roller 115, the bottom door of the conveyor bucket will be closed by force of the relaxation of the spring 111.

At the same time that the above is occurring, the sprocket 31 drives the sprocket 33 through the chain 32 and rotates the shaft 34 which shaft enters the auxiliary transmission 35, and has a suitable gear on the inner end thereof. The auxiliary transmission 35 is provided with a conventional clutch mechanism for engaging, disengaging and changing the gears therein, and is also provided with gearing mechanism to provide three different forward speeds and a reverse movement. This gearing mechanism is conventional.

When the clutch controlling the auxiliary transmission is engaged, the shaft 37 leading from the auxiliary transmission will be rotated and will in turn rotate the sprocket 38 attached

thereto, driving the chain 39 and therethrough the sprocket 47. The sprocket 47 is attached to the shaft 45 and rotates it, thus rotating the gears 52 in the manner hereinbefore described. This in turn drives the chains 130 which drive the sprockets 131 attached to the hubs for the rear wheels of the tractor. Thereby the tractor is moved.

The ditch digging mechanism may thus be rotated independently of the movement of the tractor. That is, the tractor may be thrown out of gear by disengaging the clutch for the auxiliary transmission and at the same time the ditch digger buckets may continue to rotate.

The ditch digger and the tractor are driven off of the same power take-off of the tractor, and the forward and rearward speed of the tractor is thus coordinated with the rotation of the ditch digger. This is advantageous, because when digging in soft ground the ditch digger will dig faster, and thus the tractor should move forward faster; and when digging in hard ground the tractor may be stopped or slowed down by the clutch mechanism in the auxiliary transmission, to conform to the necessarily slower rotation of the ditch digger.

If it is desired to operate the tractor without the ditch digger attached thereto, the ditch digger, with its gearing and driving mechanism, may be removed from the tractor by merely removing the bolts 14 and disengaging the coupling 13. Thus, the only mechanism left on the tractor will be the mounting bracket which is attached to the rear axle and differential of the tractor, and the frame for the auxiliary transmission and gear box. These may also be easily removed, if desired.

When it is desired to raise the ditch digger, the handle 128 may be turned clockwise, thus rotating the shaft 123 which turns the worm gear 124 and drives the gear 122, thus winding the cable 125 around the drum 125a. The tubular members 87 and 88 are thus pushed upward through the sleeves 96. The chain 81 will move upward with the bucket conveyor mechanism carried by the rods 87 and 88 and the tension thereof will not be disturbed. The bucket conveyor mechanism may be lowered to digging position, and lowered while digging, by turning the shaft 123 in a counterclockwise direction.

It is to be understood that only a preferred embodiment of this invention is disclosed herein, and other and further changes and modifications may be made therein and still remain within the spirit and scope of the appended claims.

I claim:

1. In a ditch digger for attachment to a tractor, a substantially vertical rigid frame member arranged for attachment to the rear differential housing of a tractor; power transmission means carried by said frame and arranged to be driven from the rear power take-off of said tractor; another power transmission carried by said frame and arranged to be driven from the rear power take-off of said tractor; driving means driven through said second named transmission for driving the rear wheels of said tractor; a rearwardly extending frame member arranged for attachment to the rear end of said tractor; a substantially vertically disposed conveyor frame member carried by said rearwardly extending frame member, and being slidably disposed vertically with relation to said rearwardly extending frame member, and adapted to be raised and lowered; a pair of sprockets journaled at the upper end of said conveyor frame; a pair of sprockets journaled at the lower end of said conveyor frame; a pair of spaced conveyor chains arranged between the upper and lower sprockets; a plurality of digging buckets attached to the outer sides of said conveyor chains; and driving means between the said first named transmission and the said sprockets, for rotating same.

2. In a ditch digger, a rigid frame arranged for attachment to the rear differential housing of a tractor; power transmission means carried by said frame and arranged to be driven from the rear power take-off of the tractor; a separate auxiliary transmission carried by said frame and arranged to drive the rear wheels of said tractor, and to be driven from the rear power take-off of the tractor; a rearwardly extending frame member attached to said tractor; a substantially vertically disposed digging bucket conveyor frame slidably disposed upwardly and downwardly in relation to said rearwardly extending frame member; a pair of sprockets journaled at the upper end of said conveyor frame; a pair of sprockets journaled at the lower end of said conveyor frame; a pair of chains arranged between the upper and lower sprockets; a plurality of digging buckets carried by the outer sides of said chains; means between the said power transmission means and the said sprockets for rotating the said sprockets; means for raising and lowering said bucket conveyor mechanism without displacing the driving means between said power transmission means and said sprockets.

3. In a ditch digger adapted to be mounted on a tractor having a rear power take-off, a differential housing and a rear axle housing; an upright frame member attached to the said rear differential housing; power transmission means carried by said frame member; a separate auxiliary transmission carried by said frame member; driving means for driving the said transmissions from the rear power take-off of said tractor; driving means between said auxiliary transmission and the rear wheels of said tractor and adapted to drive said tractor forward and rearward; a second frame member attached to said rear differential and rear axle housing; an upright digging bucket conveyor frame carried by said second named frame member, and movable upwardly and downwardly with relation thereto; a pair of sprockets journaled at the upper end of said conveyor frame; a pair of sprockets journaled at the lower end of said conveyor frame; a pair of chains extending about said upper and lower sprockets; a plurality of digging buckets carried by the outer sides of said chains; means carried by the second frame member for raising and lowering the said upright bucket conveyor frame member; driving means between said first named power transmission means and the said sprockets; a spiral conveyor carried by the second frame member and arranged adjacent to said conveyor frame and adapted to receive dirt expelled from the buckets and to convey it to the side of the ditch being dug; and driving means between the said first named power transmission means and the said conveyor for rotating same.

4. In a ditch digger adapted to be attached to a tractor having a rear power take-off, a differential housing, a rear axle housing and rear wheels, a frame carried by said differential housing; power transmission means carried by said frame; another power transmission carried by

said frame; driving means between the said rear power take-off and the transmissions; driving means between one of the transmission and the rear wheels of said tractor; a rearwardly extending frame member supported by said rear differential housing and axle housing; an upright conveyor frame slidably carried by said rearwardly extending frame member; a pair of spaced sprockets journaled at the upper end of said conveyor frame; a pair of spaced sprockets journaled at the lower end of said conveyor frame; a pair of chains extending between said upper and lower sprockets; a plurality of digging buckets attached to the outer sides of said chains; driving means between one of the transmissions and the sprockets; and means for raising and lowering said conveyor frame.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
556,513	Nettelbeck	Mar. 17, 1896
802,985	Helm	Oct. 31, 1905
824,740	Poulson	July 3, 1906
848,742	Helm	Apr. 2, 1907
1,015,850	Sommers	Jan. 30, 1912
1,038,915	Lyback	Sept. 17, 1912
1,126,264	Odell	Jan. 26, 1915
1,201,232	Archer	Oct. 17, 1916
1,290,266	McEwen	Jan. 7, 1919
1,535,509	Ursino	Apr. 28, 1925
2,052,372	Van Voorhis et al.	Aug. 25, 1936
2,069,712	Penote	Feb. 2, 1937
2,225,129	Osborn	Dec. 17, 1940
2,274,970	Tiffany	Mar. 3, 1942
2,335,166	Wilson	Nov. 23, 1943
2,384,441	Carter	Sept. 11, 1945
2,519,076	Schmidt	Aug. 15, 1950
2,519,077	Schmidt	Aug. 15, 1950