June 5, 1956 H. H. TURNER 2,748,505

ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 1

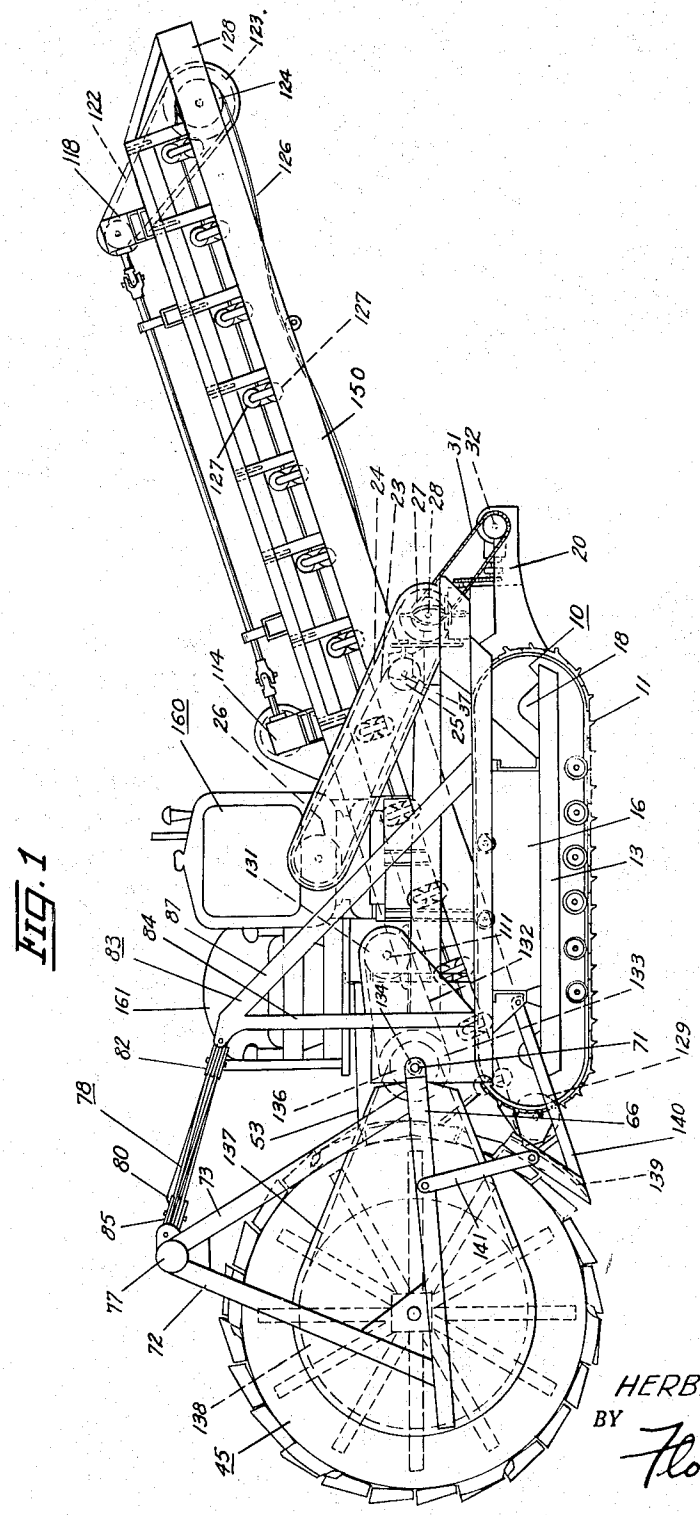


FIG. 1

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ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 2

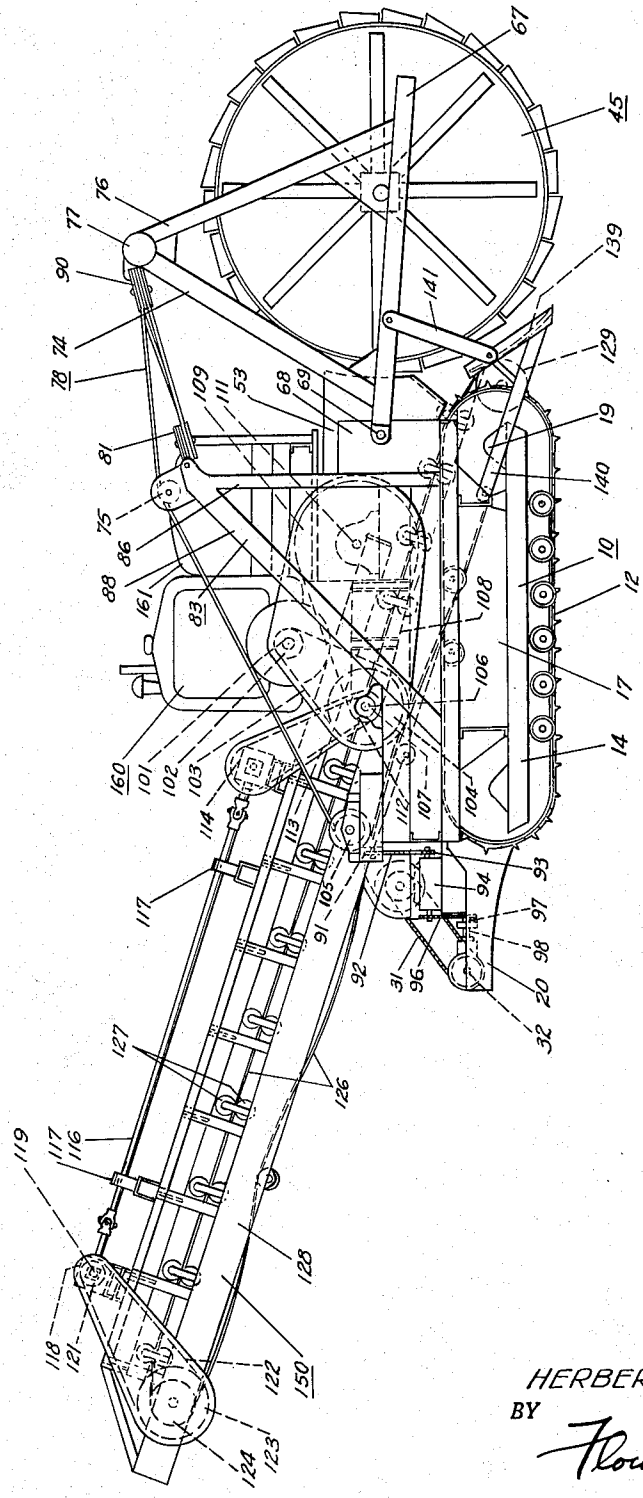


FIG. 2

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ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 3

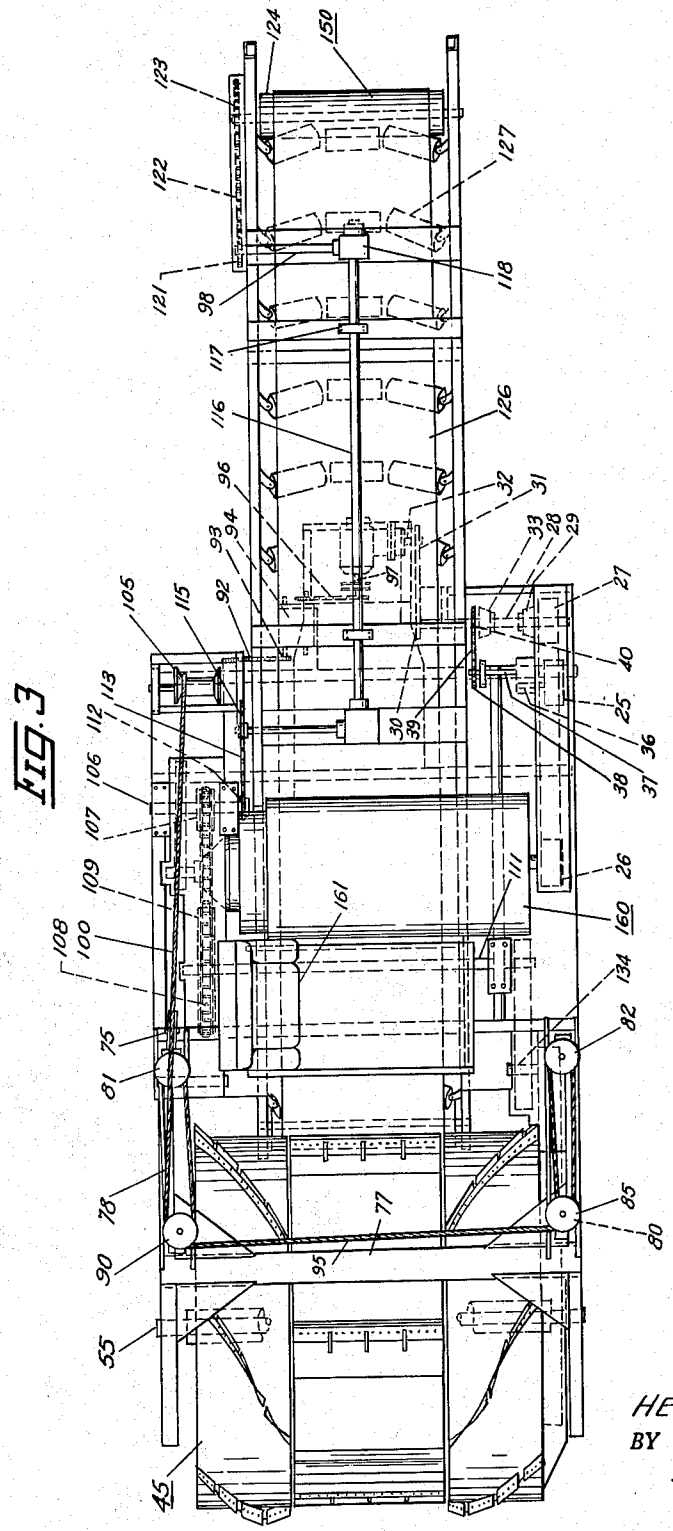


FIG. 3

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ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 4

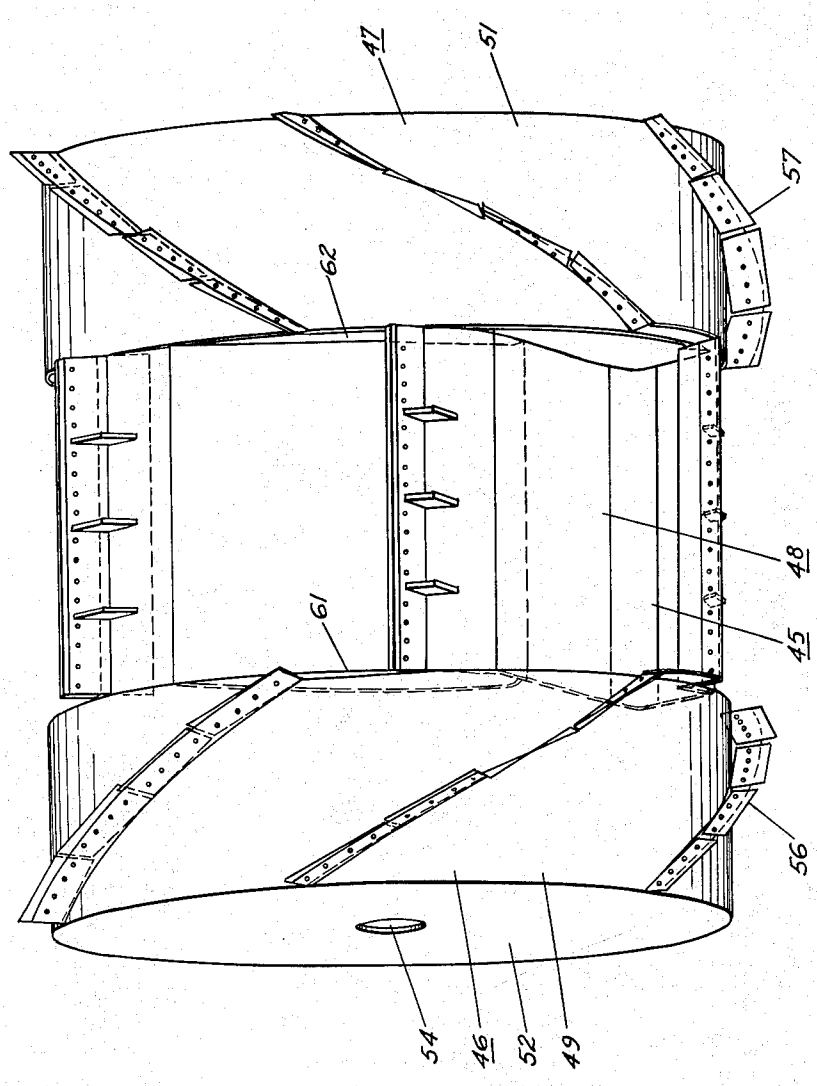


Fig. 4

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ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 5

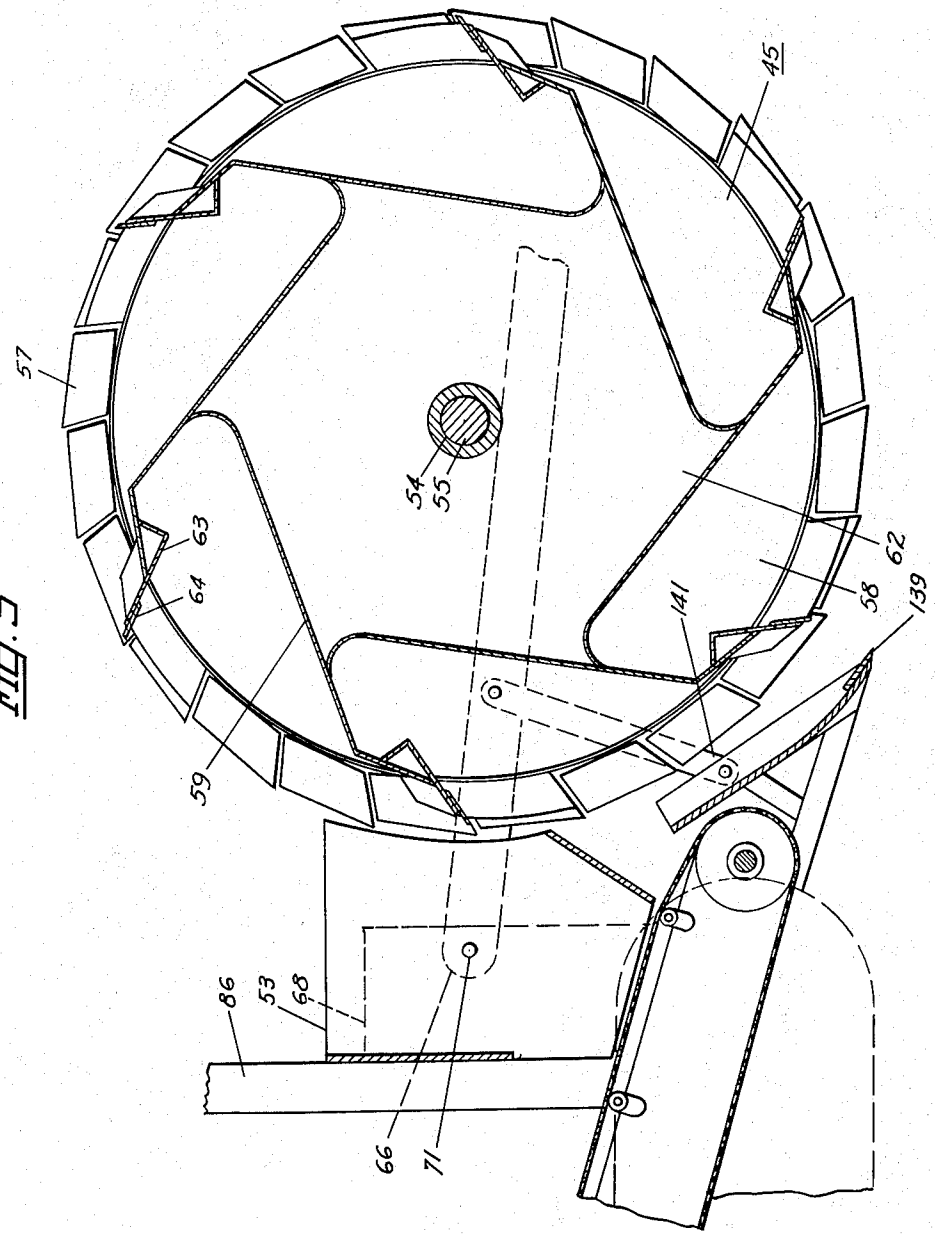


FIG. 5

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ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 6

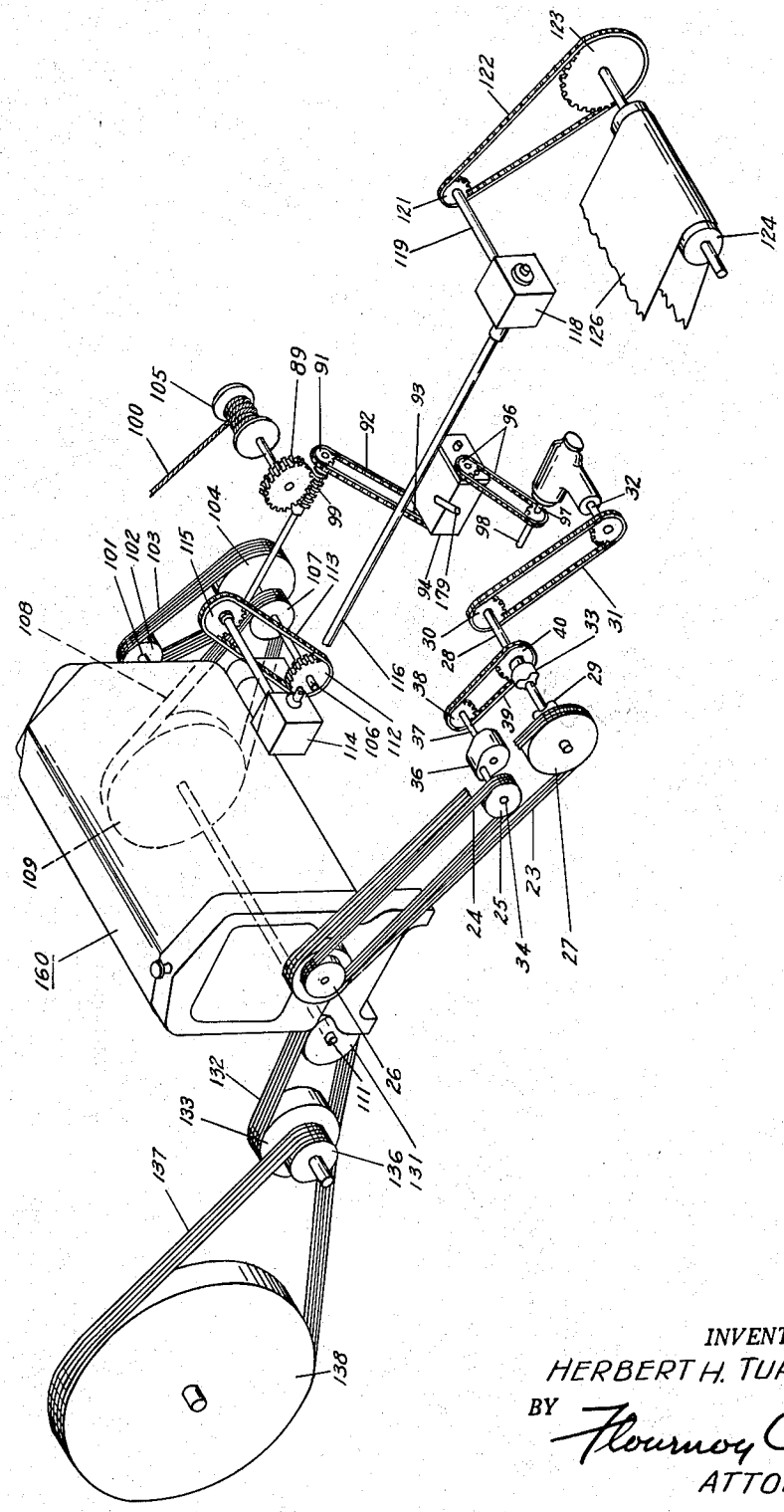


FIG. 6

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ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 7

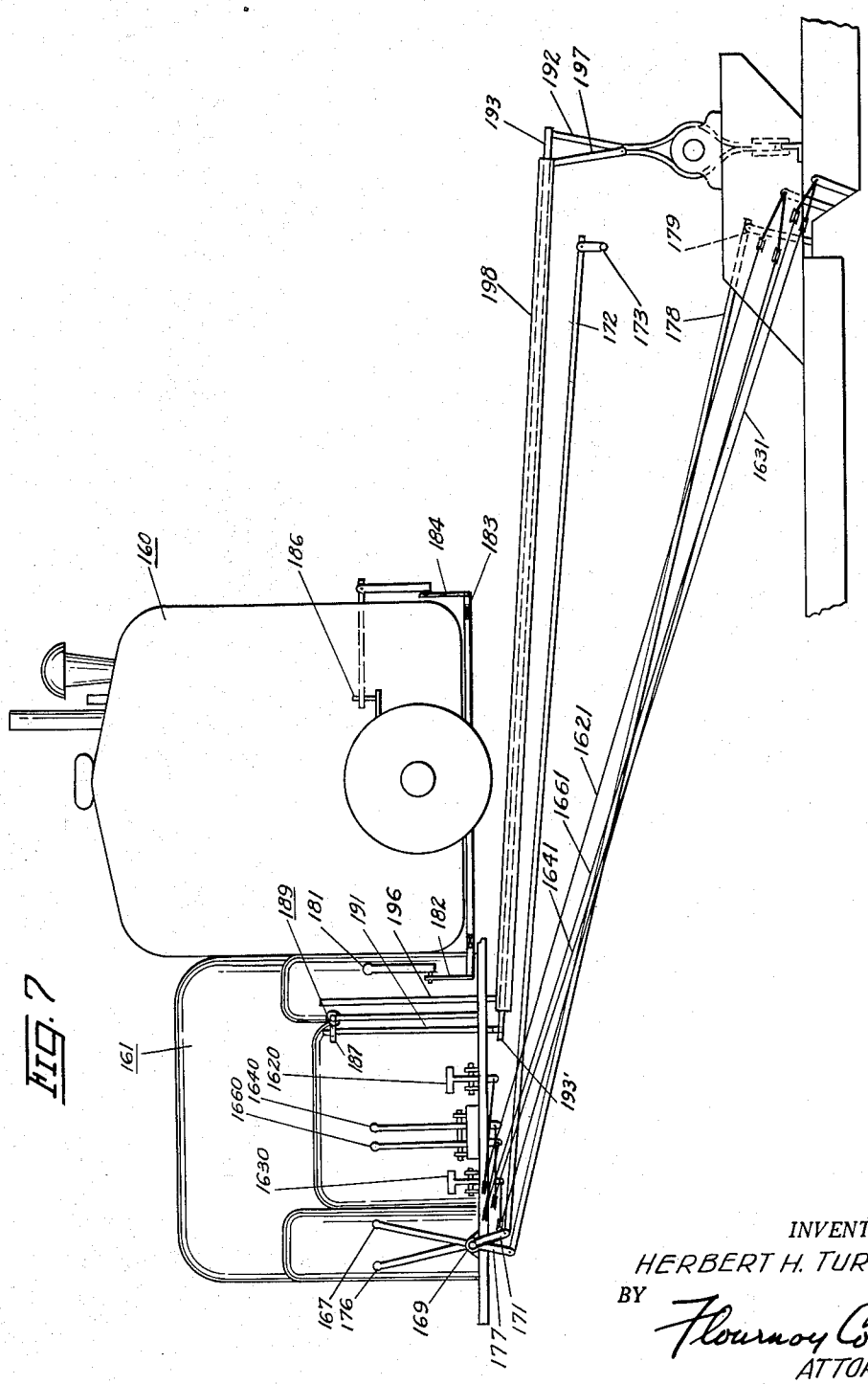


FIG. 7

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ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

Filed July 31, 1952 8 Sheets-Sheet 8

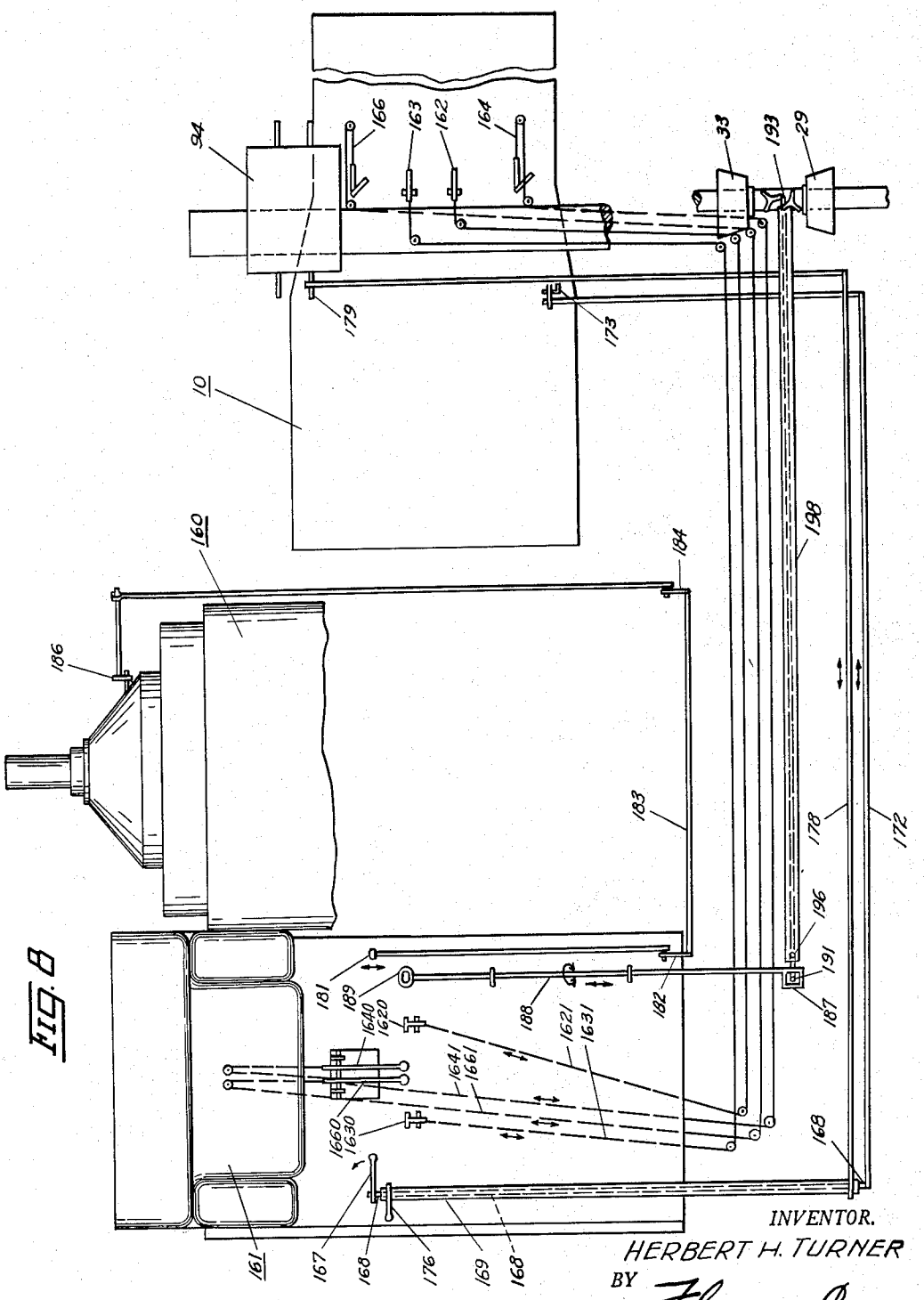


Fig. 8

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United States Patent Office 2,748,505 Patented June 5, 1956

2,748,505

ROTARY TYPE EXCAVATING DEVICE FOR LOADING MACHINE

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Application July 31, 1952, Serial No. 301,931

2 Claims. (Cl. 37—96)

This invention relates to excavating machinery or loaders and has particular relation to a new and novel apparatus and method of excavation and loading whereby continuous digging and movement of the material may be accomplished.

In the moving of material, the desirability of a continuous flow of material over what may be termed batch transportation is apparent. For instance, for a given bulk of machinery, a conveyor belt will carry more material per day than a drag line or shovel.

It is one of the important objects of my invention to provide a machine and apparatus and method of excavating whereby a continuous flow or substantially continuous flow of the material is secured.

An important feature of my invention is the continuously operative excavating device which digs over a relatively widespread area and, at the same time, concentrates the material being thus excavated into a narrower stream, to thus reduce the cross sectional area of the transporting means, as compared to the much greater cross sectional area of the excavating means.

Another important object of my invention is to provide a mobile support and mounting for the excavating and transporting means which I have invented.

One of the features of my invention is that the excavating or digging means may be as broad or broader than the running gear of the transporting means, and yet the material is concentrated by the excavating means in such manner that it may pass between the running gear of the transporting structure.

Another important object of my invention is to provide a new and improved loading means for loading trucks and carriers with materials such as sand, aggregate, dirt and the like.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and following specifications, wherein is disclosed a single exemplary embodiment of the invention, with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims, without departing from the spirit of the invention.

In said drawings:

Figure 1 is a view in side elevation of a device constructed according to one embodiment of my invention, and we may consider the machine as advancing toward the left so that the view of Figure 1 may be said to be a view in left side elevation.

Figure 2 is a view in right side elevation of the machine shown in Figure 1.

Figure 3 is a plan view of the machine.

Figure 4 is a view in front elevation in perspective of the rotary digging wheel or excavator or rotary loader which is at the front end of the excavating and loading machine illustrated in Figures 1, 2 and 3.

Figure 5 is a vertical cross sectional view of the rotary digging wheel taken through the central or elevator portion. Shown also are the associated inclined conveyor, hopper and clean-up blade.

Figure 6 is a view illustrating schematically the driving means for the various parts of the rotary excavator shown in the previous drawings.

Figure 7 is a view in side elevation illustrating the levers, cables and rigging by which the controls of the running gear, as well as the control for the rotary hoist and the rotary digger, are operated from a position well above the running gear, and

Figure 8 is a plan view further illustrating the control system of Figure 7.

Referring now to the drawings, and more particularly to Figures 1, 2 and 3 thereof; the device here shown may be considered as being constructed of a running gear **10** upon which the machine is mounted for transport and crowding, as in digging, a rotary excavating wheel or digger, indicated generally at **45**, and an inclined conveyor or elevator conveyor **150**.

The rotary loader is propelled and powered by means of the power plant, illustrated generally at **160**, which may be any suitable power source such as an electric motor or internal combustion engine but which, in the present case, is an internal combustion engine mounted crosswise of the running gear and having power take-off pulleys at the front and several power take-off sprockets at the rear thereof.

The machine is controlled by an operator who faces to the left side of the machine or crosswise of the greatest dimension of the machine so that he can both supervise and operate the rotary loader **45** and actuate the belt elevator **150** to load a truck, as well as to actuate the necessary controls for driving the running gear.

In constructing a loader according to the present embodiment of my invention, I employ a conventional running gear of the crawler type, well known in the art, and having a pair of endless tracks **11** and **12** mounted for rotation on the main frame, indicated at **13** and **14**, and driven by a pair of independently actuated sprockets within the housing **16** and **17** and located at **18** and **19**. The sprockets which drive the endless tracks are driven by means of a longitudinal drive shaft and other conventional drive mechanism, not shown, located within the housing **20**, and the endless tracks may be independently driven forward and back by manipulation or control levers, illustrated in Figures 7 and 8 and hereinafter explained.

In the present instance, it is preferable that this running gear be driven selectively at two different speeds, one of which we may term the transport speed which is a relatively high speed, and the other which we may term the crowding speed which is an extremely low speed since it is the speed employed to advance the digger while it is operating so as to crowd it into the material being dug.

I preferably accomplish this two-speed drive of the running gear by means of a pair of belt drives, illustrated at **23** and **24**, and driven by means of a power take-off sheave **26** located on the front of the engine **160**.

The belts **23** drive a driven pulley located at **27**, which in turn drives a drive shaft **28** through the agency of a clutch **29**. This shaft drives a sprocket and chain transmission, illustrated at **30** and **31** respectively, and this in turn drives a cross shaft **32** which drives the conventional drive shaft of the running gear. This effects the high speed or transport speed drive of the entire machine.

When it is desired, however, to crowd the rotary digger into the material pile, an extremely slow powerful motion is desirable, and this is secured by introducing an additional reduction into the drive mechanism.

This is accomplished by disconnecting the high speed **29** (see Figures 3 and 6) and connecting the low speed clutch **33**.

This causes the shaft 28 to be driven at a slower speed through the agency of the belt drive 24, the hydraulic coupling 25 mounted on the shaft 34, a speed reducer 36, shaft 37, sprocket 38 mounted thereon and the chain 39 which, in turn, drives the sprocket 40 engaged to the low speed clutch 33.

Thus, a very material reduction in speed of the drive shaft 28 and of the drive shaft 32 is secured, and this speed is such as to afford sufficient force to effectively crowd the rotary digger into the material pile or retract it therefrom.

The rotary lift or rotary loader 45 is preferably comprised of three generally cylindrical sections. The two outer or digger-feeder drum sections 46 and 47 dig and loosen material against which the device is moved and feed or convey the loosened material transversely toward the inner or elevator section 48. The diameter of the rotary loader, shown in Figures 4 and 5, may for example, be approximately 9 feet, in which case I have found that the width over-all should be approximately 9 feet, with the width of the two digger-feeder drums 46 and 47 approximately 2½ feet and the width of the central elevator section 48 approximately 4 feet. These dimensions may be varied to a considerable degree.

The two digger-feeder drums 46 and 47 include steel drums 49 and 51 provided with outer closed ends 52, each having a central opening 54 therethrough, by which the assembly may be mounted on the drive shaft 55. The drums 49 and 51 are provided with oppositely disposed scrapers or cutting blades 56 and 57 arranged in opposed spiral relation about the periphery of the drums in such manner that, upon crowding of the rotary loader into a bank of earth or the like, and upon rotation of the rotary loader in a clockwise direction, as viewed from the left side thereof in Figure 1, the spirally arranged scraper blades 56 and 57 will cause material to be dug or loosened and driven toward the center of the drum where it can be picked up by the center or elevator portion 48, as hereinafter described.

Some material will be carried up and over the outer digger drums 46 and 47 by scrapers 56 and 57 so that this action is both a digging and lifting action. The slanted position of the scrapers reduces the power needed to drive them as compared to transverse blades.

The central elevator section 48 is comprised, in this case, of six pocket-like shovels, illustrated at 58, and arranged about the central axis of the drum and extending entirely across this central portion 48. These pockets are formed by means of shovel shaped partitions 59 which join the inner walls 61 and 62 of the digger-feeder drum sections 46 and 47. The pockets 59 are provided with heavy scraper blades 63 having hardened steel cutting edges 64, so that as the material is deposited in front of the central portion of the rotary digger 45 by the digger-feeder drums 46 and 47, and as the digger is advanced against the material pile and as it is rotated, these cutting edges scrape the material, such as gravel, earth, snow and the like, into the pockets so that as the drum is rotated, the dirt is lifted by the shovels or pockets 58 and thrown over the top of the excavator and into the hopper 53 from which it is deposited on the belt of the belt conveyor 150. The hopper 53 is sufficiently wide across its top to receive all material carried over the tops of the digger-feeder drums 46 and 47 by the scraper blades 56 and 57.

The rotary digger 45 is mounted for rotation on a pair of feeder supports 66 and 67, which supports are pivotally attached at their rear ends to the running gear of the tractor by means of the framework 68, and pivotal connections 69 and 71.

The weight of the rotary excavator is normally sufficient to cause it to dig into the material and lift it up and over and deposit it onto the belt conveyor, but at times it is desirable to lift the rotary digger 45 out of contact with the ground to regulate the cut or withdraw the digger for transporting, and this is accomplished by means of the A frame illustrated at 72, 73, 74 and 76. The pairs of side members 72 and 73 and 74 and 76 are connected by a heavy cross beam 77 and a cable system, indicated at 78 is employed to tilt the A frame and thus the digger upwardly and rearwardly. The cable system has fixed sheaves 81 and 82 which are mounted on the main rotary digger supporting framework or gantry 83 and moving sheaves 90 and 85 on the A frame.

The supporting framework 83 consists of a pair of gantry frames on each side of the running gear and projecting upwardly therefrom. The frames are comprised of vertical struts 84 and 86 and inclined tension struts 87 and 88. A cable 100 is reeved from a fixed terminal 80 on the sheave 85, over sheave 82, over sheave 85, across the machine at 95, around the sheave 90, around sheave 81, back over sheave 90, over fixed idler sheave 75, then passes down to a cable drum 105.

The cable drum 105 is driven by means of a speed reduction unit, such as the worm gear 89, and the worm 99 which is driven by means of sprocket 91, chain 92, and sprocket 93 (see Figures 3 and 6). The sprocket 93 is mounted on a driven shaft of the gear case 94, and this gear case is provided with suitable reverse and forward drive gearing so that the sprocket 93 may be driven in either direction, to take in or pay out the cable 100, to thus raise or lower the rotary digger 45 as desired. An optional neutral position of the gearing permits the worm 99 to lock the cable drum in any position. The drive shaft of the gear case 94 is driven by means of the sprocket and sprocket chains 96, the drive sprocket 97 of which is mounted on the drive shaft 98 which drives the running gear. This drive shaft 98 runs only when either clutch 29 or 33 is engaged, but since this running gear drive shaft is in operation most of the time, the rotary digger may be raised and lowered substantially as desired.

The power take-off at the rear of the engine, as best illustrated in Figure 2, is employed both to drive the belt conveyor 150 and the rotary loader drum 45. The drive shaft or crank shaft 101 of the engine has a sprocket 102 mounted thereon, which drives a chain 103, which in turn drives a large sprocket 104 driving a first reduction jack shaft 106. This jack shaft 106 has a small sprocket 107 thereon for driving a chain 108 which in turn drives large sprocket 109. The sprocket 109 drives a cross or second reduction jack shaft 111.

The shaft 106 also has a second small sprocket 112 mounted thereon, and this sprocket drives a chain 113, which in turn drives bevel gearing mounted in the casing 114 to drive the long elevator drive shaft 116 positioned for rotation in bearings 117 above the belt conveyor. The outer or upper end of the drive shaft drives bevel gearing within the housing 118, which in turn drives a cross shaft 119 on which is mounted a small sprocket 121. The sprocket 121 drives a chain 122, which in turn drives a large sprocket 123 to drive the outer roll 124 which causes movement of the belt 126.

The belt 126 rests on idlers such as 127, and extends out almost to the end of the main frame 128 of the conveyor 150 so as to discharge material, such as dirt or aggregate, out over the end of the conveyor. The belt also extends beneath the engine and well back under the rearmost portion of the rotary wheel 45 and over the idler roller 129. Dirt and aggregate delivered by the wheel 45 from the pockets thereof, upon rotation of the wheel, falls down into the hopper 53 and onto the conveyor and thus is rapidly carried the length of the conveyor and discharged off the high rear end thereof and into the box of a truck or trailer or other conveying means, or may be delivered to still another conveyor for carrying in any direction.

Dirt or other material which is carried by the loader wheel 45 beyond the point at which it would fall within the hopper 53 or upon the belt, falls upon a clean-up blade 139 which directs the material forward beneath

the rotary loader which again picks it up. The blade **139** is carried by push arms **140** pivotally attached to the main frames **13** and **14** and is supported by lift arms **141** pivotally connected to the blade **139** and to the feeding supports **66** and **67**.

The shaft **111** extends transversely across the machine beneath the driver's seat, as indicated in Figure 1, and a sprocket **131** mounted on this shaft drives a chain **132** to drive a larger sprocket **133**, which in turn drives a shaft located on the same axis as the pivotal mounting points **71** of the **A** frames. The shaft **134** carries a small sprocket **136** thereon, and this sprocket, by means of a large chain **137**, drives a large sprocket **138** which is attached to the end of the rotary loader wheel **45**.

As has been indicated, control of all of the functions of a machine, constructed according to the present embodiment of the invention, may be effected by a single operator. The operator's post, as may be ascertained by reference to Figure 1 and other figures of the drawing, is preferably well above the main body of the machine beside the engine **160** in a comfortable seat **161** where he may view the operation of the digger wheel **45** and the elevator conveyor **150** and the relation of these two important systems to the material being excavated and the trucks or other vehicles which carry away the excavated material.

Referring more particularly to Figures 7 and 8, the group of running gear controls on the running gear **10** are conventional and consist of the left steering brake **162**, right steering brake **163**, left steering clutch lever **164**, and right steering clutch lever **166**. These controls are the same ones an operator would use in driving the running gear **10** if it were the running gear of a tractor and the operator of such a unit was at his post.

The operator sitting on the seat **161** has before him a remote left steering brake **1620** and a remote right steering brake **1630**, and these are connected by cables **1621** and **1631** to the left and right steering brakes **162** and **163**.

The levers **1640** and **1660** are left and right hand levers which are connected by cables **1641** and **1661** to left steering clutch lever **164** and right steering clutch lever **166** to actuate the clutch (not shown) which engages the respective endless treads of the running gear **10**.

Thus the operator in the seat **161** steers the running gear when it is in motion in the same manner as though he were seated on the running gear.

Control of the forward and reverse drive of the running gear **10** is effected by a remote directional control lever **167** at the right side of the operator. This lever is mounted on the solid shaft **168** which is housed for rotary movement in a hollow shaft **169**, and the shaft **168** projects beyond the far end of the shaft **169** (see Figure 8), and a crank **171** on the far end of shaft **168** is attached by a drag link **172** (see Figure 8) to the directional control level **173** of the conventional forward and reverse control system of the running gear **10**.

The hollow shaft **169** (see Figures 7 and 8) also has a remote gantry control lever **176** on the end nearest the operator, and it likewise may rotate. Rotation of the hollow shaft **169** actuates a crank **177** on the far end of hollow shaft **169** which crank is connected by drag link **178** to the gantry control lever **179** of the gear box **94** (see Figure 6). This gear box has in it suitable shiftable gearing for effecting forward, reverse and neutral drive of chain **92** which drives worm **99** and worm gear **89** to thus rotate the drum **105** in opposite directions or hold it in neutral to raise or lower the gantry to raise or lower the digger or hold it steady.

The digger and elevator belt may be engaged or disengaged for operation by a push-pull clutch lever **181** which rotates a crank **182** (Figure 7) on cross shaft **183** to correspondingly rotate a crank **184** which, in turn, is connected to the clutch operating lever **186**. If desired, the digger and elevator belt may be separately controlled by a suitable additional clutch not here shown.

Control of the high and low driving speed of the running gear is effected by a throw over lever generally indicated at **189**. The lever or eye **187** is on the far end of a shaft **188** of lever **189** which may be rotated, as well as moved forward and back by the operator who grasps and manipulates the handle of lever **189** on the near end thereof.

If the speed shaft **188** of lever **189** is moved and rotated to the operator's right until the eye **187** engages the top of lever **191** (see Figure 7), and the shaft pulled or pushed, the low range clutch **33** is engaged and disengaged to connect or disconnect the low speed range drive. Connection between lever **191** and the low range control lever **192** is effected by rotation of the connecting link or shaft **193** which is connected at its left hand end at **193'** to the bottom of vertically disposed lever **191** (see Fig. 7).

If the speed shaft **188** is thrown to the left and the eye **187** rotated so as to be engaged over the remote high range control lever **196**, which extends vertically and in spaced relation parallel to lever **191** (see Figure 7), and the shaft pushed or pulled, the high range control lever **197** is moved through the agency of the connecting hollow shaft **198** to engage and disengage the high speed clutch **29**.

The eye and lever structure just described is a simple means of controlling the high and low speed clutches and insures that these clutches will never be operated simultaneously.

While the applicant's loader may move under its own power, it is the usual practice to deliver it to the job on a large platform trailer. When the machine reaches the job, it is driven down off the trailer and moved directly to the point where it is to be used by means of the transport gear as previously described. After the rotary wheel **45** has been pushed into contact with the pile of aggregate or dirt or whatever, the crowding drive is engaged, the wheel is lowered to the desired operating position, and is caused to rotate. The cross feed scraper blades of the drums **46** and **47** loosen the aggregate and feed it in toward the centrally disposed elevator wheel at **48**, and the pockets or scoop members **58** pick up the material and carry it forwardly and upwardly, and then rearwardly to be discharged onto the conveyor belt. The material is then carried on up the belt and is discharged off of the high rear end thereof as desired.

The operator can raise and lower the rotary drum by rotating the cable drum **105** in one direction or the other, and he can engage not only the elevator and rotary drum at will, but can also drive the entire machine forward to crowd it into the aggregate pile. The crawler tracks may also be driven in the reverse direction to withdraw the machine from the aggregate pile for a new cut or new positioning.

The delivery of aggregate to the end of the conveyor is continuous and a continuous flow of material off the end of the conveyor belt may be had for as long periods as desired.

For a given size of machine, the material excavated, raised and loaded is much greater than other loading means, such as excavating shovels and the like, and the operation is efficient and reliable.

Another marked advantage of devices constructed according to my invention is that the cutting, excavating, driving and lifting elements are all formed in one simple part which may be mounted on two bearings. Further, loading of the digging elements is a cutting and lifting away operation rather than cutting and forcing material into hoppers where the first material in the hopper is moved back by jamming more material against it.

While the embodiment of my invention shows and describes the device as mounted on endless tread tracks, it is quite apparent that the loader may be mounted on rubber tired wheels in accordance with common practice with heavy tractors of the kind here described. Such

modification is of course within the scope of my invention and when endless tread running gears are described or claimed, it is intended that rubber tired wheels are included.

Although I have described a specific embodiment of my invention, it is apparent that modifications thereof may be made by those skilled in the art. Such modifications may be made without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim as my invention:

1. In a device of the class described, a running gear including side frames and endless tracks, a rotary digger mounted on said frames on a transverse axis in advance of said running gear, means for rotating said digger about the transverse axis thereof, said rotary digger comprising a drum having a narrow central section and end sections, said central section of said drum having a plurality of openings in the surface thereof each having a leading and trailing edge with respect to the direction of rotation of said drum, a plurality of bent wall members each having opposed wall portions mounted in said drum, each of said members being positioned beneath each of said openings in said central section, said wall portions each having terminal edges secured respectively to the leading and trailing edges of the openings in said central section of said drum associated therewith, a cutting blade secured to each leading edge of said openings in said drum and extending along and outwardly of said drum, an endless conveyor coextensive in width with said central section and having a front end positioned beneath said central section to receive material from the shovel-shaped pockets of said drum, said conveyor extending upwardly and rearwardly of said front end, means for driving said conveyor, said end sections of the drum having spiral blades extending outwardly therefrom and adapted to feed material towards the openings in said central section, and a blade mounted on said side frames adjacent the front end of said conveyor, said blade being coextensive in width with at least said conveyor and said central section of said drum and positioned beneath said central section, said blade being adapted to direct material deposited thereon by said central section to a point where rotary digger engages the material to be dug.

2. In a device of the class described, a running gear including side frames, a rotary digger mounted on said side frames on a transverse axis in advance of said running gear, means for rotating said digger about the transverse axis thereof, said rotary digger comprising a drum having a narrow central section and end sections, said central section of the drum having a plurality of pocket openings extending in from the periphery thereof each having a leading and trailing edge with respect to the direction of rotation of said drum, a plurality of bent wall members each having opposed side wall portions mounted in said drum disposed between each end section and the central section, each of said bent wall members being positioned beneath each of said openings in the central section, and forming shovel-shaped pockets in the central section of the drum, said bent wall members each having terminal edges secured respectively to the leading and trailing edges of the openings in said central section, a cutting blade secured to each leading edge of said openings in said drum and extending along and outwardly of said drum, said end sections of the drum having spiral blades extending outwardly from said drum and adapted to feed material towards the openings in said central section, said spirally disposed blades having a leading end adjacent the outer ends of said end sections and disposed in the direction of digging rotation for said drum while the trailing end of the spiral blades terminates at the inner end of said end sections in radial alignment with said opposed side wall portions of the shovel-shaped pockets in the central portion of the drum and in adjacent spaced relation near the deeper portion of said shovel-shaped pockets, radial plates extending radially from said opposed side walls of the shovel-shaped pockets and joining the trailing end of the spiral blades projecting from said central portion of the drum whereby material dug and picked up by said spiral blades slides along said blades and is guided into said shovel-shaped pockets in the central portion of the drum, an endless conveyor coextensive with the width of said central section and having a front end positioned below said central section of the drum, said conveyor being positioned to extend upwardly and rearwardly of the front end thereof.

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