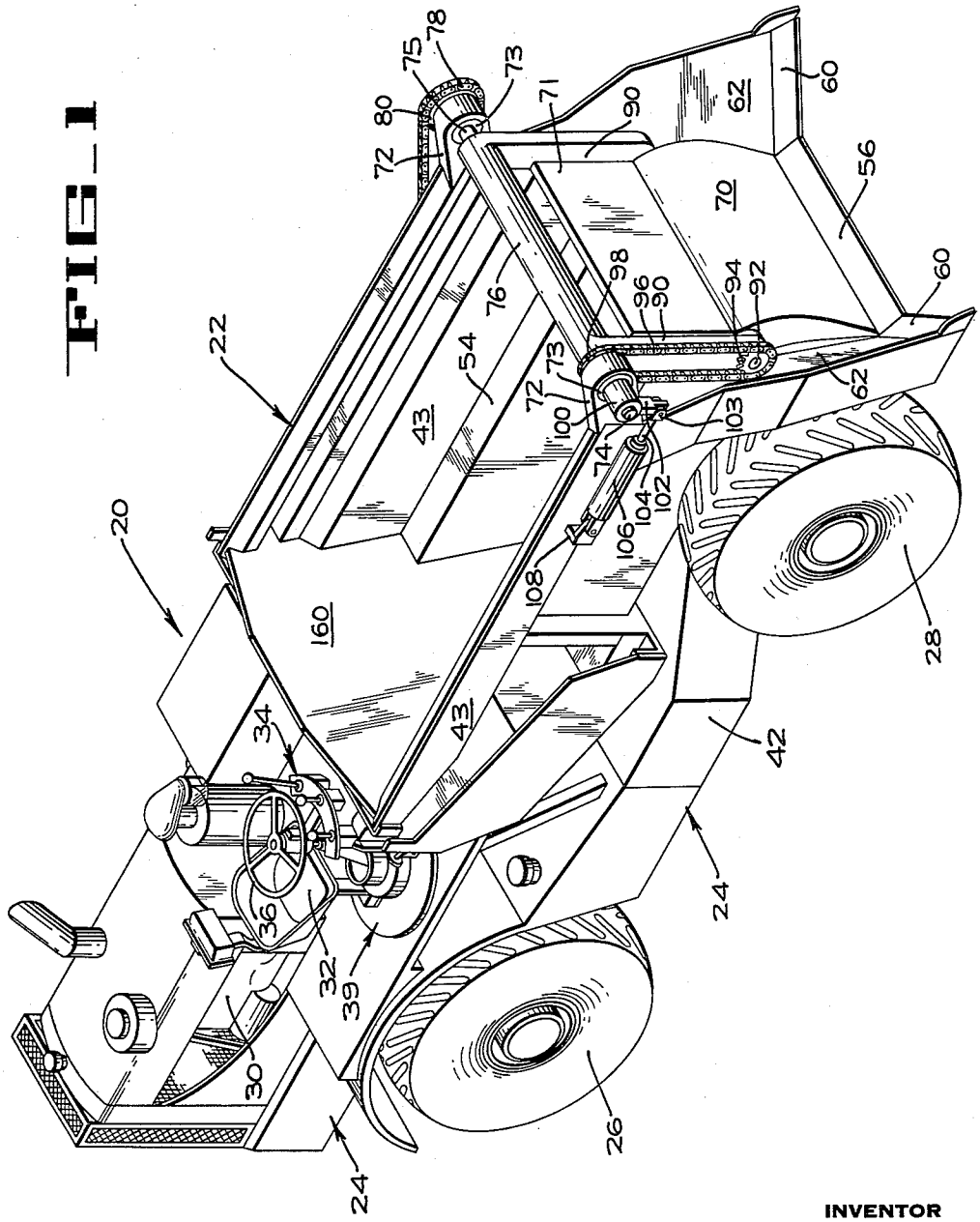
Oct. 1, 1963 J. M. HAIT 3,105,311

EARTH MOVING VEHICLE

Filed May 25, 1960 4 Sheets-Sheet 1

FIG. 1



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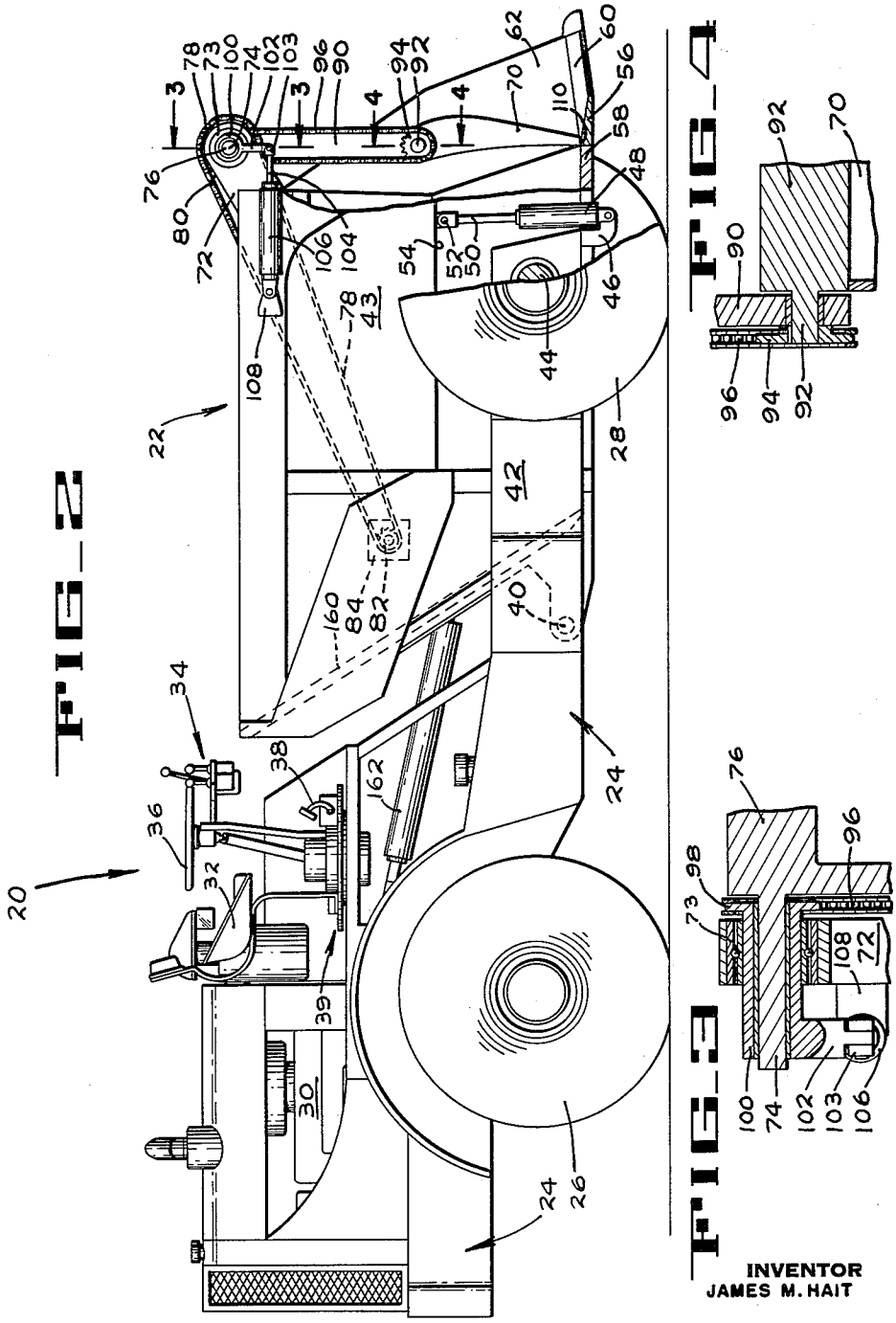
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EARTH MOVING VEHICLE

Filed May 25, 1960 4 Sheets-Sheet 2



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EARTH MOVING VEHICLE

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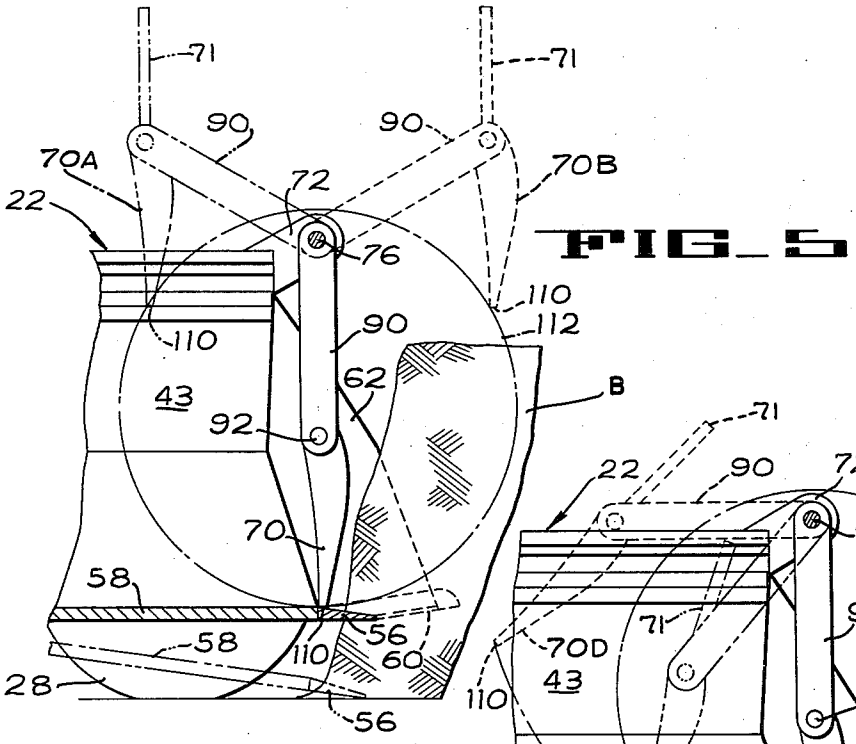


FIG_5

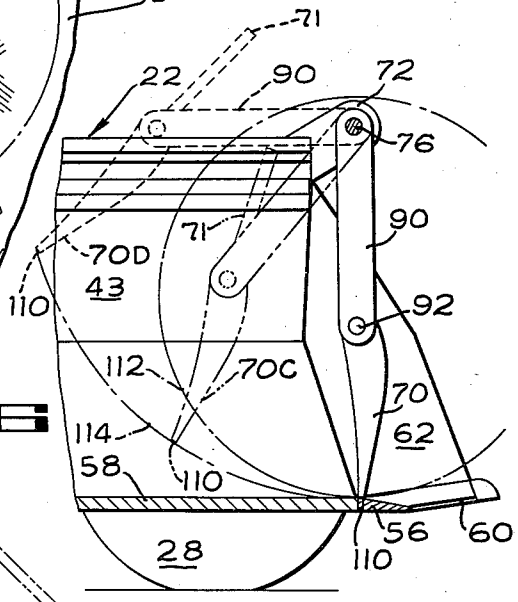


FIG_6

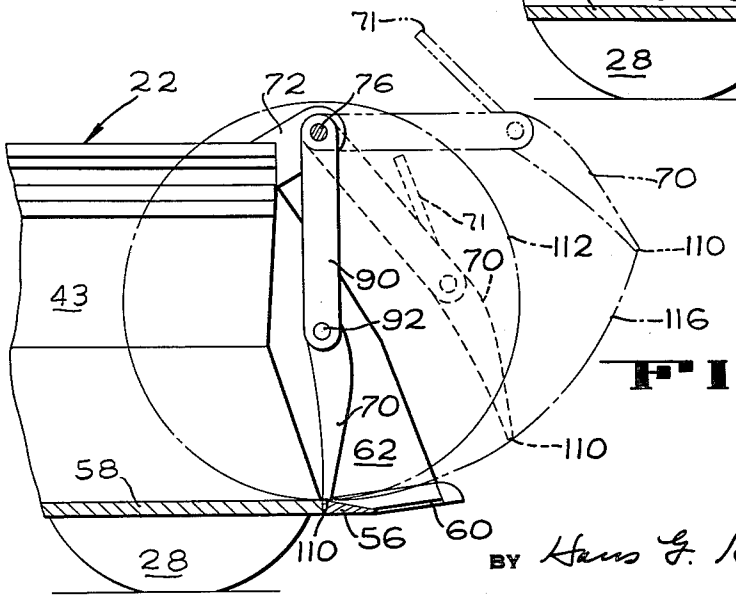


FIG_7

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EARTH MOVING VEHICLE

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FIG_8

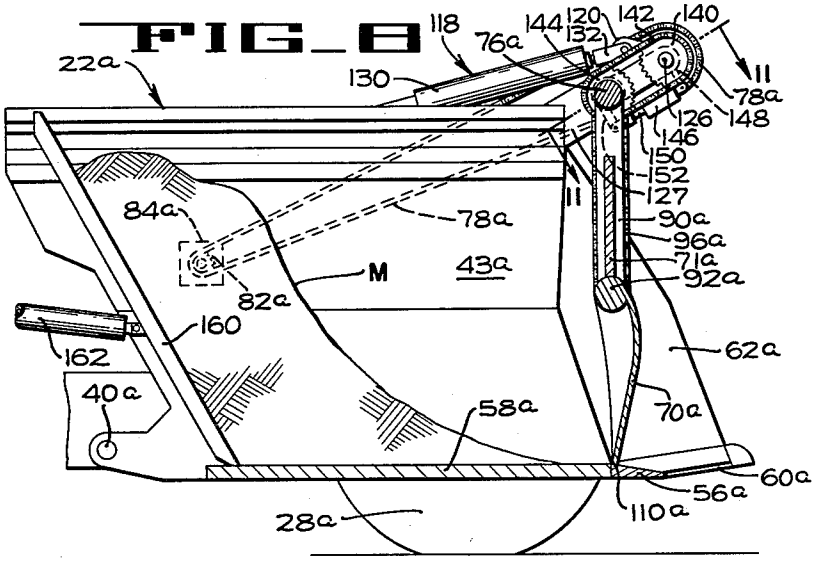


FIG_9

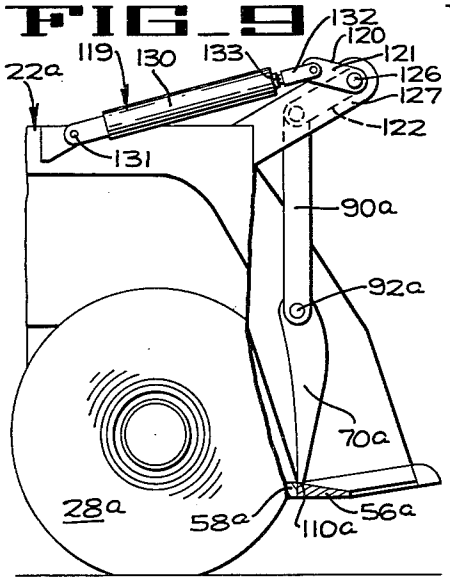
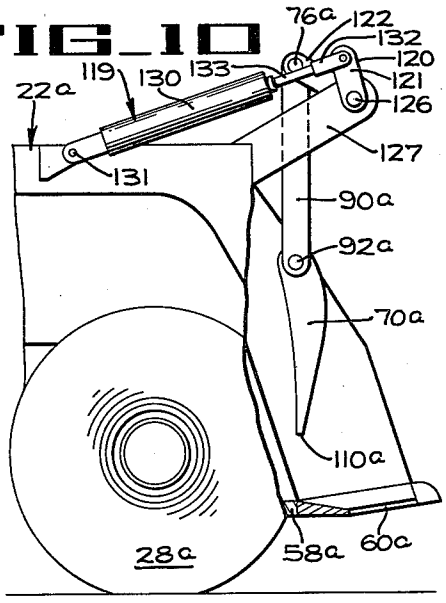


FIG_10



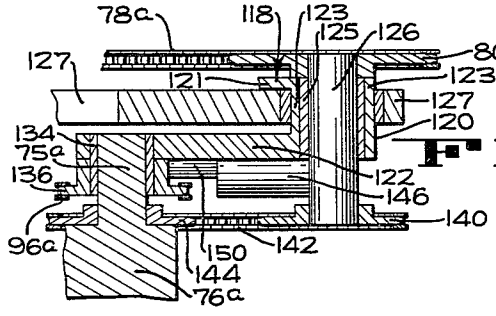


FIG_11

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United States Patent Office 3,105,311 Patented Oct. 1, 1963

3,105,311

EARTH MOVING VEHICLE

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Filed May 25, 1960, Ser. No. 31,692
11 Claims. (Cl. 37—4)

The present invention pertains to earth moving equipment and more particularly relates to an improved loading mechanism for self-loading earth moving vehicles.

A prior problem common to many large-capacity earth moving vehicles has been the difficulty of utilizing the entire capacity of the earth container because the open end of the container becomes blocked, and successive loading operations must also move the material previously moved into the earth container. It has been attempted, in order to overcome this problem, to provide loading means for moving the cut earth to the rear of the hopper. These attempts have largely been unsuccessful, however, because the two operations, cutting and loading, have interfered with one another in that they both demand the operator's guidance and attention.

This invention provides a large capacity self-propelled earth moving vehicle in which unusually efficient and simple loading means are incorporated that enable the full capacity of the vehicle to be used in the self-loading operation. The vehicle of the present invention is also self-dumping and is, in general, an all purpose vehicle adapted to scrape, bulldoze, load, carry, and dump heavy materials such as earth, loose rock, broken paving, and the like.

Accordingly, one of the objects of the present invention is to provide a heavy duty earth moving vehicle having an improved and simplified rapid loading mechanism which enables use of the full capacity of the vehicle.

Another object of this invention is the provision of an improved general purpose earth moving vehicle which attains the results of several different specialized earth movers.

Another object of this invention is to provide, in an earth moving vehicle, a loading blade which is arranged for adjustable movement in a fixed circular path by means providing efficient control over the adjusted angle of the blade.

Another object of the present invention is to provide a loading blade for an earth moving vehicle, the blade being arranged for adjustable movement in a variable circular path.

These and other objects and advantages of the present invention will become apparent from the following description and the accompanying drawing, in which:

FIGURE 1 is an isometric of the earth moving vehicle of the present invention.

FIGURE 2 is a side elevation, with parts broken away, of the vehicle shown in FIGURE 1.

FIGURES 3 and 4 are fragmentary vertical sections taken on line 3—3 and 4—4, respectively, of FIGURE 2.

FIGURES 5, 6 and 7 are schematic views of the loading end of the vehicle of the present invention, illustrating the orbital movement of the loading blade thereof.

FIGURES 8, 9 and 10 are schematic views similar to FIGURE 7 and illustrating a lowered and a raised position, respectively, of a modified form of loading blade mounting.

FIGURE 11 is a fragmentary section taken on lines 11—11 of FIGURE 8 and illustrating a portion of an adjustable drive and mounting mechanism used in the modified loading blade mounting (FIGS. 8–10).

The earth moving vehicle 20 (FIGS. 1 and 2) of the present invention includes an open-end rearwardly facing hopper 22 which is cradled in a frame structure 24 that is mounted upon front pneumatic wheels 26 and upon

rear pneumatic wheels 28. Each of the four wheels 26, 28 is driven by a drive train, not shown, that is powered by an engine 30 that is mounted upon the frame 24 in a position overhanging the front wheels 26 in order to assist in counterbalancing the vehicle when the hopper 22 is loaded.

A vehicle operator's seat 32 positions the operator for easy access to a group of hydraulic valve controls 34 which control movement of the various mechanisms, to be later described, that are associated with the hopper 22. A steering wheel 36 controls the steering movement of the vehicle 20 by turning the front wheels 26, and control pedals at 38 regulate the speed, shifting and braking of the vehicle. The operator's seat 32, the controls 34 and 38, and the steering wheel 36 are mounted on a turret 39 and turn in unison to permit the operator to control the vehicle while facing either the front or the rear of the vehicle.

The mounting of the closed end of the hopper 22 to the frame 24 includes a pivoted connection at 40, only one such connection being shown, between each side rail 42 of the frame and an adjacent side wall 43 of the hopper. The two side rails 42 extend rearwardly from the pivot points 40 along each side of the hopper and have no transverse connections to each other so that the hopper is free for vertical pivotal movement between the two frame rails 42. It will be understood that the far side rail and associated hopper mountings are identical, but oppositely disposed, to the near rail and mountings to be described.

A stub axle 44 (FIG. 2) projects outwardly from the rear end portion of each side rail 42 to support the adjacent rear wheel 28. Support means for each side of the open rear end of the hopper 22 is provided by a mounting bracket 46 that depends from the rear end portion of the side rail 42 and to which is pivotally mounted the lower end of a hydraulic cylinder 48. The piston rod 50 of the cylinder 48 is pivoted to a bracket at 52 which is secured to the underside of an outwardly directed wall portion 54 of the side wall 43 of the hopper 22, whereby the hopper may be pivoted around the pivots at 40 to and from engagement with the ground. When the hopper 22 is lowered to a ground engaging position by the cylinders 48, a hardened steel cutting bar or blade 56, which provides a substantially coplanar extension of a bottom panel 58 of the hopper, engages the ground. The free edge of the bar 56 is sharpened so that when the vehicle is moved rearwardly, earth or other material adjacent the sharpened cutting edge is scraped free and lifted onto the inclined bottom panel 58 of the hopper.

In order that the wheels 28 will not traverse uneven ground and alter the ground engagement of the cutting bar 56, a similarly shaped cutting bar 60 extends diagonally outward from each end of the bar 56 and coplanar therewith, so that the effective cutting edge of the bar 56 is extended beyond the track of the wheels. An outwardly flared apron 62 is connected to each bar 60 and the adjacent side wall 43 of the hopper to provide a smooth transition surface between the cutting bars 60 and the sides 43 of the hopper 22 for guiding the cut and loaded material into the hopper.

Due to the very large capacity of the hopper 22, it will be appreciated that when the vehicle 20 is scraping a heavy and firmly compacted material, such as clay, the power requirement for moving the vehicle into the clay might not be sufficient to cut and deposit the clay to the rear end of the hopper. Of course, smaller cuts might be made, but the object of rapid loading and the utilization of the full capacity of the hopper would not be realized because the material in the hopper would

have to be forced rearwardly therein by succeeding cuts of the material.

It is customary, therefore, in many earth moving vehicles of this general type, to augment the scraper loading of the hopper by means of a movable blade, apron, bucket, or the like, which moves the cut material to the rear end of the hopper. For this purpose, the present invention provides a loading blade 70 which, in one embodiment, is moved in a circular path around a horizontal transverse axis above the rear end of the hopper 22 and in a selected angular position in relation to the hopper. In addition, the loading blade 70 is adapted to assist the scraping action of the cutting bar 56 by cutting, as well as loading, the material against which the vehicle 20 is moved. The loading blade 70 is provided with a hopper closure plate 71 (FIG. 1) which forms a substantially coplanar rigid extension of the loading blade and cooperates therewith in order to close the open end of the hopper after it has been filled.

Included in the mounting means provided for the loading blade 70 is a support arm 72 (FIG. 1) which extends diagonally upward from the top rear corner of each side wall 43 of the hopper and is integral therewith. The upper end portion of each support arm 72 is provided with a suitable bearing 73, the two bearings 73 being transversely aligned and adapted to rotatably support reduced diameter end portions 74 and 75 of a loading arm driveshaft 76.

The driveshaft 76 is rotated by a roller chain 78 (FIGS. 1 and 2) which is trained around a sprocket 80 that is fixed to the driveshaft, and around a sprocket 82 (FIG. 2). The sprocket 82 is driven by a hydraulic motor 84 which is secured to the outer surface of the adjacent wall 43 of the hopper 22. The hydraulic motor 84 is driven by pumping means, not shown, connected to the engine 30 and controlled by manipulation of one of the controls 34 to effect rotation of the loading arm driveshaft 76 in a clockwise direction as viewed in FIG. 2. For a purpose mentioned later in this description, the hydraulic motor 84 is reversible to rotate shaft 76 counterclockwise also.

Two spaced apart and aligned loading blade support arms 90 (FIG. 1) are integrally formed with the driveshaft 76 and have apertured free-end portions which journal opposite ends of a loading blade shaft 92 for free rotation. The loading blade shaft 92 extends through, and is fixed to or formed integral with, the loading blade 70. The ends of the loading blade shaft 92 project through the support arms 90 and one end is keyed to a sprocket 94 (FIG. 4). By means of a roller chain 96 the sprocket 94 is connected to a sprocket 98 (FIGS. 1 and 3) that is the same size as the sprocket 94 and is integral with the inner end of a sleeve 100 which is interposed between the end portions 74 of the shaft 76 and the adjacent bearing 73.

As is clearly seen in FIGURES 1 and 3, the sleeve 100 projects outwardly beyond the associated support arm 72 and has an integral depending arm 102 which is secured by a clevis 103 to a piston rod 104 of a hydraulic double-acting cylinder 106. A bracket 108 pivotally mounts the base of the cylinder 106 to the adjacent side wall 43 of the hopper, and actuation of the cylinder is governed by one of the hydraulic controls 34. It will be apparent, therefore, that the angular disposition of the sleeve 100 relative to the support arm 72 is governed by the adjusted position of the piston rod 104 in relation to its cylinder 106. When the loading arm driveshaft 76 (FIG. 5) is rotated by the hydraulic motor 84, the loading blade shaft 92 is moved in a circular path around the axis of shaft 76. Due to the fact that the chain 96 connects the fixed sprocket 98 and the sprocket 94 that is keyed to shaft 92, the shaft 92 will be rotated during the circular movement of the shaft 92. Also, it will be apparent that since the sprockets 98 and 94 are the same size, the angular disposition of the loading blade 70 in relation to the hopper 22 during such movement remains the same.

In FIGURE 5, the movement of the loading blade 70 is illustrated for a particular angularity of the blade as controlled by the adjusted position in which the piston rod 104 (FIG. 1) is held in its cylinder 106. In this instance the loading blade 70 is fixed in a substantially vertical position and it will be apparent that when the cutting bar 56 is plunged into a bank of earth B, the blade 70 must be held in one of its elevated positions, such as at 70A or 70B, so as to not close off the open end of the hopper 22. Although the hopper 22 is shown as being elevated above the natural grade, if the bank B is of loose, fairly soft earth, the hopper might be lowered by means of the cylinders 48 to shear a larger volume. When the bank B is penetrated by the cutting bar 56, or when the vehicle is positioned as illustrated, the loading blade 70 is set into motion by the vehicle operator. Also, if the hopper is swung down to the phantom line position of FIG. 5, the scraper blade 56 will dig into the ground and earth will be automatically moved back into the hopper as the vehicle is moved rearwardly. In all scraping and digging operations, the loading blade 70 may be used to move material forwardly in the hopper to completely fill the hopper.

Due to the described movement of the loading blade, a sharpened and hardened lower edge 110 of the blade 70 follows the circular path shown at 112 and descends into the bank B to cut portions of it away and then move the cut portions forwardly into the hopper 22. The cutting and loading action of the blade 70 can be carried on simultaneously with the rearward movement of the vehicle into the bank. Since the leading end portion of the hopper is kept clear of accumulated earth by the loading action of the blade, no increase in the power requirements is needed as the vehicle advances into the bank, because the volume of earth cut and loaded at any one time remains, for all practical purposes, constant.

In the two modified forms of operation for the loading blade 70 (FIGS. 6 and 7) a cyclic cam control, not illustrated, but well known by those skilled in the art, causes a predetermined movement of piston rod 104 (FIG. 2) in the cylinder 106 during each revolution of the driveshaft 76. This action rotates the sprocket 94 and results in a changing angle of attack of the loading blade 70 as it is moved by the arms 90. In this manner, the same advantageous angle of the loading blade 70 may be preserved during its downward cutting stroke, and during rearward movement of the blade, as at 70C and 70D (FIG. 6) the blade may be kept in a more longitudinally aligned position with the mounting arms 90 in order to increase the effective throw of the blade toward the forward end of the hopper 22. The increased throw of the blade 70 may be readily seen by comparison of the circular path 112 superimposed on FIGURE 6, and an arcuate path 114 showing the path of the cutting edge 110 of the blade.

When a loosely packed material is loaded that requires less cutting force to dig, such as sand or gravel, the effective reach of the loading blade 70 (FIG. 7) may be extended during its forward movement by means of a different manipulation of the piston rod 104 (FIG. 2) by the same cyclic cam control aready mentioned. An arcuate path 116 illustrates the increased reach of the cutting edge 110 of the blade as compared with the circular path 112 already described. Obviously, the embodiment of all three actions, i.e., the normal cutting and loading action (FIG. 5), the extended throw cutting and loading action (FIG. 6) and the extended reach cutting and loading action (FIG. 7) can be incorporated in a single vehicle for selected use by the operator of any desired combination of the cutting and loading actions. FIGURE 8, although primarily intended to show a second embodiment of loading blade control mechanism of the present invention, further illustrates the manner in which the loading blade, as hereinbefore described, moves ma-

terial M to fill the rear end of the hopper so as to advantageously use its large capacity.

In FIG. 8 the parts of the machine which are identical to those of FIGS. 1–7 will be given the same reference numerals followed by the suffix "*a*." The embodiment disclosed in FIG. 8 provides means whereby the driveshaft **76***a*, about which the blade moves, can be positioned at selected elevations above the hopper **22***a* in order to provide clearance between the lower edge **110***a* of the blade **70***a* and the floor **58***a* of the hopper. The loading and cutting blade **70***a* is thus capable of being raised from the position of FIG. 8 to an elevated position such as that of FIG. 10 to clear any obstructions, such as boulders or logs, which may have been moved into the entrance of the hopper. At the same time, the loading blade can be pivoted around its support shaft **92***a*, in the same manner previously described, to vary the relative position of the blade and the support arms **90***a* so that the advantageous loading movements of FIGS. 6 and 7 can be realized.

The adjustment of the driveshaft **76***a* is effected by means of two power actuated linkages **118** and **119** (FIGS. 8 and 9). Since the linkages are identical, their parts will be given identical reference numerals and only the linkage **119** will be described in detail. The linkage **119** includes a bellcrank **120** (FIG. 9) that has arms **121** and **122** which are connected by a tubular section **123** as shown in FIG. 11 in connection with the bellcrank **120** of linkage **118**. The tubular section of each bellcrank is rotatably journalled by means of a bushing **125** on a stub shaft **126** projecting from a support arm **127** (FIG. 9) that is secured to the adjacent side wall **43***a* of the hopper.

A double acting hydraulic cylinder **130**, having a base portion pivotally connected, as at **131** (FIG. 9) to the side wall **43***a*, has a piston rod **133** and a clevis **132** pivoted to the free end of the bellcrank arm **121**. The cylinder **130** is controlled by one of the hydraulic controls at the operator's station. As seen in FIG. 11, the free end of each arm **122** of the bellcrank is provided with a sleeve bearing **134** which extends inwardly through the hub of a rotatable sprocket **136** and is disposed around a reduced diameter end portion **75***a* of the driveshaft **76***a*. When the piston rods **133** of the actuating linkages **118** and **119** are forced out of the cylinders **130** the bellcranks **120** are rotated clockwise (FIGS. 9 and 10) causing the driveshaft **76***a* and the loading blade **70***a* to be raised. It will be evident that the amount of elevation is controlled by the length of the stroke of the power cylinders **130** and by the length of the bellcrank arms.

The drive train from the hydraulic motor **84***a* (FIG. 8) includes the roller chain **78***a* (FIG. 11) and the sprocket **80***a*, but in this instance the sprocket **80***a* is secured to the stub shaft **126** which extends inwardly through the bushing **125**. A sprocket **140** is fixed to the inner end portion of the stub shaft **126**, and a roller chain **142**, that is trained around the sprocket **140** and around a sprocket **144** secured to the driveshaft **76***a*, causes rotation of shaft **76***a* when the hydraulic motor **84***a* is energized.

The angular disposition of the loading blade **70***a* during orbital movement of the blade around the driveshaft **76***a* is controlled by a double-acting hydraulic cylinder **146** (FIGS. 8 and 11) which has one end fixed to a mounting bar **148** (FIG. 8) that depends from the arm **122** of the bellcrank **120** of the actuating linkage **118**. The piston rod **150** of cylinder **146** (FIG. 11) is pivoted to a depending bar **152** that is welded to the sprocket **136** which is freely rotatable on the sleeve bearing **134**. Thus it will be apparent that extension or retraction of the piston rod **150** will accordingly determine the rotative position of the sprocket **136** in relation to the support arms **90***a*. The sprocket **136** functions in the same manner as the previously described sprocket **98** in controlling the attitude of the loading blade **70***a* relative to its support arms **90***a*. A chain **96***a* connects sprocket **136** to a sprocket **94***a* (not shown) so that rotation of the sprocket **136**, through actuation of cylinder **146**, causes a change of the position of the loading blade **70***a* relative to its lifter arms **90***a*. In similar manner, the cylinder **146** can also be actuated by means of a cam control previously mentioned to cause movement of the loading blade **70***a* in a vertical position, or to cause the extended reach positions of the blade, as in FIG. 7, or the extended throw positions of FIG. 6.

From the foregoing description it will be seen that by providing the cutting and loading blade in both of the disclosed embodiments, the cut material may be moved to the rear end of the hopper in a manner assuring full utilization of the capacity of the hopper. When the hopper has been filled, the loading blade may be caused to make reciprocating cutting and loading strokes at the front of the hopper by means of the reversible feature of the hydraulic motor **84** or **84***a* which drives the cutting blade, without making the orbit previously described. In this manner, the hopper may be fully loaded to completely fill the space immediately behind the loading blade. The blade is then moved to the position shown in FIGURE 1, wherein the previously mentioned hopper closure plate **71** and the loading blade **70** effectively close the end of the hopper and prevent spillage of the material from the hopper.

After the vehicle has been driven to a dumping spot, the hopper may be lowered by means of the hydraulic cylinders **48** or **48***a* (FIG. 2) until the cutting bar at the rear of the hopper rests upon the ground. The hopper is thus inclined downwardly from its pivots at **40** or **40***a* and the loading blade may next be caused to move upwardly away from the hopper to open the end of the hopper. In this open inclined position of the hopper, material therein gravitates toward the lower end of the hopper. The unloading operation is primarily effected in both embodiments of the machine, however, by a pusher plate **160** which will be described in connection with FIGURES 1–7. The plate **160** (FIG. 1) occupies the entire cross-sectional area of the hopper and is normally positioned adjacent the center of the vehicle, in which position it forms a closure for the forward end of the hopper **22**. A pair of longitudinally extending spaced double-acting hydraulic cylinders **162**, only one being shown in FIG. 2, are connected to the pusher plate **162** and to part of the frame structure **24**. Suitable guide means, not shown, maintain the angular position in which the pusher plate is illustrated. The piston rods of the two cylinders **162** are extendable by means of one of the hydraulic controls **34**, to propel the pusher plate **160** from its initial forward position to a position adjacent the cutting bar **56** at the rear end of the hopper. The contents of the hopper are thereby propelled onto the dumping site.

When the earth moving vehicle **20** is to function as a bulldozer, the pusher plate **160** is positioned at the front end of the hopper **22** and the hopper is filled with earth in order to attain maximum traction. The loading blade **70** is then lowered to the position shown in FIGURES 1 and 2, in which position it is used as a bulldozing blade adapted to push earth, rocks, stumps, and so forth, ahead of the rearwardly moving vehicle. It will thus be apparent that the earth moving vehicle of this invention fulfills all of the objects set forth in that it provides a general purpose, heavy duty earthmover adapted to scrape, bulldoze, load, carry, and dump heavy materials.

While two embodiments of the invention have been set forth herein, it will be apparent that certain modifications and variations thereof may be practiced without departing from the spirit and scope of the invention as defined in the following claims.

That which is believed to be new and for which the protection of Letters Patent is desired is:

1. An earth moving vehicle comprising a wheeled support structure, a hopper on said structure having an open end adjacent the rear of said structure, a loading blade disposed transversely across the open end of said hopper, means mounting said blade upon said hopper for movement about a horizontal axis and in a continuous circular path having a portion exterior of said hopper and a portion interior of said hopper, said mounting means being so constructed that said blade is disposed entirely above said hopper open end when positioned at the apex of said circular path, means for moving said blade in said circular path, a control mechanism operatively connected between said blade and said blade mounting means for normally maintaining said blade in a fixed orientation relative to a vertical plane during movement in said circular path, and power means connected to said control mechanism for adjusting said loading blade orientation.

2. In a power driven earth moving vehicle having a mobile frame, the combination of an open end hopper mounted on the frame for receiving and storing material, a driveshaft rotatably supported from said hopper above the open end thereof, spaced aligned arms projecting radially from said driveshaft, a transverse loading blade connected to the free ends of said arms for movement therewith and for rotation around a horizontal axis while said arms are moved in a circular path by said driveshaft, said loading blade having an integral hopper closure plate which together with said blade substantially closes the open end of said hopper when said blade is disposed in a substantially vertical position below said axis, power means connected to said loading blade for adjusting the angular disposition of said blade relative to said aligned arms, and driving means for rotating said driveshaft, said loading blade being movable downwardly in an arcuate path for cutting earth adjacent the vehicle during downward movement of said arms ahead of the hopper and for moving the earth into the hopper during a rearward stroke of the loading blade.

3. In a power driven earth moving vehicle including a mobile frame structure, the combination of an open end hopper mounted on the frame structure, an earth cutting and loading blade having spaced support arms pivoted to said blade on a common axis, vertically adjustable support means carried by said hopper and connected to said support arms for mounting said blade across the open end of said hopper at selected elevations above the floor thereof, means for rotating said support arms about a horizontal axis to move said blade along a circular path, and driving means for reciprocating said cutting and loading blade through part of a circular path about said pivot axis independently of the rotation of said support arms about said horizontal axis.

4. In a power driven earth moving vehicle having a mobile frame, the combination of an open end hopper mounted on the frame, a driveshaft rotatably carried by said hopper above the open end thereof and having spaced radially aligned arms, a transverse loading blade connected to the free ends of said arms and rotatable around a horizontal axis while being carried by said arms in a circular path, first power means connected to said hopper and said driveshaft for adjusting the elevation of said driveshaft in relation to said hopper, second power means connected to said loading blade for adjusting the angular disposition of said blade relative to said arms, and driving means for rotating said driveshaft, said loading blade thereby being adapted for cutting earth adjacent said vehicle during its stroke ahead of said hopper and moving the earth into said hopper as the blade is carried rearward.

5. In a power driven earth moving vehicle including a wheel supported frame structure, the combination of an open end hopper mounted on the frame, a driveshaft rotatably supported from said hopper across the open end thereof and having spaced radially aligned arms, drive means for rotating said driveshaft, a loading blade shaft journalled in the free ends of said arms and rotatable around a horizontal axis, a transverse loading blade mounted on said loading blade shaft, a first sprocket mounted for free rotation on one end of said driveshaft, a power cylinder operably connected to said first sprocket for adjusting the angular position of said sprocket, a second sprocket of the same size as said first sprocket secured to said loading blade and concentric with said loading blade shaft in alignment with said first sprocket, and an endless chain trained around said first and second sprockets for adjustably maintaining the angular disposition of said loading blade in relation to a vertical plane during movement of the blade in said circular path in order to cause the blade to cut earth adjacent the hopper during a downward stroke ahead of the hopper and to move the cut earth into the hopper during a rearward stroke of the loading blade.

6. In a power driven earth moving vehicle including a wheel supported frame structure, the combination of an open end hopper mounted on the frame, a support arm fixed to each side wall of said hopper adjacent said open end, a bellcrank mechanism rotatably mounted on each support arm, a driveshaft rotatably mounted in said bellcrank mechanisms and having spaced radially aligned arms, drive means for rotating said driveshaft, a loading blade shaft journalled in the free ends of said arms and rotatable around a horizontal axis, power means connected to said bellcrank mechanism and to said driveshaft for adjusting the elevation of said driveshaft in relation to said driveshaft, a transverse loading blade mounted on said loading blade shaft, a first sprocket mounted for free rotation on said bellcrank mechanism, a power cylinder connected to bellcrank mechanism and to said first sprocket for adjusting the angular position of said sprocket, a second sprocket of the same size as said first sprocket and operatively connected to said loading blade in alignment with said first sprocket, and an endless chain trained around said first and second sprockets for adjustably maintaining the angular disposition of said loading blade in relation to a vertical plane during movement of the blade in said circular path in order to cause the blade to cut earth adjacent the hopper during a downward stroke ahead of the hopper and to move the cut earth into the hopper during a rearward stroke of the loading blade.

7. In an earth moving vehicle having a mobile frame structure the combination of an open end hopper mounted on said frame, a driveshaft rotatably supported from said hopper across the open end thereof and having a radially projecting arm, a shaft journalled in the free end of said arm, drive means for rotating said driveshaft, a sleeve mounted for free rotation on one end of said driveshaft adjacent said arm, a power cylinder connected to said hopper and to said sleeve for adjusting the angular position of said sleeve, a sprocket and chain drive of 1 to 1 drive ratio interconnecting said sleeve and said shaft for rotating said shaft when said driveshaft is rotated in order to maintain a selected angular position of the shaft while it is carried in a circular path around the driveshaft by said radial arm.

8. In an earth moving vehicle having a mobile frame, the combination of an open end hopper mounted on the frame, a driveshaft rotatably supported from said hopper above the open end thereof, spaced aligned arms projecting radially from said driveshaft, a loading blade shaft mounted for rotation in the free ends of said arms to be carried thereby in a circular path, a transverse loading blade fixed to said loading blade shaft for movement therewith in said circular path, and an endless chain drive train including a sprocket connected to said loading blade shaft and a sun sprocket journalled on said drive shaft and adjustably mounted for movement independently of said driveshaft to selected angular positions, whereby when said loading blade shaft is carried in said circular path the angular position of said shaft is adjustable in relation to said hopper and said loading blade

is adjustably maintained at an angle of attack controlled by said drive train.

9. An earth moving vehicle comprising a wheeled support structure, a hopper on said structure having an open end projecting beyond the adjacent wheels, a loading blade carried on the open end of said hopper for movement in a circular path about a generally horizontal axis, said movement being into and out of said hopper, means for moving said blade along said circular path to contact material adjacent the open end of said hopper and move it into said hopper, and control means connected to said blade for normally maintaining said blade in fixed orientation relative to said hopper during said loading blade movement, said control means including adjusting means for varying the upright orientation of said blade without shifting said axis whereby said blade can move along said circular path relative to said hopper with any one of a plurality of selected inclinations relative to a vertical plane through said axis.

10. An earth moving vehicle comprising a mobile support structure, a hopper mounted on said support structure having an open end, a loading blade mounted on said hopper at the open end thereof for movement in a circular path having an initial arc of movement exterior of said hopper and a subsequent arc of movement inside said hopper, means for moving said blade along said circular path to contact material adjacent the open end of said hopper and move it into said hopper, and control

means for adjusting the orientation of said blade relative to a vertical plane independently of said circular path relative to said hopper including a first sprocket carried by said hopper upon said axis of rotation of said loading blade, means for adjusting the rotative position of said first sprocket, a second sprocket of the same size as said first sprocket and fixed to said blade, and a chain trained around said sprockets.

11. In a power driven earth moving vehicle including a wheel supported frame, the combination of an open end hopper mounted on the frame, an earth cutting and loading blade extending across the open end of said hopper, mounting means carried by said hopper and mounting said blade for orbital movement about a horizontal axis, power driven adjustable support means connected to said mounting means for positioning said blade at selected elevations above the floor of said hopper, driving means for moving said blade in said orbital path about said axis to move said blade into and out of said hopper, and means for adjusting the angular disposition of said cutting and loading blade relative to a vertical plane during movement thereof in said orbital path independently of the position of said horizontal axis.

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