

March 10, 1942.

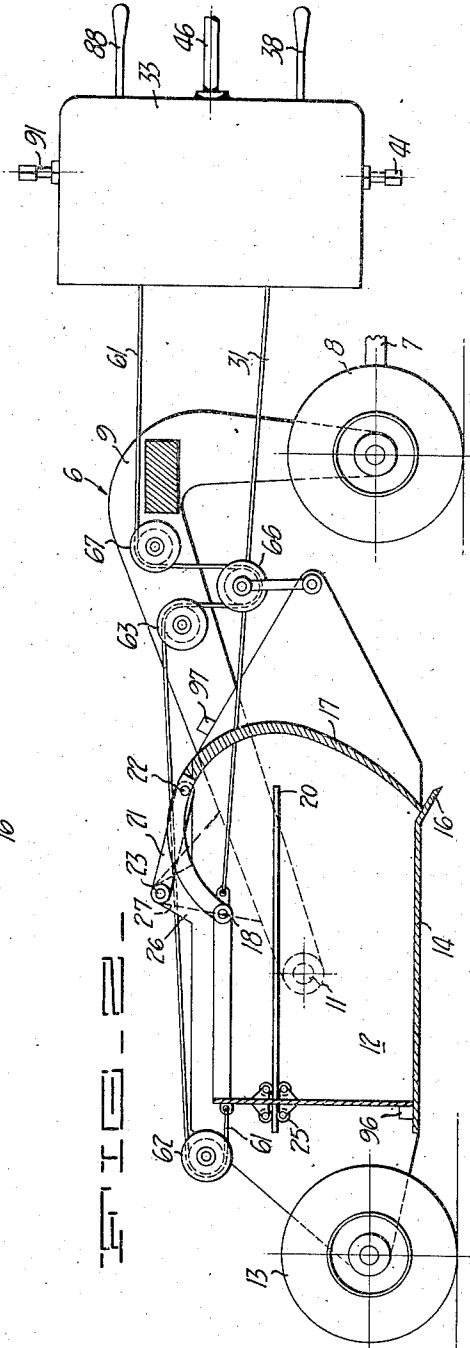
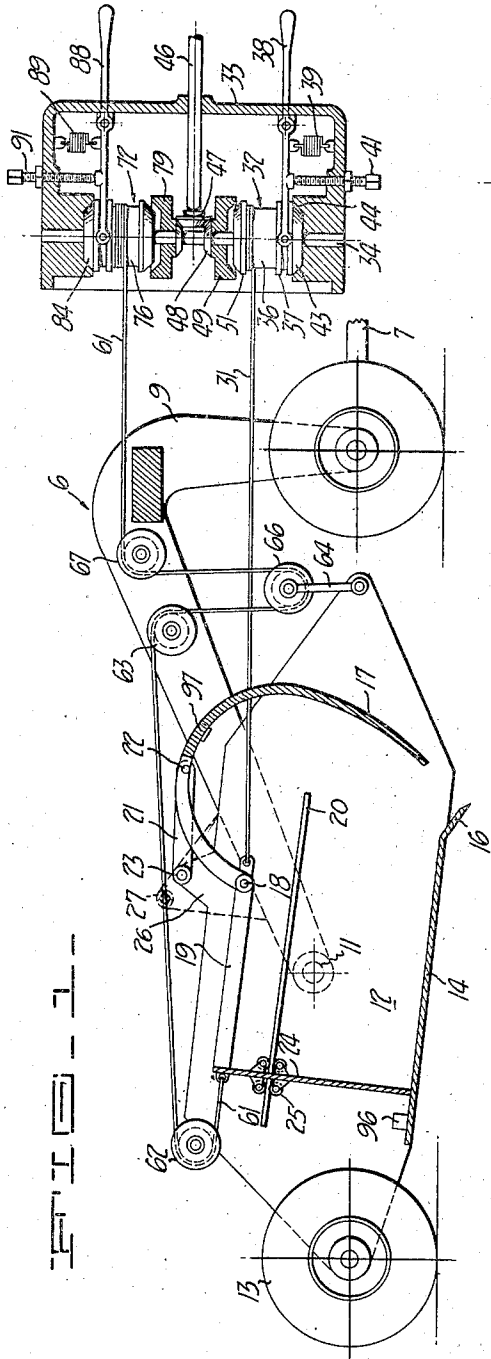
E. W. AUSTIN ET AL

2,275,601

EARTH MOVER

Filed Dec. 11, 1939

2 Sheets-Sheet 1



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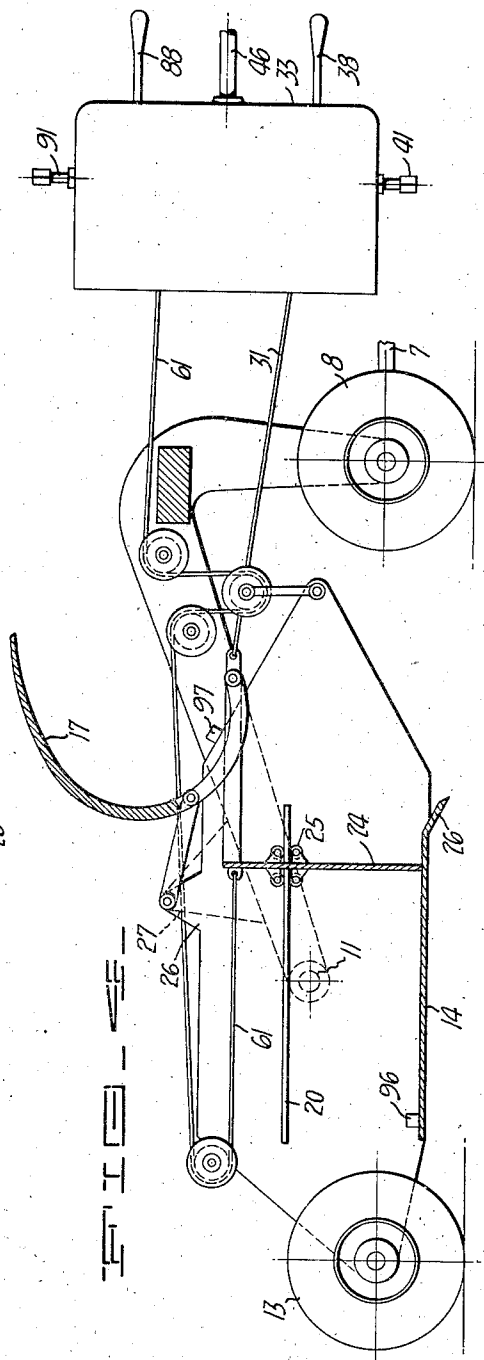
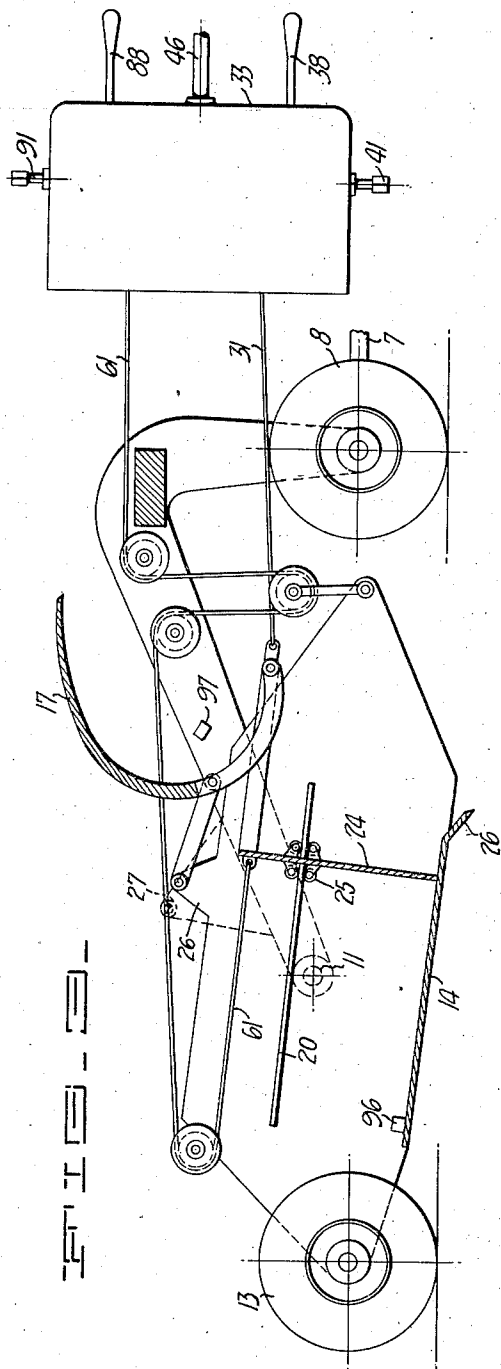
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EARTH MOVER

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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EARTH MOVER

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17 Claims. (Cl. 37—126)

Our invention relates to earth movers generally embodied as tractor-drawn wheeled vehicles for dislodging or scraping and carrying earth for transfer to or dumping in a remote location, and is concerned especially with an earth mover of the type shown in the copending application of Ellsworth W. Austin, Serial No. 299,299, filed October 13, 1939, and entitled "Excavator," of which this application is a continuation in part.

In devices of the character referred to, there is usually provided a drawn vehicle having a main bowl or comparable earth-containing instrumentality which is provided with a closure to retain the earth during transportation, and a pusher for dislodging the earth when it is to be discharged. It is desirable to manipulate the earth container in such a way as to raise and lower a cutting edge thereon as well as to advance and retract the pusher and to open and close the end closure or front apron.

It is likewise advisable to provide such instrumentalities in such a way that they can be controlled by the operator of the tractor drawing the earth mover and to provide such operator with a relatively simple control device. For example, two control levers are considered to be the optimum number.

It is therefore an object of our invention to provide an earth mover in which the pusher and the end closure are correlated for conjoint operation.

Another object of our invention is to provide a connection between such elements in an earth mover to afford the desired relative movement thereof.

Another object of our invention is to provide in an earth mover an arrangement in which the various instrumentalities are appropriately caused to function under the control of two control levers.

A further object of our invention is in general to improve earth movers and especially the control thereof.

The foregoing and other objects are attained in the embodiment of the invention illustrated in the drawings in which—

Fig. 1 is a diagram showing an earth mover in schematic form in longitudinal vertical section, connected to a winch mechanism shown in diagrammatic form in transverse cross-section, the earth mover being in a convenient position for excavating;

Fig. 2 is a diagram similar to Fig. 1 but showing the earth mover in carrying position;

Fig. 3 is a diagram similar to the preceding figures but showing the earth mover in a lower, expelling or discharging position; and

Fig. 4 is a view similar to the preceding schematic figures, showing the earth mover in a raised position for expulsion or discharge of material.

In its preferred form, the earth mover of our invention includes an earth container having a cutting edge and also having an earth pusher and a closure, the pusher and the closure being related by a direct pivotal connection and being actuated in company with the main bowl by means of a pair of control cables, one of which extends from the pusher and closure to a first winch drum which is normally frictionally braked but is provided with a control lever for releasing the restraint of the brake and connecting the drum to a source of power, the pusher and the end closure being also provided with a second cable preferably related through a speed reduction to adjust the cutting edge of the main bowl and extending to a second winch drum normally restrained by a friction brake and under the control of a second lever for releasing the restraint of the brake and connecting the drum to a source of driving power.

While the earth mover of our invention can be incorporated in a very large number of different forms, depending upon surrounding circumstances, especially upon commercial requirements, it is illustrated schematically or diagrammatically herein in order to show the general principles of the invention, it being understood that various mechanical modifications can be made within the ability of those skilled in the art.

The earth mover comprises a vehicle, generally designated 6, which is provided with a draft connection 7 ordinarily connected to a draft vehicle, such as an engine-operated tractor (not shown), although the vehicle 6 can itself carry a source of propelling power in which instance the draft vehicle is dispensed with. The earth mover 6 includes a pair of front dirigible wheels 8 for guiding the vehicle, which are appropriately articulated with the frame 9 connected by a pivotal connection 11 to the opposite side walls 12 of the device. At their rearmost terminals the side walls 12 carry rear ground-engaging wheels 13 which, in concert with the wheels 8, bear the weight of the vehicle.

Included in the vehicle is a bottom or earth-supporting surface 14 which spans the side walls 12 and together therewith constitutes a main

bowl or earth-containing instrumentality. The leading edge of the bottom 14 terminates in a cutting member 16 for dislodging earth to be excavated. The main bowl is partially enclosed by a front apron 17 which is constituted generally by a transverse curved plate extending between the side walls 12 and is sometimes referred to as an end closure, end apron or front apron. Its general function when closed is to retain earth loaded within the main bowl, yet when open is to be in a position definitely out of the way of material entering or being discharged from the main bowl. For that reason the front apron 17 continues its arcuate curvature, in accordance with our invention, and is connected by a pivotal connection 18 or a simple pivot to a carriage 19 which is preferably constrained by any suitable means, such as a track 20 on the walls 12 and co-operating rollers 25 on the carriage 19, to rectilinear translation relative to the side walls 12 of the main bowl, so that the pivot 18 moves in a straight path fore and aft as the carriage 19 is moved. Also to determine the path of movement of the front apron 17, there is provided a linkage in the form of a strut 21 which at one end is connected by a pivot 22 to the front apron 17 and at the other end is connected by a pivot 23 to an ear 26 projecting from the side wall 12 of the main bowl. The strut 21 permits the pivot 18 to move in a rectilinear path, while the end of the front apron 17 most nearly adjacent the cutting edge 16 moves in a curved path.

The carriage 19 is rigidly fastened to and generally is included within a structure ordinarily referred to as a pusher or sometimes as a rear end gate or ejector, which likewise incorporates a plate 24 extending in an approximately vertical plane and transversely of the main bowl between the walls 12; so that as the carriage 19 moves fore and aft, the wall 24 likewise so moves. Because the front apron 17 is pivoted to the pusher, the two partake of movement with respect to each other conjointly and also move simultaneously with respect to the main bowl; but the linkage is such that for the initial forward movement of the wall 24 the lower edge of the front apron 17 moves very rapidly away from the cutting edge 16, so as to give a quick and large initial opening of the front apron before the wall 24 has advanced very far. During the intermediate portion of advancement of the wall 24 the front apron 17 is opened very widely to give an unhampered egress from the main bowl, and during the final portion of movement of the wall 24 the front apron 17 opens even farther; so that latter positions of the wall 24 are adaptable for the discharge or receipt of an exceedingly high or voluminous body of material from or into the main bowl. These desired relative movements of the pusher and the front apron are made possible by directly pivoting the front apron to the pusher and by then connecting the front apron to a relatively stationary part, such as the ear 26 on the main bowl or a similar alternatively utilized ear 27 on the frame 9.

In order conjointly to propel the pusher and front apron forwardly with respect to the main bowl, there is attached to the carriage 19 a first draft cable 31 which extends to a first winch drum 32, diagrammatically illustrated as being mounted within a casing 33 upon a stationary shaft 34 anchored within the housing 33. The drum 32 includes a central winch portion 36 and a shifting collar 37 with which an operating lever

38, pivoted on the casing 33, co-operates to move the winch drum axially of the stationary shaft 34. A spring 39 normally urges the drum 32 in one direction against an adjustable stop 41 which can be suitably regulated so as to adjust the maximum amount of frictional engagement between a cone 43 on the drum 32 and a similar conical seat 44 integral with the casing 33 and together with the cone 43 constituting a frictional brake. The restraint or retardation of the drum 32, diagrammatically illustrated as produced by a conical friction brake, can be produced by other means as well, such as any power absorption brake or virtually any other well known expedient for producing a substantially constant resistance to the continued rotation of the drum 32.

When the drum 32 is shifted by the operator-controlled lever 38 away from the cone 44, the restraint of the brake is released and the drum passes through a neutral unrestrained position and then into engagement with a power driving structure. This includes a drive shaft 46 extending from the tractor power plant, for example, or from any suitable source of power, and includes a bevel gear 47 which meshes with a bevel gear 48 included with a power cone 49 freely rotatable on the shaft 34 and engageable by a co-operating cone 51 at one end of the drum 32, so that when the lever 38 is moved a maximum amount against the restraint of the spring 39, the cones 49 and 51 are in engagement and the drum is driven by power derived from the shaft 46. Thus, when the lever 38 is appropriately manipulated, the cable 31 can be wound upon the drum 36 by power means, or when the lever is in a neutral position the cable 31 is unrestrained so far as drum rotation is concerned, and, finally, when the lever 38 is in a braking position the cable 31 is restrained from paying out cable from the drum 36 by whatever degree of restraint is frictionally exercised by the brake 43. The brake restraint is partially under the control of the operator, but the maximum amount is under the control of the adjustment 41 which can be set so as to provide for all practical purposes an absolute frictional lock against any movement of the cable 31 when the brake is fully applied, or can be given any intermediate degree of adjustment so that there is any desired amount of resistance to paying out of the cable 31 from the drum 36.

A similar power mechanism is employed for retracting the pusher and lowering the front apron, but this structure also includes mechanism for performing a further function. To the carriage 19 is attached a second cable 61 which extends around a reversing pulley 62 mounted on the side wall 12, and thence around a pulley 63 for convenience mounted upon the frame 9. To the forward portion of the main bowl wall 12 is secured a fitting 64 on which a sheave 66 is mounted and around which the cable 61 passes just prior to extending over a pulley 67 mounted on the frame 9. The passage of the cable 61 over the pulleys 63 and 67, and especially over the sheave 66, constitutes a speed reduction in that for each unit that the cable 61 moves in a linear direction the fitting 64 moves one-half that amount with the arrangement shown. As a practical matter, the cable 61 would pass around a multi-sheave connection between the frame 9 and the main bowl, so that the speed ratio is of the order of ten or twelve, or even more, to one. That is to say, in the ordinary

commercial embodiment, movement linearly of the cable 61 through one unit of distance produces only a tenth or twelfth of that amount of movement of the fitting 64 and hence an even smaller rising or falling movement of the cutting edge 16.

The mentioned movement of the cable 61 is provided by a second winch structure, generally designated 72, incorporating a second winch drum 76 having a driving connection 79 to the shaft 46 and a resisting brake 84, all under the control of an operating lever 88 normally urged toward one position by a spring 89 under the control of an adjustment 91 for regulating the maximum resistance to paying-out of the cable 61. It will be observed that while the drive shaft 46 rotates the drums 76 and 36 in opposite directions on the stationary shaft 34, the cables 31 and 61 are wound upon such drums in opposite directions; so that both the cables 31 and 61 are tensioned by a movement toward the right hand in Fig. 1 and are slackened by a movement toward the left hand in that figure.

With the arrangement of winches and cables described, various possibilities of operation are presented. Various effects can be produced at different times by changing the adjustments 41 and 91 and by varying the speed reduction or ratio effectuated by the sheave 66; but in an exemplary arrangement the earth mover is shown in Fig. 1 as in an excavating position with the pusher in a position slightly forward of its extreme rearward position. If, then, it is desired to raise the cutting edge 16 from excavating or cutting position and to close the front apron 17 so as to carry the previously excavated material, this can be done in at least two ways. In the first way, the control lever 38 can be moved so that the drum 36 is in neutral position, allowing no restraint whatsoever to be imposed by the cable 31, and the control lever 88 can then be operated so as to take in or draw in the cable 61. Since the resistance to rearward movement of the pusher and front apron is relatively slight, usually being less than that of the main bowl to be raised, the carriage 19 is first drawn rearwardly until such time as a part of it—for example, the plate 24—abuts a stop 96 defining the rearmost position of the pusher with respect to the main bowl. As soon as the pusher strikes such stop, it cannot move farther, but further movement is not necessary since in such position the front apron 17 is closed or is in its lowermost position. Continued tension upon the cable 61, however, results in lifting the fitting 64 so that the cutting edge 16 is raised, for example into the position shown in Fig. 2. In such position the controls 88 and 38 are released by the operator and both return by the springs 39 and 89 into maximum restraining position so that the parts are held as positioned.

As a second manner of operation, assuming that the parts are initially as shown in Fig. 1, it is not necessary first to manipulate the lever 38 to release the cable 31, but such lever can be left in its normal position in which the drum 36 is frictionally restrained. If, then, the lever 88 is manipulated to connect the drum 76 to the source of power, the cable 61 is tensioned and operates against two resistances, one of which is composed of the resistance to movement of the pusher and front apron, which is relatively slight, plus the resistance to unwinding imposed upon the cable 31 by the brake 44, whereas the other resistance is the resistance to lifting of the

main bowl as proportioned by the speed reducing mechanism including the sheave 66. The cable 61, being tensioned, will then first effectuate whichever of the two movements involves the least resistance, and, if the adjustment 41 is so disposed, taking in of the cable 61 will first move the pusher rearwardly and close the front apron and, when the stop 96 is struck, as before, the cutting edge 16 will then be raised.

On the other hand, if the adjustment 41 is such that the resistance to rising of the cutting edge 16 is less than the resistance to rearward movement of the pusher and front apron plus the resistance of the brake 44, then the cutting edge 16 will be lifted as the main bowl is lifted, at least until such time as the side walls 12 strike an upper stop 97 on the frame 9. Contact between the main bowl and the frame stop 97 increases the rising resistance, so that then the pusher and the front apron will be drawn by the cable 61, against the resistance of the cable 31, into their rearmost position. At that time the lever 38, being released by the operator, returns to its normal restraining position so that the parts are held in the position shown in Fig. 2.

The various resistances referred to are made up of load resistances, frictional resistance to movement of the various parts, and resistances due to the weight of the various parts and their linkage as variously affecting each other in different positions of the parts, as well as the frictional brake resistance imposed by regulation of the adjustments 41 and 91. In addition, while the adjustments 41 and 91 are shown as maximum limits, either they can be varied during operation of the machine or, what is more usual, the operator, by nicely regulating the position of the levers 38 and 88, can likewise regulate the amount of resistance offered by either of the brakes 44 or 84 to the movement of the cable 31 or the cable 61 at any intermediate degree up to the set maximum for each. Thus, the particular sequence of operations desired under any circumstances can readily be regulated either by nice manipulation of the levers 38 and 88 by the operator or by predetermined regulation of the adjustments 41 and 91, or by both.

Under most conditions of adjustment, however, it is characteristic of this arrangement that the drawing in of one of the cables 31 or 61 is accompanied by a paying out of the other cable against a brake or frictional resistance which is substantially constant throughout the entire movement of the cables. In some structures the drawing in or tensioning of one of the cables, although entirely unrelated to the other cable, is effective to compress or tension a resistance such as a spring, which is not constant but which increases rapidly or markedly during the cable movement, so that the conditions of operation alter even while an operation is taking place. In the present instance, however, the resistance being preferably of the frictional type or having similar characteristics, is substantially constant throughout the entire operation and, unlike a spring, need not be reversed to be released.

As a further operation, the device can be moved from the position shown in Fig. 2 into the position shown in Fig. 3 in various different ways. In one way, the lever 88 can be moved to a neutral position so that there is no longer any restraint upon the cable 61, so that the fitting 64 lowers gravitally to drop the main bowl into the position shown. Then the lever 38 can be moved to connect the cable 31 to a source of power, and

the pusher and the front apron are then drawn forwardly and raised, accompanied by a free paying out of the cable 61. As another possibility, the lever 88 can be left alone and only the lever 38 moved to connect the cable 31 to a source of power so that the pusher is drawn forwardly and the front apron is raised while the cable 61 is pulled forcibly from the drum 76 against the brake resistance thereof until the pusher and the front apron are in foremost position. During this time, whether or not the main bowl and the cutting edge will lower will depend upon the amount of resistance offered by the brake 84. If this resistance is relatively slight, then the cutting edge will lower, as in the previous instance, but if the resistance is relatively great, the cutting edge will remain in uppermost position until the resistance is released by slight operation of the lever 88. Because of the speed reduction due to the sheave 66, the amount of cable 61 which must be advanced in order to afford a complete stroke of the pusher is sufficient to produce only a relatively smaller movement of the main bowl. A complete stroke of the pusher forwardly by taking in cable 31 and rearwardly by paying it out against the drop of the main bowl, even if no cable 61 whatsoever is taken in or paid out, is accompanied by only a relatively smaller rising and falling movement of the main bowl and, consequently, the cutting edge 16. The relation of the movements is two to one, as diagrammatically shown in the drawings, but in commercial practice, as described above, the relation is usually ten or twelve to one.

In order to move the structure from the position shown in Fig. 3 into the position shown in Fig. 4, the usual way is to leave the lever 38 in braked position so that the cable 31 is held, and then to take in upon the cable 61 so that this cable pulls against the cable 31 and also against the sheave 66, the resistance of movement of which is less than the brake resistance of the drum 36 so that this change in position is effectuated. Then, to move the structure from the position shown in Fig. 4 to the position shown in Fig. 2, for example, the cable 61 can be taken in at the same rate at which the cable 31 is paid out, in which instance the position of the cutting edge 16 does not change but the pusher moves rearwardly and the front apron closes. Conversely, if the cable 31 is taken in at the same rate that the cable 61 is paid out, the position of the cutting edge does not change but the pusher moves forwardly while the front apron opens—that is, from Fig. 2 position into Fig. 4 position.

While in the foregoing description the manipulation of the levers 38 and 88 has been usually referred to as being from one extreme position to another, or to an intermediate neutral position, and while the operation of the levers has been described sequentially, a skilled operator in commercial practice moves the levers 38 and 88 in varying amounts, not only to the extreme positions but in gradations therebetween and also more or less simultaneously, depending upon the particular maneuver which is to be accomplished.

With the described arrangement, however, it has been commercially demonstrated that with but two cables, such as 61 and 31, connected to winches of the character shown, the pusher and the front apron are positively moved conjointly and in opposite directions by power, and the cutting edge of the main bowl is raised and lowered as desired.

We claim:

1. An earth mover comprising an earth container, a closure for one side of said container, means for discharging earth from said container connected by a pivot to said closure, means independent of said pivot for articulating said closure on said container, and means for moving said closure and said discharging means with respect to said container.

2. An earth mover comprising a main bowl, a front apron, a pusher movable within said main bowl and pivotally connected to said front apron, and a strut connection between said front apron and said main bowl.

3. An earth mover comprising a main bowl, a front apron mounted at a predetermined location on said main bowl, and a rigid earth pusher movable within said main bowl and pivoted on said front apron at a different location.

4. An earth mover comprising a main bowl, a front apron having spaced mounting points movably mounted on said main bowl at one of said points, a rigid earth pusher movable within said main bowl, and a direct pivotal connection between said pusher and said front apron at another of said points.

5. An earth mover comprising an earth-containing framework, means for expelling earth from said framework, means movable with respect to said framework for retaining earth therein, a strut pivoted to said framework and to said retaining means, and a pivotal connection between said expelling means and said retaining means.

6. In a machine of the class described, the combination of an earth-containing body, an end apron movably mounted upon said body, and translated load-removing means pivoted on said end apron extending the entire width of the body and across the entire depth of said body when the end apron is wide open, for forcing a load in said body to be entirely removed therefrom.

7. In an earth mover body, a transversely extending member movable within said body, a movable end apron adapted in one position to close the end of said body, a strut mounted on said body and connected with said end apron, and a pivot connection between said transversely extending member and said end apron for constraining said transversely extending member and said end apron to move conjointly.

8. An earth mover comprising a main bowl, a pusher movable within said main bowl, a front apron pivoted on said pusher to turn about a predetermined axis, and means for movably connecting said front apron to said main bowl to turn about a plurality of different instantaneous axes.

9. An earth mover comprising a main bowl, a pusher translatable within said main bowl, a front apron pivoted to said pusher, and an articulation between said front apron and said main bowl.

10. An earth mover comprising an earth-carrying bowl, a pusher mounted for a predetermined movement within said bowl, a first power means effective when energized to move said pusher in one direction of said movement and when de-energized to resist movement of said pusher in the other direction of said movement, and a second power means effective when energized to move said pusher in said other direction and when de-energized to resist movement of said pusher in said direction.

11. An earth mover including an earth-carrying bowl, a pusher member mounted to move within said bowl in a first direction and in a second, opposite direction, a first power means effective when energized to move said member in said first direction, a second power means effective when energized to move said member in said second direction, and means for imposing a substantially constant resistance to movement of said member in said first direction and said second direction.

12. An earth mover comprising an earth-carrying bowl, a pusher member mounted to move within said bowl in a first direction and in a second direction, a first winch drum, a normally applied brake restraining said first winch drum, a first cable connected to said first drum and to said member, means for releasing said brake and energizing said first drum to wind in said first cable to move said member in said first direction, a second winch drum, a normally applied brake restraining said second winch drum, a second cable connected to said second drum and to said member, and means for releasing said brake and energizing said second drum to wind in said second cable to move said member in said second direction.

13. An earth mover comprising ground engaging means, an earth sustaining member supported by said ground engaging means and adapted to be raised and lowered with respect to the ground, an earth abutting member supported by said ground engaging means and adapted to be moved to and fro with respect to said earth sustaining member, a first winch drum, a first normally applied brake thereon, a

first cable connected to said first drum and to said earth abutting member, a second winch drum, a second normally applied brake thereon, a second cable connected to said second drum and to said earth sustaining member and to said earth abutting member, means for releasing said first brake energizing said first drum, and means for releasing said second brake and energizing said second drum.

14. An earth mover comprising an earth-containing bowl having an open end, a pusher constrained to move through said bowl in a rectilinear path, a pivot mounting on said pusher, and a front apron adapted to occupy said open end and connected to said pivot mounting.

15. An earth mover comprising an earth-containing bowl, a pusher within said bowl, a pivot mounting on said pusher constrained to move in a rectilinear path, and a front apron connected to said pivot mounting.

16. In an earth mover, as a subcombination, a front apron having a pair of mounting pivots, means for constraining one of said pivots to movement in an arc, means for constraining the other of said pivots to movement in a straight line, and means for imparting a thrust to said other pivot in the direction of said line.

17. An earth mover comprising an earth-containing bowl, an apron, means constraining said apron to lifting movement from a position closing said bowl toward an open position, an earth pusher within said bowl and pivoted to said apron, and means applied to said pusher for raising said apron.

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