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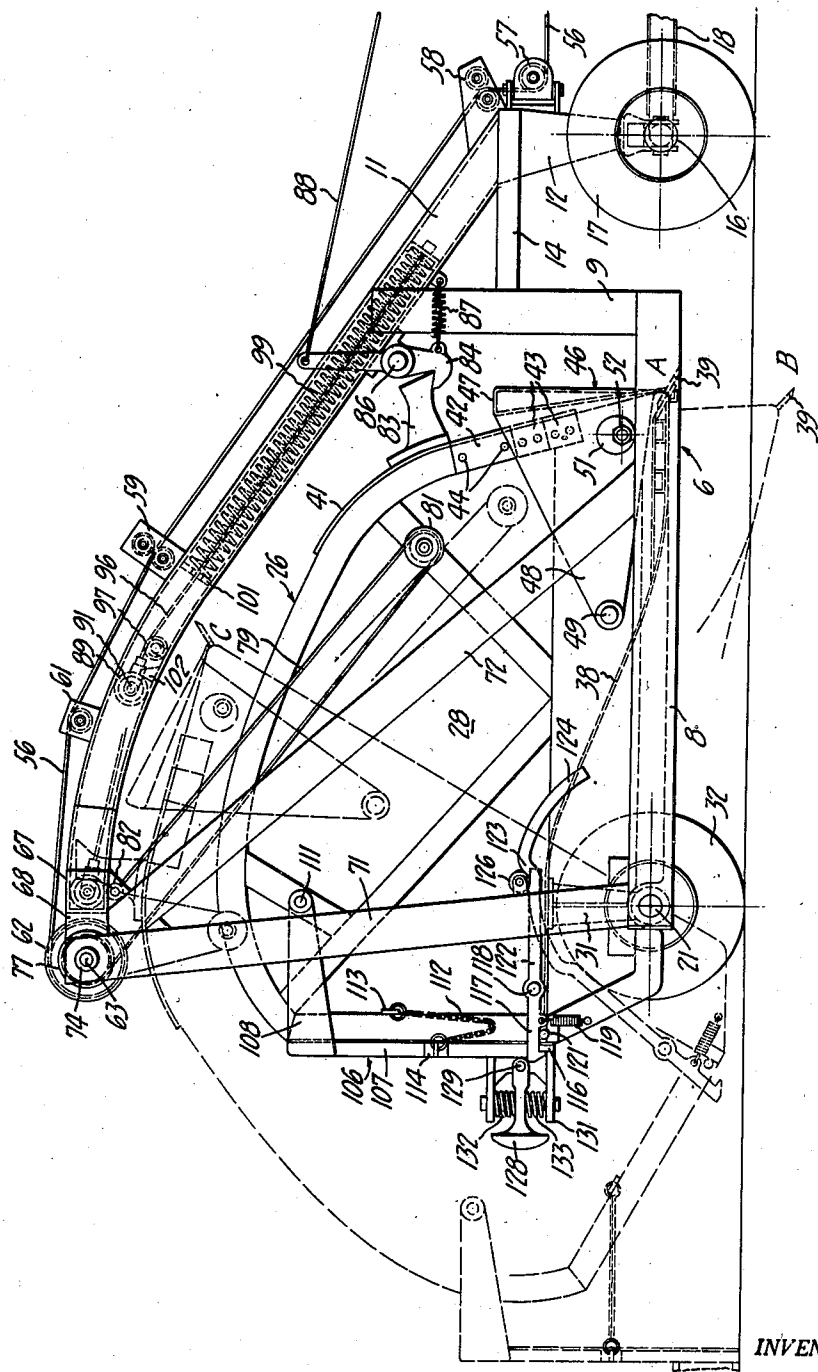
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2,329,241

EXCAVATOR

Filed March 31, 1942

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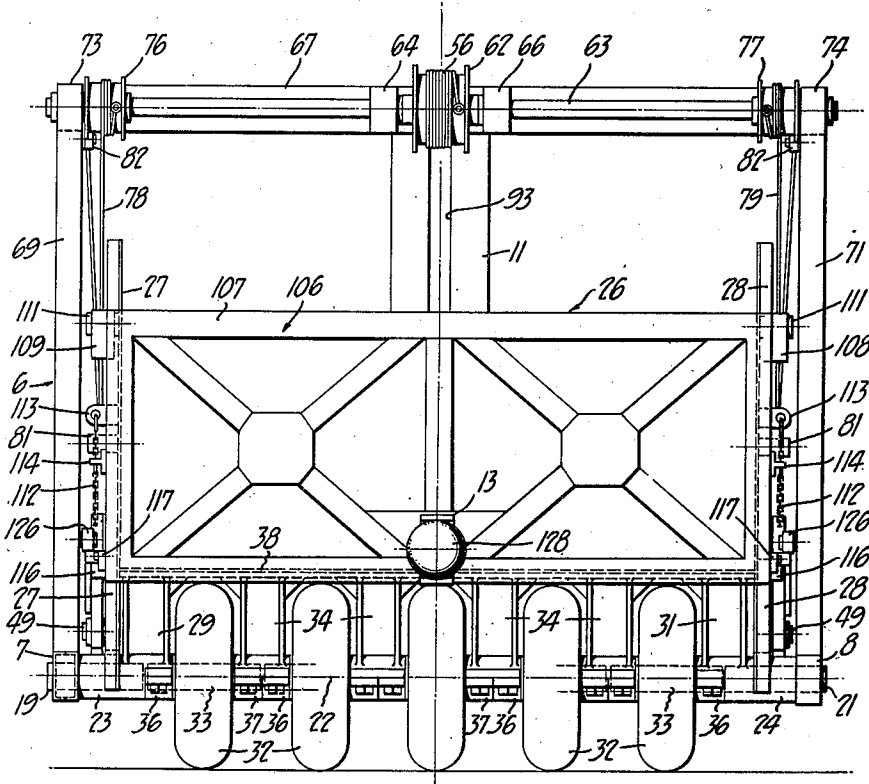
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EXCAVATOR

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FIG. 3.



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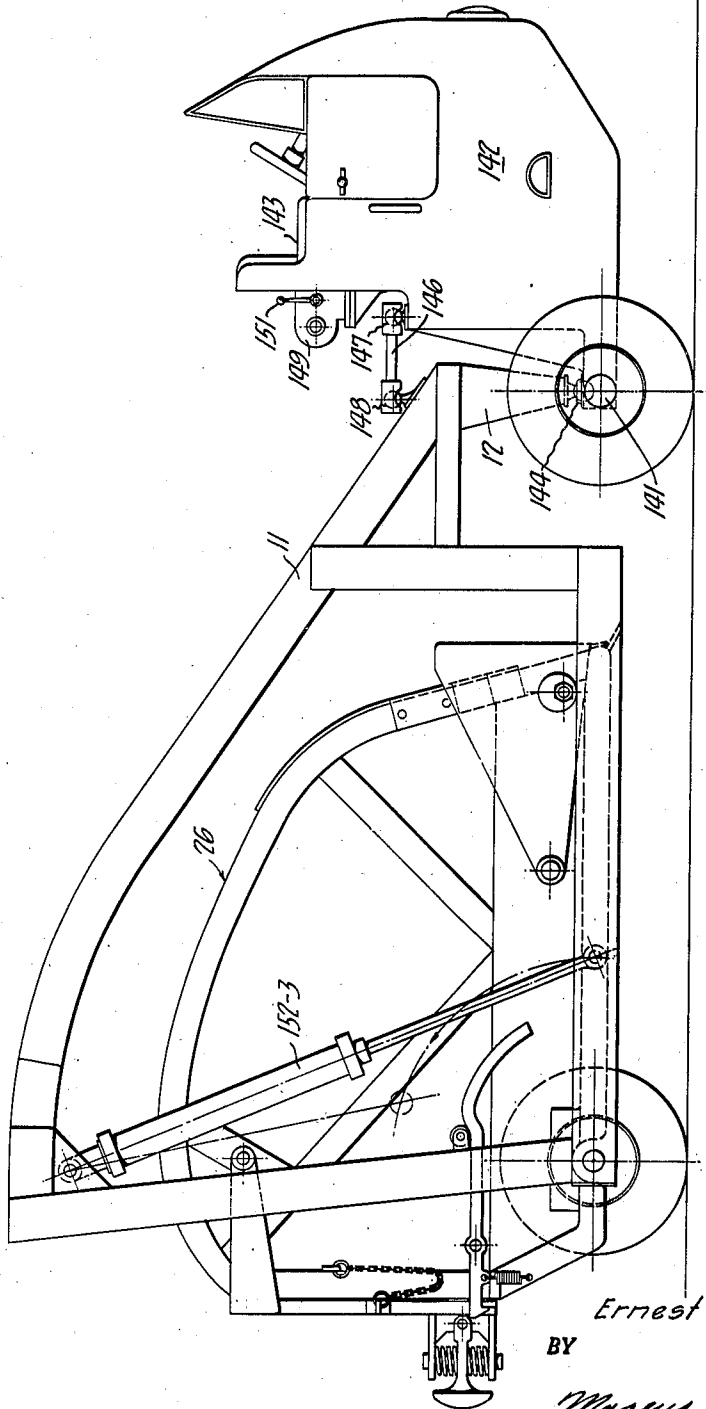
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UNITED STATES PATENT OFFICE

2,329,241

EXCAVATOR

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Application March 31, 1942, Serial No. 437,073

4 Claims. (Cl. 37-128)

My invention relates to means for excavating, carrying, discharging and spreading earth, or comparable material, and is designed to be drawn by an attached tractor or to be self-propelled.

It is an object of my invention, in general, to provide an improved excavator.

Another object of my invention is to provide an excavator of such a design that it can readily be rigged for operation by cable or by hydraulic means.

Another object of my invention is to provide an excavator in which the excavated earth is directed upwardly and rearwardly to a position for ready rearward discharge.

A further object of my invention is to provide a rear discharge excavator having means for returning the main bowl from its discharging position toward its carrying position.

An additional object of my invention is to provide an excavator in which the discharge of the earth is controlled automatically.

An additional object of my invention is to provide an excavator having means for relieving the controlling mechanism of strain during long carry periods.

A further object of my invention is to provide an excavator having an automatic front apron.

Other objects together with the foregoing will be set forth in the following description wherein the preferred forms of my invention are described and in the accompanying drawings in which—

Fig. 1 is a side elevation of an excavator constructed in accordance with my invention for operation by a cable.

Fig. 2 is a plan of the excavator shown in Fig. 1, a portion being broken away to disclose the interior construction.

Fig. 3 is a rear elevation of the excavator disclosed in Figs. 1 and 2.

Fig. 4 is a side elevation of a self-propelled excavator in accordance with my invention and designed for operation by hydraulic means.

In its preferred form the excavator of my invention incorporates a frame having front and rear ground-engaging wheels and on which is pivotally mounted an earth retaining bowl, movable from an excavating position through a carrying position and a dead center position to a discharging position. There is provided a means, either cable or hydraulic, for moving the main bowl, the front end of which is closed in all except digging positions by an automatic apron. The main bowl can be held in carrying position by a manually operated latch. In lifting toward

discharge position, the bowl encounters a spring which is tensioned so as to propel the main bowl back through dead center position after the discharge operation. A rear gate, normally closing the rear end of the bowl, is latched in position and the latch is released when the bowl is pivotally tilted into a predetermined position approaching discharge. There are many other features of advantage which are set forth in greater detail in the following description.

In the form of device especially shown in Figs. 1, 2 and 3, I provide a main frame, generally designated 6, which includes a pair of side beams 7 and 8 at their forward ends joined by a cross-truss 9, merging with a longitudinal box-beam 11, extending forwardly to a goose-neck 12. A pair of braces 13 and 14 reinforce these various members. The goose-neck 12 serves as the support for a centrally pivoted axle 16 at the opposite ends of which ground-engaging wheels 17 are disposed. These wheels are steerable to guide the vehicle and their axle 16 also serves as the fastening point for a draft beam 18 which extends to a tractor or other suitable source of draft power, not shown.

Adjacent their rear ends, the side beams 7 and 8 terminate in mountings for stub shafts 19 and 21, respectively, which are aligned on a transverse axis 22. Mounted on the stub axes 19 and 21 are bearing sleeves 23 and 24 located at the opposite sides of a main bowl, generally designated 26 and to which the sleeves 23 and 24 are joined not only by their extended side walls 27 and 28, but also by brackets 29 and 31 so that the main bowl 26 is pivotally mounted with respect to the main frame to rotate about the axis 22 as a center.

Disposed also on the axis 22 and designed to support the rear portion of the mechanism are ground-engaging wheels 32, provided in any selected number and each mounted to rotate about its own stub axle 33, the opposite ends of which are removably clamped in either the brackets 29 and 31 or intermediate brackets 34 of a similar nature and all of which have removable caps 36 and 37. Upon the removal of any pair of caps 36 and 37 the associated wheel 32 can individually be demounted and replaced. The various wheels 32 are effective across the entire width of the machine to support a load within the main bowl 26 and since a good portion of this load is located adjacent to and over the axis 22, the wheels 32 rather directly bear the principal forces.

Spanning the distance between the side walls 27 and 28 and overlying the various brackets

29, 34 and 31, is the floor 38 of the main bowl. This floor is constructed of suitable metal plates and has a curved shape from its position overlying all of the wheels 32 in a generally downward direction in carrying position until at its forward end it merges smoothly with a forward cutting edge 39 adapted to engage and dislodge the ground as the excavator advances thereover. The contour of the bottom 38 is such that when the earth is dislodged by the cutter 39, it is carried rearwardly and upwardly in an easy curve to overlie as nearly as possible the axis 22 and to occupy all parts of the main bowl, including the rearmost parts.

With many excavators there is often experienced difficulty in compelling some of the excavated material to flow far enough to the rear of the main bowl so that a full load can be had for each particular cycle of excavation. The tendency of the excavated earth is to stay in the forward portion of the bowl 26 and even to tumble forwardly after it has been excavated and to roll ahead of the cutting edge 39. This has led in many instances to the adoption of a front apron of the type having a forwardly and upwardly extending wall ahead of the cutting edge 39 so that the forwardly rolling material can fall into and be carried by it. This type operates quite satisfactorily under most circumstances, but is sometimes difficult to close in the event a mass of earth is forced ahead of the cutting blade 39.

To overcome this and other disadvantages of such front aprons, I provide that the side walls 27 and 28 of my main bowl are spanned by a closure plate 41 which is an arcuate plate extending upwardly and rearwardly from adjacent the cutting edge 39 and overlying the forward portion of the side walls 27 and 28, so that earth which rises, after having been excavated, above the cutting edge 39 is deflected by such plate 41 and instead of tending to fall forwardly on top of and ahead of the cutting edge is directed rearwardly to occupy a rearward position in the main bowl 26. Since the plate 41 does not extend entirely down to the cutting edge 39 and since under different soil conditions different openings between such plate and the cutting edge are desirable, I provide various auxiliary closure plates 42 and 43, for example, which when in position form continuations of the plate 41 and leave a narrower opening or throat between their lower edge and the cutting edge 39. The auxiliary plates are fastened by removable fasteners 44, for example bolts, and can be installed or removed by the operator, depending upon the characteristics of the particular material being excavated. Thus, some or all of the plates 41, 42 and 43 assist in moving earth rearwardly in the bowl 26.

To close the remaining throat opening when the machine is not excavating and is in or above the carry position, I provide a front apron 46 which itself has little or no earth sustaining capacity, but is effective to retain already excavated earth within the bowl 26. This front apron comprises a transversely extending nearly vertical wall 47 having a rather sharp lower extremity so it will cut through any material overlying the cutting edge 39. Side plates 48 join the opposite extremities of the plate 47 and terminate in mounting pivots 49 secured at convenient points on the respective side walls 27 and 28.

In order that the front apron 46 will open

automatically when the cutting edge 39 is moved downwardly from its carrying position A, shown in full lines in Fig. 1, to an excavating position B, shown in dotted lines in that figure, I provide eccentric extensions 51 on the respective side arms 48 of the front apron and mount such extensions by adjusting fastenings 52 so that they can be rotated into and held in any selected position and will then about side beams 6 and 7 as the main bowl lowers and thus will automatically cause the opening of the front apron varying amount as the machine moves from its carrying position into an excavating position. Conversely, when the machine is moved from an excavating position back into its carrying position, the weight of the front apron causes it to remain in position cutting through whatever material happens to overlie the cutting edge 29. Further lifting movement of the main bowl is accompanied by movement in unison of the front apron.

In order to produce the requisite movement of the main bowl 26, a cable 56 extends rearwardly from any suitable source of control on the tractor and passes over a lead sheave 57 mounted on the goose-neck 12, thence between a pair of guide pulleys 58 and a similar pair of guide pulleys 59 and thence over another guide pulley 61 to be trained around and fastened to a central cable drum 62. This cable drum is on a transverse shaft 63 which is journaled in central bearings 64 and 66 mounted on a cross-beam 67 just ahead of the shaft 63. The beam 67 at its opposite ends has rearwardly directed portions 68 which merge with a pair of uprights 69 and 71, respectively, upstanding from the side beams 7 and 8. Brace beams 72 are secured to the forward portions of the side beams 7 and 8 and at their upper rearward ends are fastened to the rearward portions 68 of the cross-beam 67 as well as to the uprights 69 and 71, thus affording a rigid arrangement. The center of the cross-beam 67 is also supported by the rearward part of the box beam 11 which after extending upwardly and rearwardly in a straight line is curved about the axis 22 as a center to merge with the cross-beam 67.

Being supported not only by the bearings 64 and 66 but also by bearings 73 and 74 at the top of the uprights 69 and 71, the shaft 63 is able to carry also a pair of individual cable drums 76 and 77, respectively, mounted adjacent the ends of the shaft and approximately overlying the side walls 27 and 28 of the main bowl. Fastened to and extending around each of the cable drums 76 and 77 are cables 78 and 79, respectively, which extend from such drums around pulleys 81, rotatably mounted on the side walls of the main bowl, and then extend upwardly and rearwardly to suitable dead end fastenings 82. Thus, the cables are dead ended on the super structure of the main frame, the super structure including generally all of the frame members above the side beams 7 and 8.

With this arrangement when the cable 56 is tightened or taken in the drum 62 is rotated and the consequent rotation of the shaft 63 likewise rotates the individual drums 76 and 77, thereby taking in the cables 78 and 79 to rotate the main bowl rearwardly or counter-clockwise, as seen in Fig. 1, about the axis 22. If this rotation moves the cutting edge 39 from position B into position A as shown in Fig. 1, the machine is moved from its excavating into its carrying position. If the

carry is relatively short, it is usually feasible to maintain the line 56 in tension and to hold the load in that fashion. If, however, the load is to be transported a long distance, additional supporting means are provided.

On the main bowl and preferably secured to the closure plate 41 is a projection 83 in a form suitable to engage a hook latch 84 which is connected by a pivot 86 to the box beam 11 and which normally is held out of the path of the projection 83 by a coil spring 87. A jerk line 88, however, when tautened is capable of moving the hook 84 beneath the projection 83. In operation, the load is lifted so that the projection 83 is slightly above the hook 84 which is positioned against the urgency of the spring 87 by tightening the line 88 and then slacking the line 56 slightly to lower the projection 83 onto the hook 84. That being done, the inter-engagement of the projection and of the hook is sufficient to hold the parts securely latched in place. The load can thus be transported over a great distance and if the cutting edge 39 is to be lowered again or if the load is to be dumped, retensioning of the line 56 lifts the projection 83 off of the hook latch 84 and if no tension is then exerted on the jerk line 88, the spring 87 moves the hook latch 84 out of the way.

If the load is to be discharged, it is done by tipping the main bowl 26 rearwardly about the axis 22. To accomplish that, the line 56 is taken in sufficiently to rotate the entire mass about the stated axis. In order to secure an adequate angle for discharge, it is deemed advisable to tip the main bowl 26 to such an extent that its center gravity not only approaches a position directly overlying the pivotal axis 22 (referred to as dead center position), but also to move somewhat past that position. For that reason, I provide means not only for retarding any rearward motion of the main bowl past dead center position but likewise for restoring the empty bowl toward its load-carrying position. For that reason, in the path of the projection 83 I provide a carriage 89 which includes a cross-shaft 91 having rollers 92 thereon designed to run in the track-like sides of the box beam 11, which beam in its bottom web has a central slot 93 cut therein for a considerable portion of its length. The shaft 91 of the carriage 89 has secured to it a pair of cables 94 and 95 passing over guide rollers 97 and extending to the far end of coil springs 98 and 99, respectively, which are housed within the box beam 11 and at the forward ends are set against a plate 101 therein, so that as the carriage 89 is moved toward the rear of the machine, the springs are tensioned.

The portion of the track-like box beam 11 in which the carriage 89 operates is curved or arcuate about the axis 22 so that as the projection 83 rises it enters the slot 93 and projects upwardly therein far enough to engage the carriage 89 which normally is retracted against stops 102. Further pivotal movement of the main bowl 26 rearwardly causes a tensioning of the springs 98 and 99 and as the bowl passes dead center position, the tension of the springs increases so that the final travel of the bowl is materially cushioned although it can still be produced by continued drawing in of the cable 56.

When it is desired to return the main bowl from its maximum tilted or dumping position C, the cable 56 is slacked and the springs 98 and 99 are effective to restore the main bowl past dead center position and further downward movement thereof can be readily controlled by the rate at

which the cable 56 is paid out. The carriage 89 returns under the influence of the springs 99 to its position against the stops 102 and the projection 83 leaves the carriage and the slot 93 ready for a subsequent cycle.

The discharge of material from the main bowl 26 is under the control of a rear gate 106 which in general constitutes a transverse planar plate 107 at its upper edges secured by mounting arms 108 and 109 to the side walls 27 and 28, respectively, by means of pivots 111. A pair of link chains 112 secured to hooks 113 on the side walls and also to fastenings 114 on the plate 107 can be adjusted into any desired position to regulate the amount of opening of the gate 106.

Normally the gate is retained closed and this is accomplished by projections 116 adjacent the bottom of the gate which are cooperative with latch hooks 117 each of which is mounted on a pivot pin 118 on the adjacent side wall of the main bowl. A coil spring 119 urges the latch lever against a stop 121. The lever also has an extended tail 122 which has a cam portion 123 and an arcuate termination 124, both of which are designed to contact a cam roller 126 mounted on the adjacent uprights 71. As the main bowl moves between position A and position B, the roller 126 has substantially no effect upon the rear gate latch. As soon as the bowl moves from position A toward position C, which is the maximum dumping position, the cam portion 123 engages the roller 126 and causes rotation of the latch lever 117 about the pivot 118 against the urgency of the spring 119 to release the member 116. Thus, the rear gate 106 is entirely released and is free to open under the influence of gravity, or under the strain imposed upon it by dragging over the ground or the discharging material to the full extent permitted by the chains 112.

When the main bowl is restored from its position C toward its position A, the arcuate portion of the lever 124 rides under the roller 126 until the gate 106 is substantially in its closed position by gravity whereupon the cam portion 123 of the lever permits reclosure of the latch lever 117. If, by some chance, the gate 107 is not yet shut, the member 116 cams against the latch lever 117 to snap shut in the customary fashion. In this way there is provided a rear gate which is automatically opened during the dumping operation and is opened a pre-determined amount to give the desired depth of spread and is automatically closed upon restoration of the main bowl from dumping toward subsequent carrying or excavating position.

Under certain circumstances it is desirable that the excavator be pushed by a supplementary tractor. For this reason, there is secured to the rear gate 106 a pusher bar 128 which is connected by a pivot pin 129 to its mounting 131 and is left to oscillate in a vertical plane, but is restrained from such oscillation by a pair of oppositely acting coil springs 132 and 133, respectively, interposed between the shank of the pusher 128 and extensions of the mounting 131. Thus, after the pusher 128 has been engaged by a following tractor, for example, and force is being exerted thereon, the operator can raise and lower the cutting edge, say, between the positions A and B without altering the positioning of the push member 128, but simply resulting in corresponding deflection of the springs 132 and 133.

In the form of my device shown in Fig. 4, the general layout is the same as previously described,

but the draft means is somewhat different. Here the goose-neck 12 and the cross-beam 11 are anchored not to a standard front axle, but to a specially driven front axle 141 which is connected to a draft vehicle 142 provided with a suitable source of power and an operating station 143 for the operator. The power unit 142 and the front axle 141 are connected to the goose-neck 12 by a ball joint 144 and the draft unit is also connected to the frame member 11 by a link 146 joined by ball joints 147 and 148 to the adjacent parts, preferably in such a manner as to pass over the vertical axis of the ball 144. In this form of the apparatus the operation is entirely hydraulic and, hence, on the draft unit 142 there is provided a source 149 of hydraulic power with a suitable controller 151 therefor. From the hydraulic controller 151 lines extend to a pair of hydraulic cylinders 152 and 153, respectively, which are connected to the super structure and to the main bowl 26. With this arrangement it is not necessary to have the latch lever 84, nor to have any of the mechanism associated with the cable 56, since the double acting hydraulic mechanisms are effective to lower the cutting edge from position A into position B and to raise it into position C, and also to restore it without springs. Under circumstances where hydraulic power is permissible and feasible the Fig. 4 arrangement is somewhat simpler. The remaining part of the structure is substantially as described in connection with Figs. 1, 2 and 3.

I claim:

1. An excavator comprising a ground-supported frame, an earth receiving bowl pivotally mounted with respect to said frame, means for pivotally moving said bowl to and past a dead center position, a carriage adapted to run on said track-like superstructure, a spring fastened at one end on said superstructure and at the other end to said carriage, and a projection on said bowl adapted to

engage said carriage as said bowl moves to and past dead center position.

2. An excavator comprising a frame, front and rear ground-engaging wheels supporting said frame, an earth receiving bowl, means for supporting said bowl on said frame to pivot about the axis of said rear wheels, a cutting edge on said bowl, a releasable latch for supporting said bowl in carrying position, cable means for also supporting said bowl in carrying position and for pivoting said bowl to and past a dead center position, and spring means for resisting pivoting of said bowl to and past dead center position.

3. An excavator comprising a frame, front and rear ground-engaging wheels supporting said frame, an earth receiving bowl, means for supporting said bowl on said frame to pivot about the axis of said rear wheels, a cutting edge on said bowl, a projection on said bowl, a releasable latch for engaging said projection to support said bowl in carrying position, a superstructure included in said frame, a carriage on said superstructure, a spring connected to said superstructure and to said carriage, and cable means for swinging said bowl to lift said projection from said latch and into engagement with said carriage to tension said spring.

4. An excavator comprising a ground-supported frame including a track-like superstructure, mounted with respect to said frame, a leading cutting edge on said bowl, a normally closed discharge gate at the rear of said bowl, means for tilting said bowl past dead center to raise the cutting edge from the ground and discharge the contained earth through the rear opening controlled by said gate, a spring on said frame and means on the bowl adapted to engage the spring as said bowl approaches dead center position and to tension said spring as the bowl moves to and past dead center position.

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