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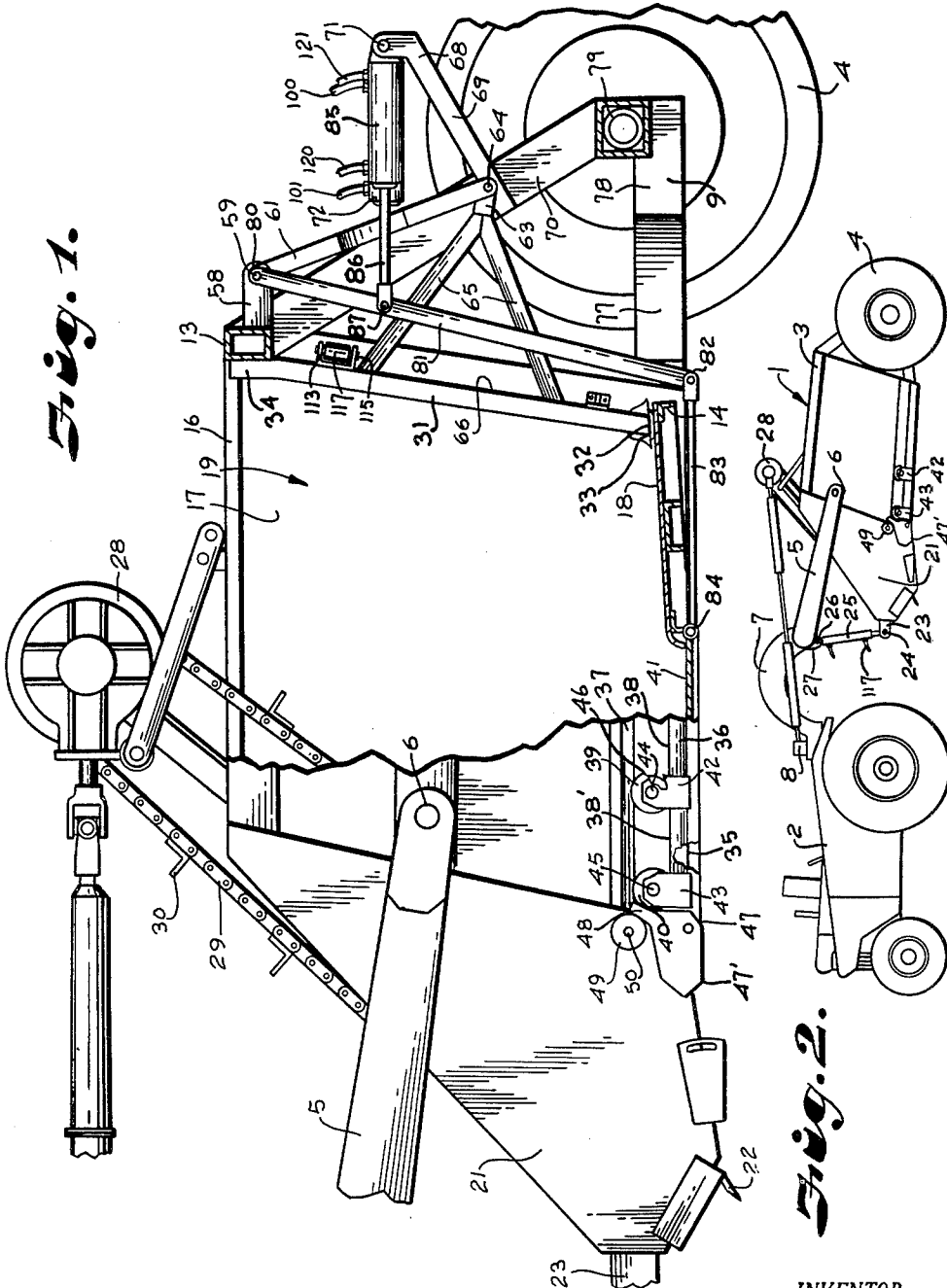
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3,066,429

EARTH MOVING APPARATUS AND FLUID CONTROL THEREFOR

Filed April 3, 1961

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

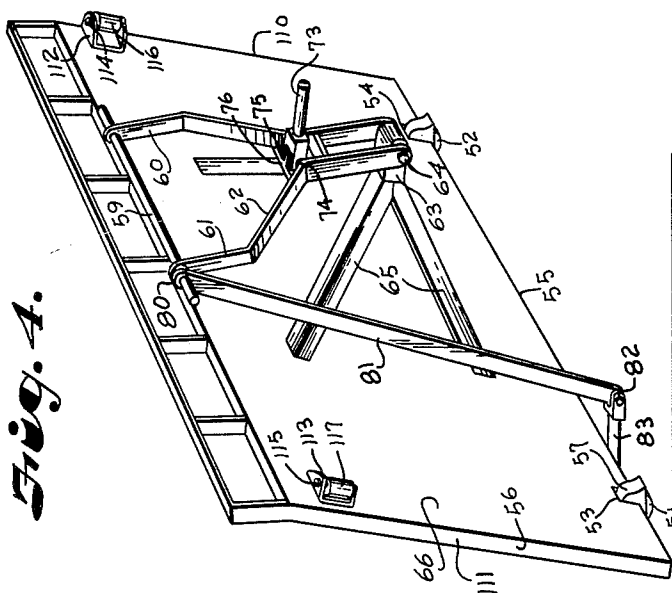


Fig. 3.

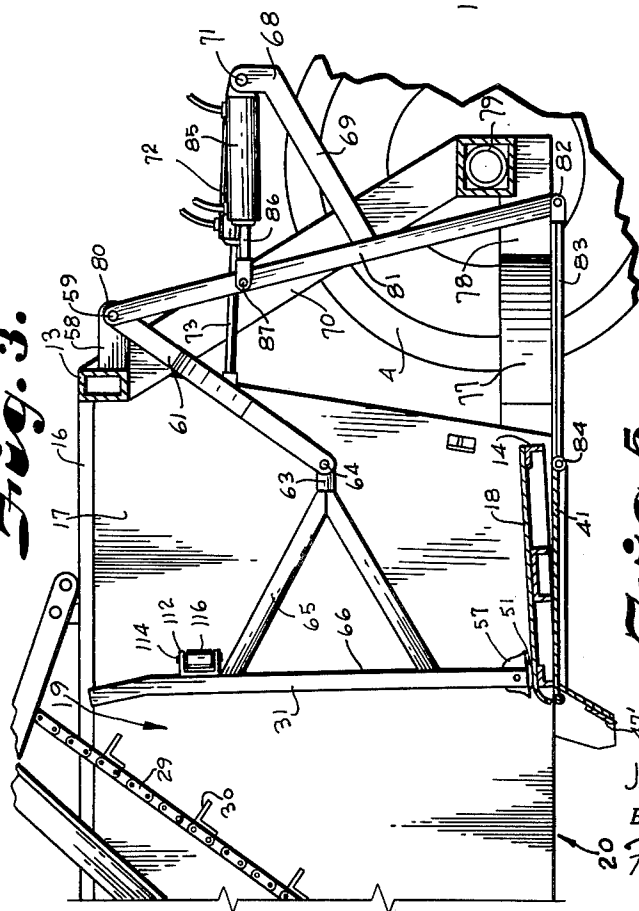
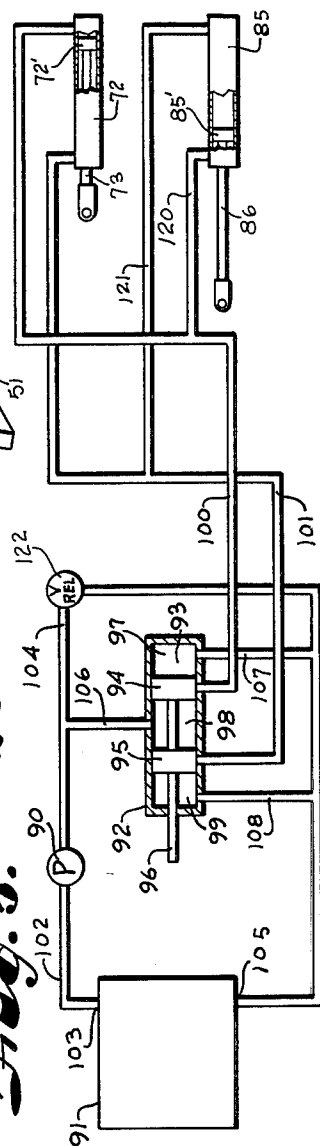


Fig. 5.



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EARTH MOVING APPARATUS AND FLUID CONTROL THEREFOR

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This invention relates to earth-handling apparatus and fluid control therefor, and particularly of the type wherein forced ejection of the earth is accomplished through a door opening in the bottom thereof. The earth-handling apparatus is of the type disclosed in Patent 2,691,041 issued May 7, 1957, and the present application is a continuation in part of application Serial No. 729,607 filed April 21, 1958, now Patent No. 2,988,832.

It is the principal object of the present invention to provide earth handling apparatus, sometimes referred to as elevating scrapers, wherein a box is utilized for receiving the material being moved; providing the box with a door opening in the forward portion of the bottom thereof and having an endgate which may be moved forwardly in the box to positively force the material through the door opening and thereby clean the box of the material.

Other objects of the present invention are to provide a mobile frame structure having side walls forming the box or earth carrying part of the apparatus, having open rear and front ends; to provide a scraper or dirt removing blade mounted on the frame in advance of the dirt collecting box; to provide conveyor or elevating means on the frame of the apparatus for moving the dirt from the blade to the box; to provide a bottom in the rear portion of the box structure and a door opening in the forward portion of the bottom; to provide a moveable bottom for closing the open forward portion of the bottom of the box structure; to provide an endgate moveable inside the box from rear to front to move the dirt from the box through the door opening; to provide means for moving the moveable door or bottom portion of the box from an open to a closed position and vice versa; to provide hydraulic means for opening and closing the door and for moving the endgate forwardly and pushing the earth material from the box structure and retracting said endgate; to provide a strike-off blade pivotally mounted on the forward edge of the moveable bottom whereby when the door is open the weight of the earth material will force the strike-off blade to a vertical position for leveling the earth material as it is discharged from the box; and to provide means on the strike-off blade for cooperating with means on the box structure to return the strike-off blade to horizontal position upon closing of said door in the bottom of the box.

Further objects of the present invention are to provide fluid control mechanism for moving the moveable door and moving the endgate of the earth moving apparatus; to provide means for the fluid control whereby the operation of the valve controlling the fluid to the respective cylinders and movement of the respective parts will be controlled by the resistance encountered on the endgate and moving door, and to provide a device of this character simple and economical to manufacture.

Other objects and advantages of this invention will become apparent in the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a side and partly cross-sectional view of my earth-handling apparatus.

FIG. 2 is a side view of the earth-handling apparatus showing same attached to a tractor.

FIG. 3 is an enlarged partly cross-sectional view of the endgate in forward position.

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FIG. 4 is an enlarged rear perspective view of the endgate of FIG. 3.

FIG. 5 is a diagrammatic illustration of the hydraulic cylinders control valve and lines leading from the tank and pump for movement of the fluid therethrough.

Referring more in detail to the drawings:

1 designates a trailer-type implement propelled by a tractor 2 with a power or drive connection from the tractor to operating parts on the trailer-type implement for driving the same.

The trailer-type implement is an elevating scraper or earth moving apparatus having a frame 3, the rear end of which is supported by ground engaging wheels 4, and the forward end of the frame 3 has a pair of arms 5 pivotally connected thereto as at 6, with said arms extending forwardly and terminating in a goose neck 7 having a fifth wheel connection or draft coupling member 8 at its forward end.

The frame includes side members 9 with uprights 11 near the rear end connected by an upper cross member 13 and a lower cross member 14, as shown in Patent No. 2,988,832. The frame includes side rails 16 at the upper extremities thereof, and which extend forwardly of the rear end of the frame and secured to the side rails 16 are side walls 17 closed by a bottom 18 forming a box 19 for the earth material. The bottom 18 extends forwardly from the rear of the frame a substantial distance but terminates rearwardly of the forward extent of side walls 17 forming a door opening 20. The side walls have forwardly extending portions 21 on each side thereof for a purpose later described. A forward portion of the side rails 16 are provided with uprights as illustrated in our co-pending application.

Slightly forwardly of the uprights on the side rails 16 and secured to each of the side walls 17 and extending from the forward portion of the frame is a scraper blade 22 extending between the sides and transversely of the trailer unit. The extensions 21 of the side walls 17 are provided with brackets 23 at each side of the framework structure to which is pivotally attached, as indicated at 24, one end of an hydraulic extensible member 25 and having its other end pivotally attached as indicated at 26 to a bracket 27 depending from the arm 5 of the goose neck 7, whereby the extension of the extensible members moves the side walls with the blade 22 and thus the forward end of the trailer-type implement downwardly relative to the arms 5 to engage the scraper blade 22 with the ground.

A conveyor 28 is supported on the scraper structure whereby operation of said conveyor moves the chains 29 thereof and the flights 30 thereon rearwardly and upwardly on the lower run of said conveyor whereby it rakes dirt from the scraper blade 22 rearwardly into the box 19, the forward lower end of the conveyor being suitably supported whereby it will float upwardly on earth being moved over the scraper blade but its downward movement is limited so the flights will pass over the scraper blade in closely spaced relation thereto.

The tractor 2 may be either a wheel or a track type suitable for propelling the scraper and having a power take-off and gearing mechanism (not shown) but illustrated in Patent No. 2,988,832 and mechanism for operating the elevator mechanisms shown in Patent No. 2,931,451.

An endgate or ejector plate 31 is provided for movement within the box 19 and comprises the rear of the box when the endgate is in the rearmost position, as illustrated in FIG. 1. The lower edge of the endgate 31 is indicated at 32 and provides an edge 33 for movement along the floor or fixed bottom 18 of the rear portion of the box. The upper edge of the endgate 31 is angled substantially vertically as indicated at 34 to pre-

vent the dirt from spilling over the rear of the structure. The upper edge of the endgate in its rearmost position rests against the cross member 13 and forms a rear closure member for the box.

Secured to a horizontal portion 35 of the side members 9 are angle-shaped members 36 and 37 (FIG. 1). A horizontal portion 38 of the shaped member 36 forms a trackway 38' on each side of the side frame for supporting pairs of rollers 39 and 40 mounting a door 41 movable under the bottom of the box 19 for closing the door opening 20. Spaced from the forward and rear ends of the bottom closing door 41 on each side thereof and suitably secured thereto by welding or other means are upstanding brackets 42 and 43 provided with openings for receiving short shafts 44 and 45 for mounting the rollers 39 and 40 respectively which are flanged on one side as indicated at 46 so that the inner surface of the flange engages laterally against the angle-shaped member 36. The brackets 42 and 43 support the moving bottom which is slidable underneath the fixed bottom 18 as illustrated in FIG. 1.

Hinged to the forward edge 47 of the movable bottom 41 is a strike-off blade 47' for leveling of the earth material as it drops from the door opening in the bottom of the box as hereinafter shown. The strike-off blade 47' supports horns 48 extending upwardly from the rear thereof and acts as cams for engaging a roller 49 mounted on a shaft 50 secured to the side members of the box, as illustrated in FIG. 1, so that when the door 41 is moved forwardly the horn will strike the roller and the strike-off blade will be moved to a horizontal position as shown in FIG. 1.

The endgate 31 rolls on the bottom 18 of the box. Rollers 51 and 52 are mounted in grooves or cut away portions 53 and 54 in the lower edge 55 of the endgate and spaced from each side 56 as illustrated in FIG. 4. The rollers are mounted on shafts (not shown) secured in the notches so that the endgate will roll on the bottom of the box as the endgate is moved forwardly and rearwardly as will later be shown. The rollers are provided with shields 57 for cleaning ahead and behind the rollers and to prevent the rollers from becoming clogged. The shield being attached to shafts of the rollers so that they will oscillate and not being fixed to the endgate except by the shaft.

Rigidly secured to the cross member 13 are outwardly extending arms 58 having openings in their outer ends for receiving the ends of a shaft 59. Arms 60 and 61 having one end pivotally attached to the shaft 59 extend parallel and then inwardly at an angle as indicated at 62 (FIG. 4) and thence parallel and connect with an extension connection 63 by a pin or the like 64 of a plurality of legs 65 which diverge outwardly and have their three ends spaced and rigidly secured by welding or other suitable means to the rearward side 66 of the endgate, as illustrated in FIG. 4, so as to distribute the forces for moving the endgate in the box, as will later be shown. A substantially U-shaped bracket member 68 has its free ends or the side arms 69 rigidly secured to the diagonal braces 70 of the frame structure, as illustrated in FIG. 3. The arms of the U-shaped member are connected by a shaft 71 to which is pivotally mounted one end of a cylinder 72. The piston rod 73 of the cylinder 72 is pivotally attached as indicated at 74 to an ear 75 of a cross member 76 extending between the braces or arms 60 and 61, as illustrated in FIG. 4, for movement of the endgate forwardly and rearwardly in the box, as will later be shown.

In FIG. 3, it will be seen that the rear ends of the side members 9 are angled inwardly as indicated at 77, then in a line parallel to the sides of the box at 78 and rigidly attached to the rear axle 79 of the vehicle. The diagonal braces 70 are extended from the axle 79 to the cross member 13 at the top of the box or frame and are rigidly secured thereto.

Pivotally attached at one end 80 thereof to the shaft 59 is a bar 81 having its other end pivotally connected at 82 to a rod or bar 83 having its other end pivotally connected at 84 to the rear center portion of the movable door 41, as best illustrated in FIG. 3, for moving the door forwardly and rearwardly through an hydraulic cylinder 85 of double acting type. One end of the cylinder 85 is pivotally attached to the bracket 68. The other end of the cylinder 85 terminates in a piston rod 86 having its free end pivotally attached by a pin 87 to the bar 81.

A fluid supply is connected to the cylinders heretofore described by lines, as will later be shown, and the fluid supply may be from the tractor or from a separate supply as desired.

In FIG. 5, there is illustrated diagrammatically the fluid supply means for operating the endgate and movable door. The fluid of the tractor may be utilized for the purpose of my invention, but I have here illustrated a pump 90, a fluid supply tank 91 and a valve 92. The valve has a chamber 93 with a double acting piston as indicated at 94 and 95 and is provided with a control lever 96. The valve is divided into compartments 97, 98 and 99. A line 100 leads from the chamber 98 to the rear end of the cylinder 72 and a branch line 120 leads to the front of cylinder 85. A line 101 leads from the chamber 98 to the front portion of the cylinder 72 and a branch line 121 leads to the rear portion of cylinder 85. The pistons 72' and 85' are shown in the cylinders 72 and 85 respectively, and the fluid lines are connected on either side of the pistons to form double acting extension member. A line 102 connects the pump to one side of the tank, as indicated at 103, and a line 104 leads from the pump to the tank as indicated at 105. A branch line 106 connects the line 104 with the chamber 98 of the valve 92, and branch lines 107 and 108 connect the line 104 with the valve at spaced points as shown in FIG. 5.

Mounted on the side edges 110 and 111 of the endgate 31 near the top of the endgate are brackets 112 and 113 having spaced ears, and mounted between the ears by pins 114 and 115 are rollers 116 and 117 which extend slightly outwardly from the side edges of the endgate to contact the inside of the walls of the frame of the vehicle to provide for ease of movement of the endgate in the box of the vehicle when the endgate is being moved forwardly and rearwardly therein.

The operation of a device constructed and assembled as described operates with a tractor which propels the scraper to a location where the scraper is to be loaded. For example, fluid from a source of fluid pressure and through controls on a tractor is transmitted through fluid line 117 (FIG. 2) to the extension members 25 for extending the same to move the forward portion of the frame scraper downwardly to cause the scraper blade 22 to contact the earth to be moved. The movement of the tractor will cause the scraper to pass the earth over the scraper blade and by the conveyor 28 is further moved into the box of the scraper.

It will be obvious at the beginning of the loading operation, the moveable door is forwardly as shown in the position in FIG. 1 to cover the door opening, and the endgate 31 is moved backwardly against the rear cross member 13 also as shown in FIG. 1. Operation of the conveyor is through mechanisms that are substantially the same as that shown in the James E. Hancock application for patent Serial No. 715,713, filed February 17, 1958. When a suitable amount of earth is loaded into the scraper, the hydraulic controls (not shown) are operated to effect contraction of the extension member 25 to raise the forward ends of the scraper to a position for movement of the scraper to point it is to be unloaded.

When the scraper arrives at the point of unloading of the earth material, movement of the control lever 96 to move the pistons 94 and 95 to the right will open

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line 100 to cause fluid to flow from chamber 98 through line 100 to the cylinder 72 back of the pistons 72' and through branch line 120 to cylinder 85 in front of the piston 85', thereby causing the moveable door 41 to be moved rearwardly by the piston rod 36 and rod 33 5 through connection of bar 81 to open the door opening 20 and, at the same time, the fluid pressure behind the piston 72' and cylinder 72 will cause the piston rod 73 to move forwardly to push the endgate forwardly in the box and cause the earth material to fall through the door opening 20. The fluid from behind piston 85' will move through branch line 121 through line 101 back to the chamber 99 of the valve, and the fluid from in front of the piston 72' will flow through line 101 to chamber 99.

More resistance will be on the endgate due to the earth in the box, and the moveable door will move to open position before the endgate moves entirely forwardly. In other words, the movement of the door and endgate is in accordance with the resistance encountered by the dirt on the door and the dirt in front of the endgate, and it will be obvious that movement of the door from under the dirt will take less power than to move the endgate forwardly in the box. Therefore, the greater resistance will be on the piston 72' than on the piston 85' and will take greater pressure to move the endgate forwardly.

When the earth has been removed from the scraper, movement of the pistons 94 and 95 by lever 96 to the left will open line 101 and close off line 100, thus causing the fluid pressure to flow to the rear of the piston 85' and the cylinder 85 and forwardly of the piston 72' and cylinder 72, and the force of the fluid will cause the moveable door 41 to move forwardly over the door opening and, when the strike-off blade and the brackets with the horns 43 contact the roller 49 on the side of the framework structure, the strike-off blade will be raised to close the door opening 20 by the door 41 and the strike-off blade. Simultaneously, with closing of the door 41, the endgate will move rearwardly in the box to its rearward position as shown in FIG. 1. During this operation, the excess fluid from the cylinders will be returned to the tank through lines 120 and 100 respectively through chamber 97 and line 107.

During this operation, should the door have less force or resistance against movement of the door in the forward end to close the door opening, less pressure will be on the cylinder 85 and greater pressure on cylinder 72 to move the endgate rearwardly. Whichever has the greater pressure, the movement will be in sequence, the same as when the operation of unloading is being accomplished. A relief valve 122 is provided in line 104 which will open at some predetermined pressure and allow the fluid to bypass the valve 92 should some obstruction occur that would cause excessive pressure.

It is possible that some simultaneous movement may be made on the pistons in the respective cylinders and movement of the moveable door and endgate may be simultaneous at times, but more likely that will be in sequence due to the greater resistance on one or the other, and definitely there will be greater pressure required to move the endgate forwardly in the box when the box is loaded. Fluid is fed to the cylinders simultaneously and while the endgate tends to advance while the moveable door is being moved rearwardly, it will not do so until the resistance to the endgate is less than that acting on the cylinder 85 which controls the moving door. In other words, the flow to the respective cylinders is simultaneous, but the difference in resistance to operation of the various objects will cause movement of the pistons in the cylinder in accordance with the resistance encountered so that, by one movement of the control lever, control of the moveable door and endgate is accomplished.

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It will be obvious from the foregoing that I have provided an improved earth moving apparatus and door operating mechanism and positive ejection mechanism, hydraulically controlled wherein the hydraulic cylinders will move in sequence in proportion to the resistance encountered by the objects to be moved.

It is to be understood that while I have illustrated and described one form of my invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

I claim:

1. Apparatus for handling dirt comprising, a mobile frame, a dirt collecting box having side walls and a fixed bottom between the side walls and extending forwardly from the back thereof a distance less than the length of the side walls forming a door opening forwardly of said bottom, a forwardly extending scraper blade extending transversely of the dirt collecting box and fixed to said frame in forwardly spaced relation to the forward end of said fixed bottom, a door for closing the opening in the bottom of the box, an endgate moveably mounted in the rear of said box, hydraulic means for moving said door to open and closed position, hydraulic means for moving said endgate forwardly to push the dirt through the said door opening, a valve for controlling said hydraulic means whereby fluid is submitted to each of said means simultaneously and movement of said door and endgate is in sequence to the resistance of each one against said hydraulic means.

2. Apparatus for handling dirt comprising, a mobile frame, a dirt collecting box having side walls and a fixed bottom between the side walls and extending forwardly from the back thereof a distance less than the length of the side walls forming a door opening forwardly of said bottom, a forwardly extending scraper blade extending transversely of the dirt collecting box and fixed to said frame in forwardly spaced relation to the forward end of said fixed bottom, a door movably mounted on the side walls of said frame for movements over a portion of the door opening, an endgate movably mounted in the rear of said box, a cylinder having a piston and rod connecting to said door for swinging said door to open and closed position, a cylinder having a piston and rod connected to the endgate for moving said endgate forwardly to push the dirt through the said door opening, and a fluid control system including a valve whereby fluid is submitted to said cylinders back of said pistons simultaneously and movement of said door, and endgate is in sequence to the resistance of the dirt on each one against movement thereof and against said pistons.

3. Apparatus for handling dirt comprising, a mobile frame, a dirt collecting box having side walls and a fixed bottom between the side walls and extending forwardly from the back thereof a distance less than the length of the side walls forming a door opening forwardly of said bottom, a forwardly extending scraper blade extending transversely of the dirt collecting box and fixed to said frame in forwardly spaced relation to the forward end of said fixed bottom, a door mounted on the side walls of said frame for movement over the door opening, a strike-off blade pivotally mounted on the forward edge of said door and dependent therefrom when the door is in retracted position for levelling the dirt as it is discharged from the box, an endgate movably mounted in the rear of said box, hydraulic means for sliding, longitudinal movement of said door to open and closed position, means on said strike-off blade co-operating with means carried by the forward portion of the frame for raising said strike-off blade to horizontal position for closing the portion of the door opening between the forward edge of the door and the scraper blade when the door is moved forwardly to closing posi-

tion, hydraulic means for moving said endgate forwardly to push the dirt through the said door opening and a valve for controlling said hydraulic means whereby fluid is submitted to each of said means simultaneously and movement of said door, and endgate is in sequence to the resistance of each one against said hydraulic means.

4. Apparatus for handling dirt comprising, a mobile frame, a dirt collecting box having side walls and a fixed bottom between the side walls and extending forwardly from the back thereof a distance less than the length of the side walls forming a door opening forwardly of said bottom, a forwardly extending scraper blade extending transversely of the dirt collecting box and carried by said frame in forwardly spaced relation to the forward end of said fixed bottom, a door, trackways mounted on the side walls of said frame, means on said door movable in said trackways for movement of the door over a portion of the door opening, a strike-off blade pivotally mounted on the forward edge of said door, an endgate movably mounted in the rear of said box, a bracket secured to said frame rearwardly of said endgate, an hydraulic cylinder mounted on said bracket having a piston and a rod connected to said door for moving said door to open and closed position, an hydraulic cylinder having a piston and a rod mounted on said bracket in horizontal relation to said endgate and having connection with said endgate for moving said endgate forwardly to push the dirt through the said door opening, a fluid supply, and means for supplying fluid to said cylinders on one side of said piston simultaneously, whereby said door and endgate will operate in sequence according to the resistance encountered by said door and endgate.

5. Apparatus for handling dirt comprising, a mobile frame, a dirt collecting box having side walls and a fixed bottom between the side walls and extending forwardly from the back thereof a distance less than the length of the side walls forming a door opening forwardly of said bottom, a forwardly extending scraper blade extending transversely of the dirt collecting box and carried by said frame in forwardly spaced relation to the forward end of said fixed bottom, a door movably mounted to the side walls of said frame for sliding, longitudinal movement over a portion of the door opening, a strike-off blade pivotally mounted on the forward edge of said door, means on said strike-off blade cooperating with means on said frame for causing said strike-off blade to assume a horizontal position after the dirt is removed from the box, an endgate movably mounted in the rear of said box, a bracket secured to said frame rearwardly of said endgate, an hydraulic cylinder mounted on the side of said bracket having a piston and a rod connected to said door for moving said door to open and closed position, an hydraulic cylinder having a piston and a rod mounted on said bracket in horizontal relation to said endgate and having connection with said endgate for moving said endgate forwardly to push the dirt through the said door opening, a fluid supply, means for supplying fluid to said cylinders on one side of said pistons simultaneously, whereby said door and endgate will operate in sequence according to the resistance encountered by said door, strike-off blade and endgate, and means for returning excess fluid to said fluid supply.

6. Apparatus for handling dirt comprising, a mobile frame, a dirt collecting box having side walls and a fixed bottom between lower portions of the side walls and extending forwardly from the back thereof a distance less than the length of the side walls forming a door opening forwardly of said bottom, a door movably mounted on said frame adjacent said lower portions of the side walls of the dirt collecting box and extending thereunder to close said door opening whereby retractive movement of said door opens said door opening, a strike-off blade mounted on the forward edge of said door and dependent therefrom when the door is in retracted position for levelling the dirt as it is discharged from the box, an endgate movably mounted in the rear of said box, hydraulic means carried by said frame rearwardly of said dirt collecting box and operatively connected to said door for sliding, longitudinal movement of said door to open and closed position, hydraulic means carried by said frame rearwardly of said dirt collecting box and operatively connected to said endgate for moving said endgate forwardly to push the dirt through the said door opening when said door is in retracted position, and a valve for controlling said hydraulic means whereby fluid is submitted to each of said means simultaneously and movement of said door and endgate is in sequence to the resistance of each one against said hydraulic means.

7. Apparatus for handling dirt comprising, a mobile frame, a dirt collecting box having side walls and a fixed bottom between lower portions of the side walls and extending forwardly from the back thereof a distance less than the length of the side walls forming a door opening forwardly of said bottom, a door for closing said door opening, trackways mounted on said frame and extending longitudinally thereof adjacent the lower portions of the side walls of said dirt collecting box, means on said door movable in said trackways for movement of the door over the door opening, a strike-off blade mounted on the forward edge of said door, an endgate movably mounted in the rear of said box, a bracket secured to said frame rearwardly of said endgate, an hydraulic cylinder mounted on said bracket having a piston and a rod connected to said door for moving said door to open and closed position, an hydraulic cylinder having a piston and a rod mounted on said bracket in horizontal relation to said endgate and having connection with said endgate for moving said endgate forwardly to push the dirt through the said door opening when said door is in open position, a fluid supply, and means for supplying fluid to said cylinders on one side of said pistons simultaneously, whereby said door and endgate will operate in sequence according to the resistance encountered by said door and endgate.

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