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Walser et al.

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[54] **STABILIZER AND POSITIVE EJECTION MECHANISM FOR EARTH MOVING APPARATUS**

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[73] Assignee: **Clark Equipment Company,** Buchanan, Mich.

[22] Filed: **Oct. 4, 1971**

[21] Appl. No.: **185,985**

[52] **U.S. Cl.** ..... **37/124,** 37/126 E

[51] **Int. Cl.** **E02f 5/00**

[58] **Field of Search** 37/4, 8, 124–129

[56] **References Cited**

UNITED STATES PATENTS

3,479,758	11/1969	Johnson et al.	37/129
3,596,383	8/1971	Bispo	37/8
2,994,976	8/1961	Hancock	37/8 X
3,066,429	12/1962	Hancock	37/8 X
3,152,410	10/1964	Monk	37/124 G
3,488,870	1/1970	Holets et al.	37/129
3,465,458	9/1969	Wagner	37/129
3,346,972	10/1967	Johnson	37/129
2,394,483	2/1946	Rockwell	37/126 AB

FOREIGN PATENTS OR APPLICATIONS

236,280	9/1960	Australia	37/8
1,095,203	12/1967	Great Britain	37/8

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[57] **ABSTRACT**

A stabilizer and positive ejection mechanism for a self-loading scraper having a movable end gate and rolling bottom door. The mechanism provides one horizontal trackway portion extending forwardly and another rearwardly of the scraper axle. A rigid stabilizing structure attached to the rear of the end gate is guided on the front trackway portion and a link member attached to the door is guided on the rear trackway portion. This arrangement permits actuating cylinders to be close-coupled to the stabilizer structure for low-center, direct pushing action in opposite directions with a minimum of side thrust and a maximum applied force.

10 Claims, 7 Drawing Figures

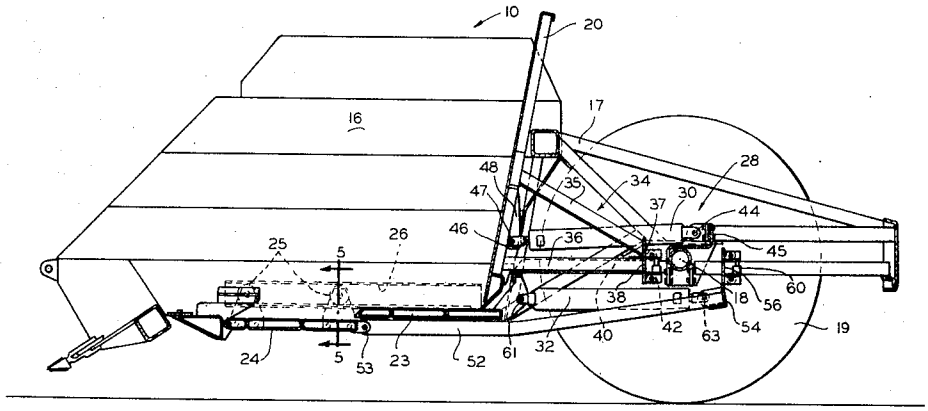


FIG. 1

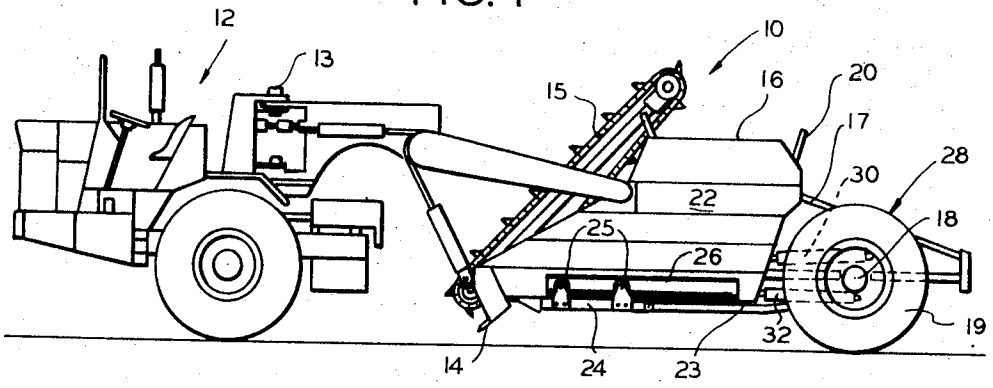


FIG. 6

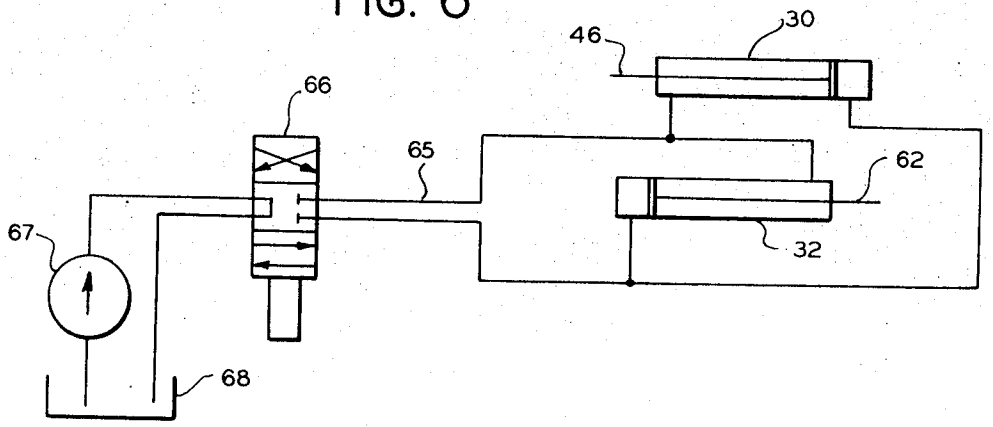
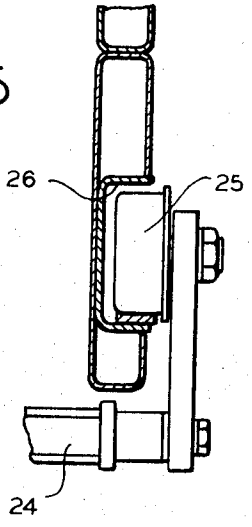


FIG. 5



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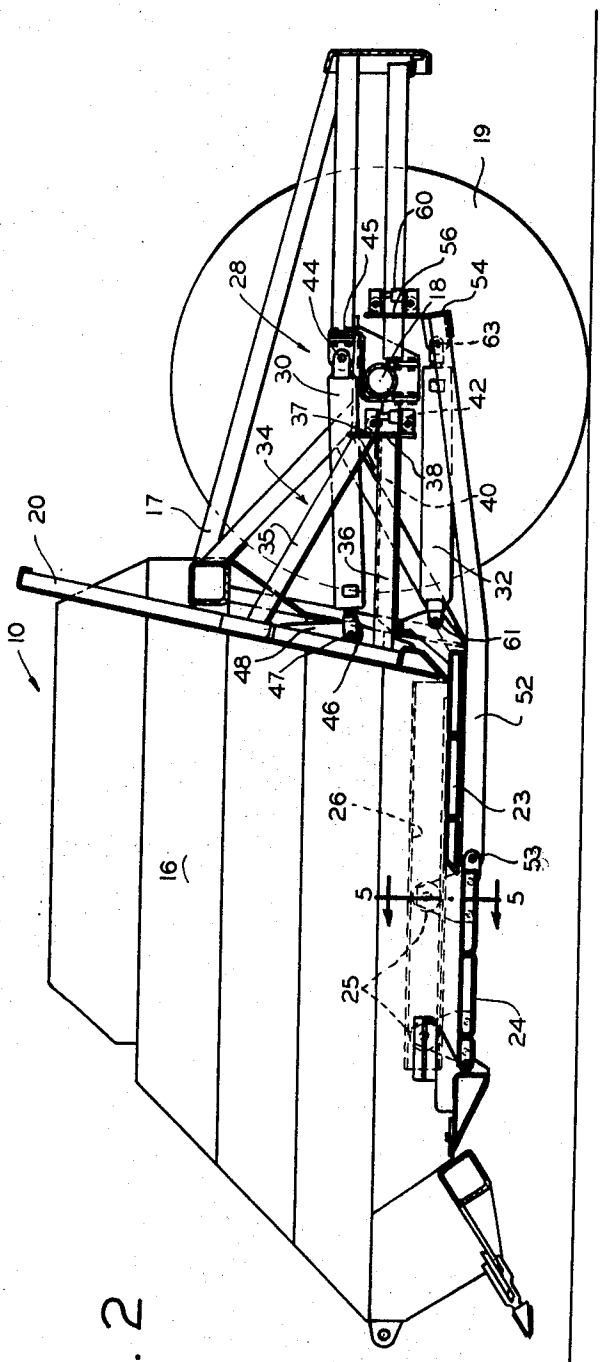


FIG. 2

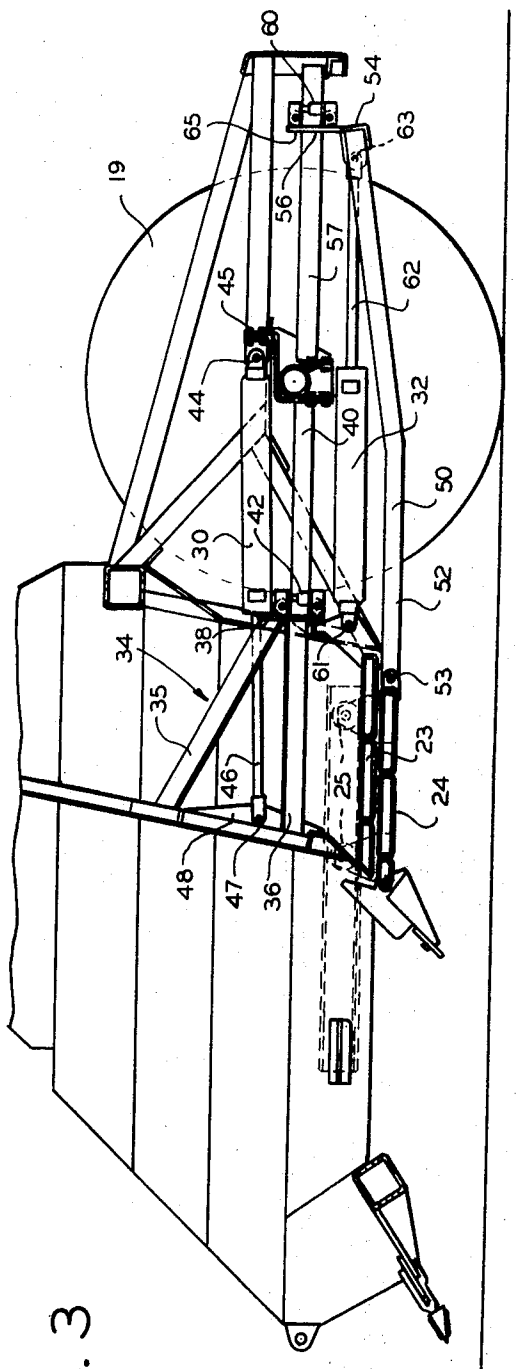


FIG. 3

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FIG. 4

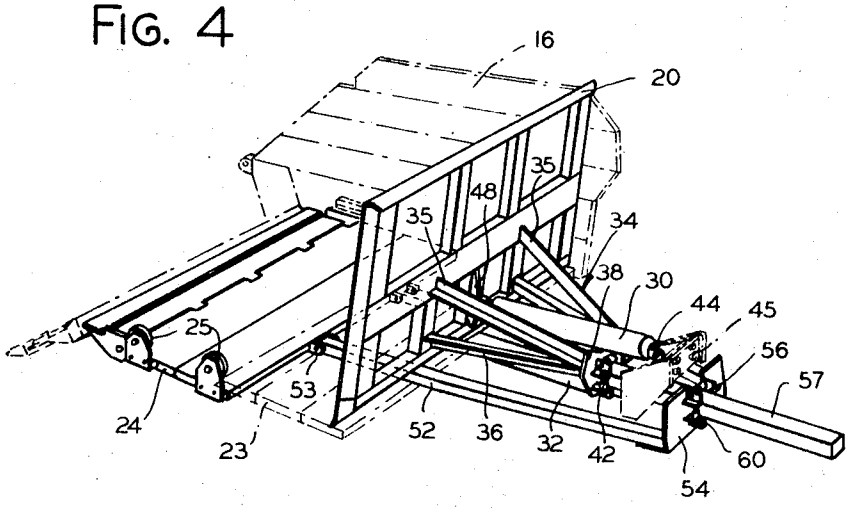
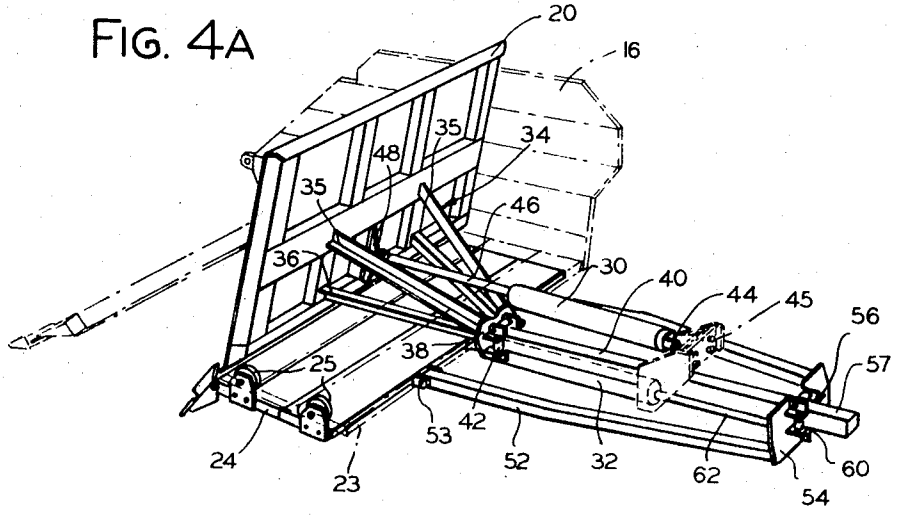


FIG. 4A



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STABILIZER AND POSITIVE EJECTION MECHANISM FOR EARTH MOVING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to earth moving apparatus, such as a self-loading scraper, and particularly to a stabilizer and positive ejection mechanism for the end gate and rolling bottom door of the scraper.

2. Description of the Prior Art

Stabilizer and positive ejection mechanisms are in general use of the type described in the U.S. Pat. No. 2,994,976 issued to J. E. Hancock Aug. 8, 1961 which, by subsequent assignment, is now assigned to the assignee of the present invention. For details of this mechanism reference is made to the patent, however, one object of any such mechanism is to counteract side thrusts on the end gate encountered as it moves forwardly pushing the burden of earth material collected in the scraper bowl. The main stabilizing effort is exerted far to the rear of the end gate by stabilizer bars which travel with the end gate. The stabilizer bars are guided on a portion of the scraper frame located to the rear of the axle.

The ejection force is applied by an ejection cylinder which is extended to push a swinging link connected to the rear of the end gate.

The rolling bottom door is suspended at its opposite ends by rollers. An actuating cylinder, the cylinder rod of which is normally extended, pulls on a second swinging link to retract the door. In the normal sequence of operation, the door is retracted and then the end gate pushes forward expelling the earth material through the door opening in the bottom.

While this pull-push mechanism has met with substantial commercial acceptance and has proved entirely satisfactory, the number of separate parts required increases the cost, adds weight to the overall scraper unit and owing to the greater complexity, increases the maintenence.

SUMMARY OF THE INVENTION

A mobile earth moving apparatus has a rear wall or end gate which is movable into the earth material receiving space. A stabilizer and ejection mechanism for the end gate is guided on a trackway portion extending immediately behind the end gate. The arrangement provides a low-center pushing action at or near the center of maximum resistance to movement of the end gate so that the stabilization and ejection effort is concentrated most efficiently.

It is further provided that the line of action of the ejection cylinder is inclined slightly downwardly so as to exert a component of force downwardly on the bottom edge of the end gate thereby reducing the tendency of the end gate to lift or be wedged up by the earth material.

It is still further provided that where the earth material receiving space has an opening in the bottom for dumping the earth material, a second movable wall or rolling bottom door is activated by the mechanism. In this case a second trackway portion extends rearwardly and is aligned with the first trackway portion. A link element is connected to the rear of the door and is supported on the second trackway portion. An actuating cylinder pivotally connected to the trailing end of the link element is actuated to extend rearwardly on a line

generally parallel and closely adjacent to the second trackway portion.

The arrangement provides that the cylinders are close-coupled to the stabilizer structure for the rolling bottom door and end gate, i.e., they act more directly with the stabilizer structures in a compact geometry in applying the actuating forces and do not employ a system of levers. The cylinders act in opposite directions on nearly parallel lines of action closely adjacent the trackway portions. This inherently stabilizes the system and insures maximum applied force at or near the effective center of resitance to movement, i.e., the center of mass of the earth burden. The arrangement eliminates some of the parts and combines into one system the functions of stabilizing the end gate ejection and operating the rolling bottom door.

These features and advantages of the invention will become more apparent by referring to the following detailed description of the invention and by reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of an earth moving apparatus and specifically a tractor scraper to which the invention may be most advantageously applied;

FIG. 2 is a partial longitudinal sectional view of the apparatus showing the scraper having its end gate retracted, and bottom door closed with the corresponding position of the stabilizing and ejection mechanism also being shown;

FIG. 3 is a view similar to FIG. 2 only with the end gate shown in the forward or dump position and in the door retracted or opened position;

FIGS. 4–4*a* are fragmentary perspective views from a left rear quarter position showing the position of parts as they are depicted respectively in FIGS. 2 and 3;

FIG. 5 is a partial cross-sectional view of a support roller and bracket assembly for the rolling bottom door taken along line 5—5 of FIG. 2; and

FIG. 6 is a hydraulic schematic diagram showing the hydraulic circuit for actuating the cylinders of the stabilizer and ejection mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, 10 designates an earth moving apparatus and particularly a self-loading scraper towed by tractor 12. The scraper 10 is articulated relative to the tractor 12 on a vertical pivot axis 13. The scraper may be lowered into engagement with the ground in a known manner. A fixed main blade 14 is mounted at the front for engagement with the ground. An elevator 15 contacts the ground ahead of the blade 14 and assists in loading earth material into the scraper bowl 16. A frame portion 17 is trailingly mounted on the bowl 16 and supports an axle 18 having ground engaging wheels 19. The scraper bowl 16 has an end gate 20 which fits closely between the side walls 22 and slides on a fixed floor portion 23. A second shiftable floor portion or rolling bottom door 24 extends forwardly of the fixed floor portion 23. The door 24 is mounted at each end on rollers 25 which move in longitudinal tracks 26 recessed in the opposite side walls 22 as shown in FIG. 5. When dumping, the door is retracted and then the end gate pushes forwardly ejecting the earth material through the bottom of the bowl.

Mounted on frame portion **17** rearwardly of the scraper bowl **16** is a stabilizer and positive ejection mechanism **28** described in more detail hereinafter. The mechanism **28** includes a first hydraulic cylinder **30** mounted above the axle **18** for operating the end gate **20** and a second hydraulic cylinder **32** mounted below the axle **18** for operating the rolling bottom door **24.**

Referring to FIGS. **2, 3, 4, 4***a*, a rigid quadrilateral stabilizer structure **34** is attached to the rear of end gate **20.** Inclined upper braces **35** and lower braces **36** extend rearwardly and inwardly to a longitudinal centerline for mounting a carrier bracket **38** having a rectangular opening **37.** A trackway portion **40** is stationary with respect to the stabilizer structure **34** and extends through the opening **37** of the carrier bracket **38** and forwardly of the axle **18.** The trackway portion **40** preferably has a rectangular tubular cross-section providing vertical and horizontal roller guide surfaces. Vertical and horizontal pairs of rollers **42** on the carrier bracket **38** travel on the roller guide surfaces and stabilize the end gate **20** as it moves between its retracted position (FIGS. **2** and **4**) and its extended position (FIGS. **3–4***a*). It is important to note that the stabilizing effort is along a low centerline entirely forward of the rear axle **18** such that unbalanced loads on the end gate are concentrated on the quadrilateral stabilizer structure **34** which focuses these forces at its trailing end where they are allowed to react at the fixed, low-center stabilizing line established by the trackway portion **40.**

The ejection cylinder **30** is mounted directly above the trackway portion **40** and pivotally connects at the rear **44** to an axle bracket **45** and its rod **46** pivotally connects at **47** to a gusset **48** secured to the end gate **20.** The pivotal connection with the end gate is close to the stabilizing line of trackway portion **40.** The cylinder **30** is mounted on a line inclined slightly downwardly so that its line of action during ejection operation is such as to produce a downward force component on the bottom edge of the end gate **20** tending to keep it in close sliding engagement with the fixed floor portion **23** resisting any tendency of the earth material to wedge the end gate up. It should also be noted that the point of application of force is close-coupled to the carrier bracket **38** where the unbalanced loads acting on the end gate are focused. This geometry inherently tends to stabilize end gate ejection.

The door **24** moves on rollers **25** between the closed position (FIGS. **2–3**) and open position (FIGS. **3–4***a*) by means of a yoke **50** and actuating cylinder **32.** The yoke **50** has laterially spaced arms **52** pivotally connected at **53** to the rear of the door **24.** The arms **52** extend rearwardly and inwardly for mounting a carrier bracket **54.** The carrier bracket **54** has a rectangular opening **56** through which a second trackway portion **57** extends. The trackway portion **57** runs rearwardly of the axle **18** and is in alignment with the trackway portion **40.** Similar to the trackway portion **40,** it has a rectangular tubular cross-section providing longitudinally extending roller guide surfaces for vertical and horizontal carrier bracket rollers **60.**

The door actuating cylinder **32** pivotally mounts at **61** to the rear of the bowl and its rod **62** is pivotally mounted at **63** to the trailing end of the yoke **50.** The cylinder **32** is positioned below the axle **18** and extends its rod **62** in retracting the door **24** in a direction opposite to that of cylinder **30.** It will be noted that cylinders **30** and **32** each is positioned closely adjacent the low center stabilizing line and is close-coupled to the carrier bracket **38,54** of the stabilizer structure for the end gate and door. That is, the actuating force and stabilizing effort are in closely spaced relationship, being applied nearly on a straight line during actuation of the end gate and door. This geometry provides greater stability with a minimum of side thrust and maximum of applied force.

It is also relevant to note that the close-coupling geometry makes it possible to utilize a single cylinder for actuating the end gate and door having one rod extending first to retract the door and another extending to push the end gate. Also, it is possible that those skilled in the art will be able to envision a cable and rotating drum arrangement for actuating the end gate and door. The essential factor, however, is that any such system which attempts to utilize the present invention will employ an actuating means and stabilizer structure operated in a close-coupled relationship near to a stabilizing line.

Referring briefly to FIG. **6,** the actuating cylinders **30** and **32** are connected by a hydraulic circuit **65** including a valve **66,** a pump **67,** and a reservoir **68.** The valve **66** has two positions which may be controlled by the operator riding in the tractor **12.** When it is desired to eject the earth material, the valve **66** is moved to cause hydraulic fluid under pressure to be delivered to cylinders **30** and **32** simultaneously, but owing to the fact that cylinder **30** experiences the greatest resistance to movement because of the burden of earth material, the cylinder **32** extends first retracting the door **24.** When it reaches the limit of its travel, then the cylinder **30** extends moving the end gate **20** from the retracted to the extended position. Such an arrangement is more fully discussed in U.S. Pat. No. 3,066,429 of Dec. 4, 1962, to J. E. Hancock.

While this specification contains a description of the invention and specific manners of using it, and sets forth the best mode contemplated for carrying out the invention, there are other variations, combinations and alterations that may be made without departing from the spirit of the invention and the scope of the appended claims.

We claim:

1. An earth moving apparatus having side walls, a fixed floor portion extending between the side walls, an end wall movable between the side walls, and a main blade extending transversely between the side walls and carried forwardly of the floor portion, an opening between said floor portion and main blade, a door normally extending forwardly from said floor portion for closing the opening, a trailingly mounted frame portion, an axle mounted on said frame portion having ground engaging wheels, and stabilizer and actuating means supported on said frame portion for opening and closing the door and for moving said end wall forwardly to push earth material through said opening when the door is open, said means comprising a rigid stabilizer structure connected to the end wall and extending rearwardly thereof a distance at least equal to the forward travel of the end wall and movable forwardly of said axle with the end wall when pushing earth material through said opening, a link element connected to said door extending rearwardly of the axle at least a distance equal to the rearward travel of said door and movable rearwardly with the said door when uncover-

ing said opening, trackway means mounted on the frame portion having a forwardly extending portion for guiding said rigid stabilizer structure and a rearwardly extending portion for guiding said link element whereby the end wall and door are guided in a fore and aft direction on a common line.

2. Apparatus according to claim 1 wherein said link element is a rigid yoke having a forked end pivotally connected to the door, guide means carried on the opposite end traveling on the rearwardly extending portion of the trackway means, other guide means mounting at the trailing end of said rigid structure traveling on the forwardly extending portion of said trackway means.

3. In an earth moving apparatus having a movable end gate, fixed parallel side walls between which the end gate moves, a fixed floor portion between the side walls, a movable door shiftable below the fixed floor portion, rollers on opposite sides of the door for supporting it during movement, a frame portion rigidly mounted to said side walls and extending rearwardly thereof and an axle supported on said frame portion having ground engaging wheels partially supporting said apparatus, the improvement comprising a stabilizing and actuating mechanism supported on the frame portion for sequentially opening said door and moving said end gate forwardly to push earth material through the opening uncovered by said door, said mechanism including a rigid stabilizer structure connected to the end gate and extending rearwardly thereof a distance at least equal to the distance of forward travel of the end gate and movable forwardly of the axle with the end gate when pushing dirt through said opening, trackway means having a portion extending forwardly of the axle for guiding the trailing end of said rigid stabilizer structure, and in cooperation with said side walls maintaining said end gate in a transverse plane during fore and aft movement thereof, a link element having laterally spaced arms pivotally connected to the door and extending rearwardly of the axle a distance at least equal to the rearward travel of said door, said trackway means having a second portion extending rearwardly of said axle supporting the end of said link element and cooperating with said rollers for guiding said door, and actuating means supported on said frame portion operable to cause movement sequentially of said door and then the end gate for expelling earth material from said apparatus, said trackway means establishing a low center stabilizing line and said actuating means being close-coupled to the door and end gate and acting on lines closely adjacent the low center stabilizing line.

4. The improvement according to claim 3 wherein said actuating means includes a first hydraulic cylinder pivotally mounted above said axle having a forwardly extensible rod pivotally connected midway between the lateral edges of said end gate, a second hydraulic cylinder pivotally mounted below said axle having a rearwardly extensible rod pivotally mounted at the trailing end of said link element, said first and second cylinders positioned in the center plane of the apparatus, and hydraulic circuit means sequentially operating one or the other cylinders before the other depending on which experiences the least resistance to movement.

5. The improvement according to claim 4 wherein said first hydraulic cylinder is inclined in said center plane so as to apply a downward force component on the lower edge of said end wall.

6. An earth moving apparatus comprising a plurality of wall members defining a space enclosed on at least three sides adapted to be filled with earth material, one of said wall members being movable into said space for ejecting at least a portion of the earth material, means connected to said movable wall member for moving it between retracted and extended positions and for maintaining it stabilized in a transverse plane with respect to the direction of movement, said means including a rigid stabilizer structure connected to the movable wall member and extending rearwardly thereof to a longitudinally extending, central stabilizing line, a stationary trackway means having a first portion situated on the fore part of said stabilizing line for guiding the end of said stabilizer structure in a fore and aft direction as said wall member is moved and wherein another of said wall members is a fixed floor portion extending below the movable wall member and there is an opening forwardly of the fixed floor portion and a movable door is shiftable for opening and closing said opening, said trackway means including a second portion situated on the rear part of said stabilizing line, a link element connected to said door and extending rearwardly thereof to said second trackway portion for guiding said door between opened and closed positions.

7. Apparatus according to claim 6 including a frame portion, an axle supporting ground engaging wheels mounted on said frame portion, the fore part of said stabilizing line extending forwardly of said axle and the rear part thereof extending rearwardly of the axle.

8. Apparatus according to claim 7 wherein said first and second trackway portions each has vertical and lateral guiding surfaces and guide means mounted on said stabilizer structure and link element include vertical and lateral guide rollers for traveling on the respective guiding surfaces in stabilizing said movable wall and door along said central stabilizing line.

9. Apparatus according to claim 7 wherein a pair of hydraulic cylinders is supported on said frame portion, one cylinder being disposed below the axle and extensible rearwardly thereof, the other cylinder being disposed above the axle and extensible forwardly thereof, each moving from the retracted to extended positions to deliver a pushing or pulling force to said door and movable wall member respectively along a line of action closely adjacent the central stabilizing line.

10. Apparatus according to claim 9 wherein the one cylinder is connected to the movable wall member and is inclined slightly downwardly so as to apply a downward component of force at the lower edge of the wall member.

* * * * *