United States Patent

Stewart et al.

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[54] EJECTOR AND FLOOR ACTUATING MEANS FOR SCRAPER

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[52] **U.S. Cl.** **37/129**, 214/82, 37/126

[51] **Int. Cl.** **E02f 3/85**, B60p 1/16, E02f 3/64

[58] **Field of Search** 37/8, 124, 126–127, 37/129; 214/82

[56] **References Cited**

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[57] **ABSTRACT**

An actuating arrangement for a scraper having a movable ejector plate and movable floor section which includes a floating lever having its lower end coupled to the movable floor section and its upper end pivoted to the ejector plate and with an actuator interposed between the central portion of the lever and the ejector plate for automatic sequential movement of the floor section and ejector plate for discharge of the material in the scraper bowl.

3 Claims, 5 Drawing Figures

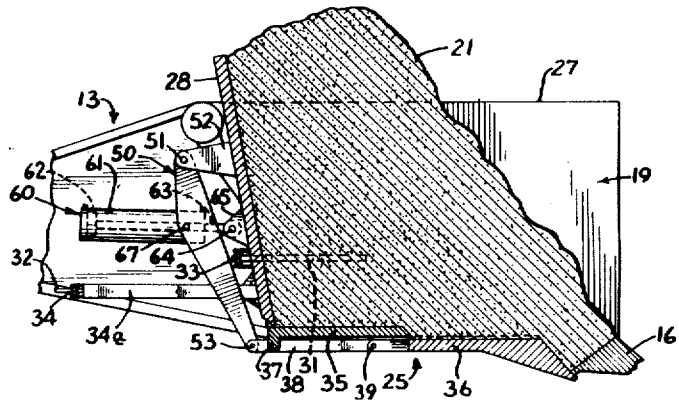


FIG. 1

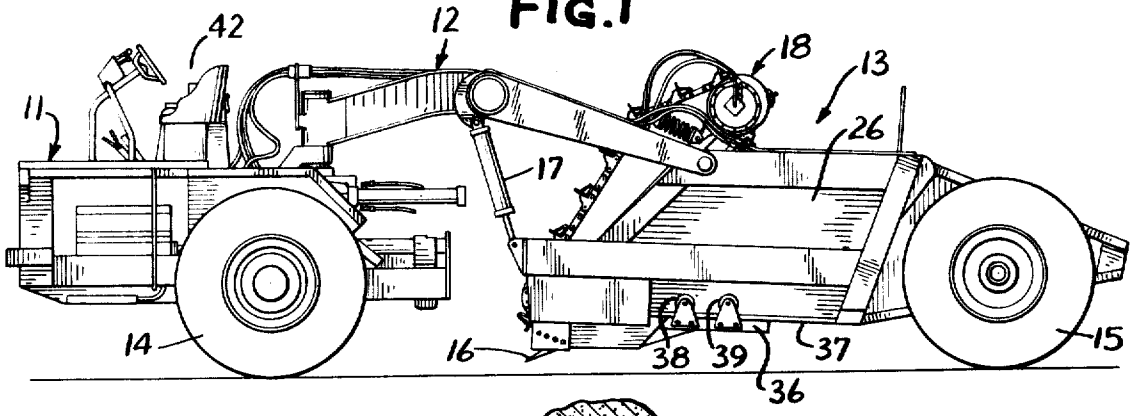


FIG. 2

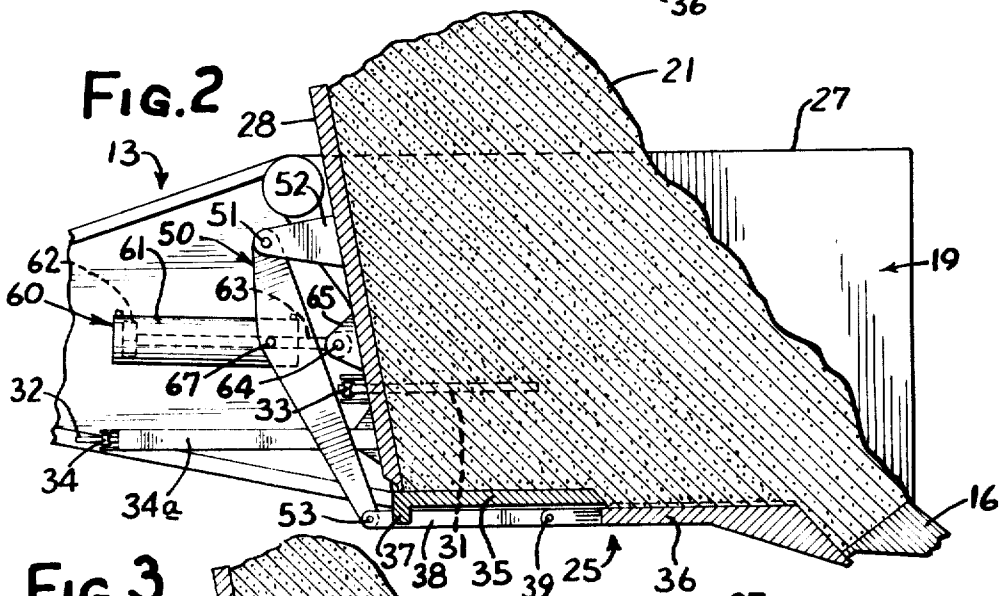
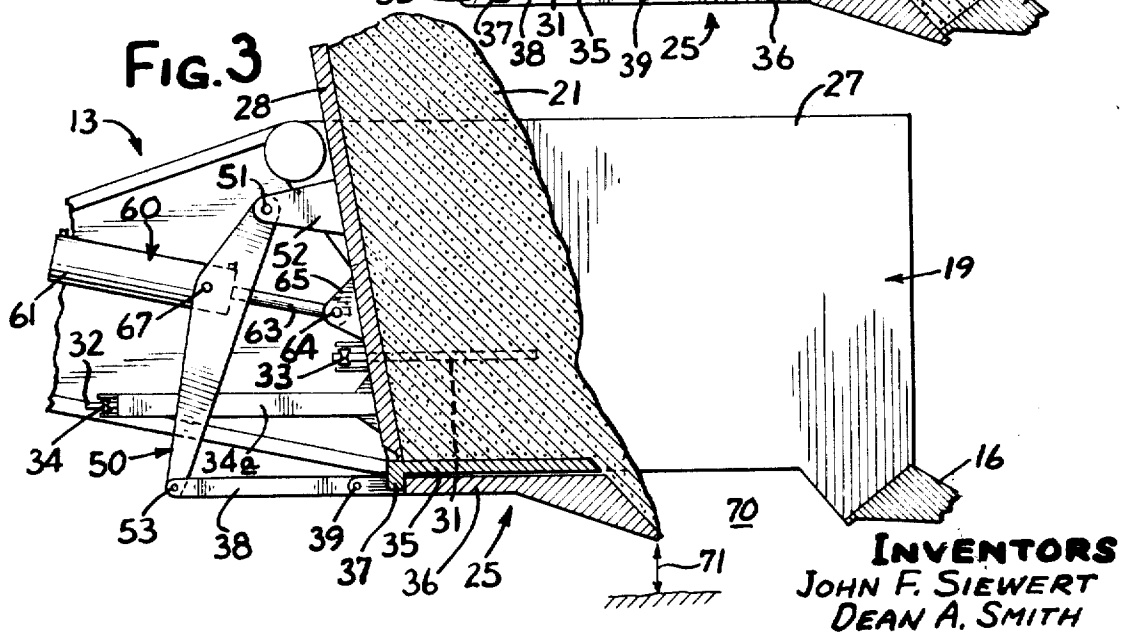


FIG. 3



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FIG. 4

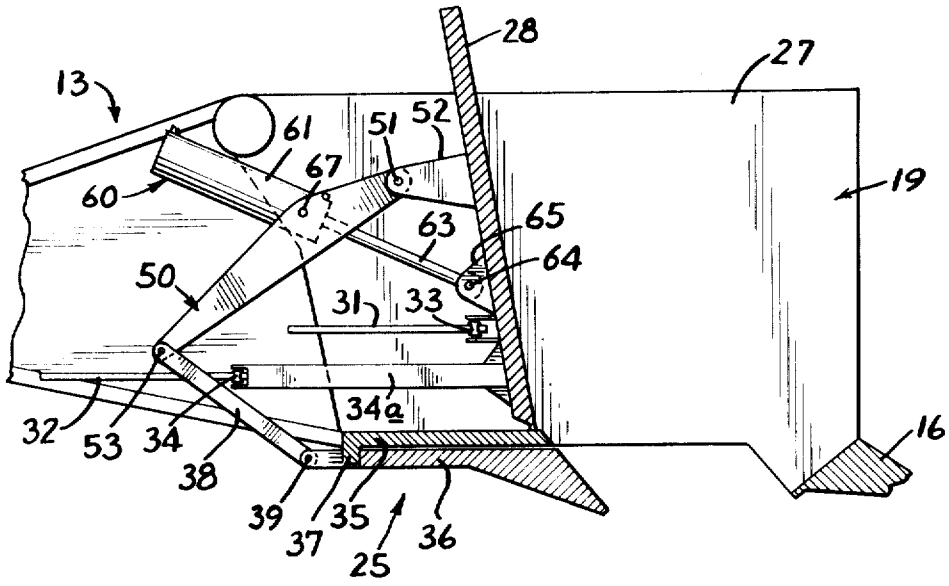
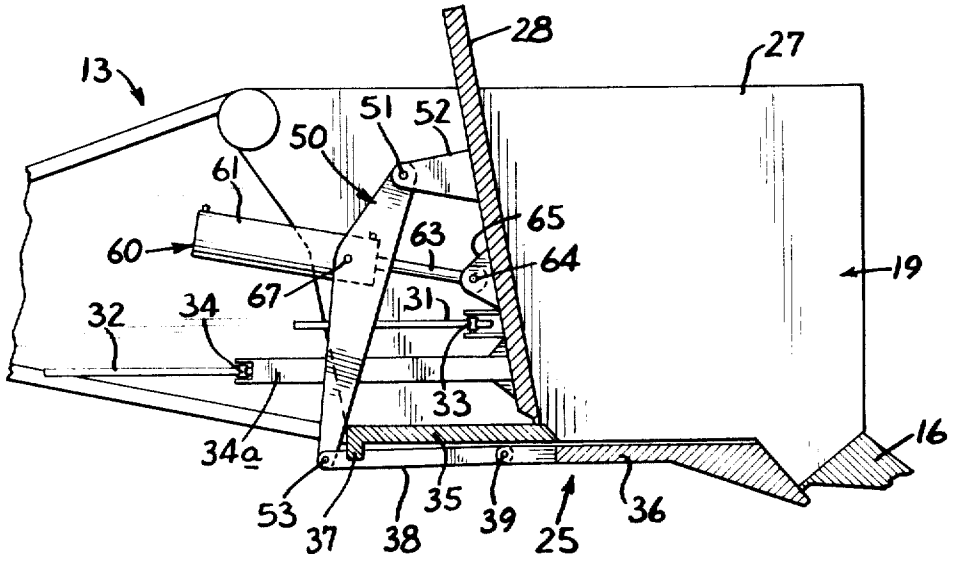


FIG. 5



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EJECTOR AND FLOOR ACTUATING MEANS FOR SCRAPER

A conventional scraper type of earth moving machine includes a bowl having its rear surface enclosed by a movable vertically arranged ejector plate, and a movable floor section which may be retracted by a floor link to form an opening through which the material in the scraper bowl is discharged as the ejector plate is progressively moved in the forward direction. Attempts have been made in the past to achieve sequential operation of the floor section and ejector plate upon progressive movement of a single fluid actuator as evidenced by Hermiz et al. U.S. Pat. No. 3,325,925. The prior device have, however, been relatively complex and expensive requiring a plurality of links or levers and supporting framework, with the links mounted in relatively exposed positions. We have found that sequential operation can be obtained, and that forces can be efficiently applied into the floor section and to the ejector plate for prompt controlled discharge of the material, using but a single lever floatingly mounted with its upper end pinned to the ejector plate and its lower end connected to the floor link and with an actuator interposed between the ejector plate and lever for swinging the latter. One advantage of the arrangement is the achieving of a high degree of economy and simplicity while insuring reliable operation, free of any need for maintenance, over a long period of time. No supporting framework is required and no connections are made to the frame or bowl.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which

FIG. 1 is an elevational view of a self-loading scraper and tractive vehicle utilizing the present invention.

FIG. 2 is a fragmentary vertical section, somewhat enlarged, showing accumulation of material in the bowl of the scraper of FIG. 1 and with the ejector blade and movable floor in normal position.

FIG. 3 is a view similar to FIG. 2 showing the movement of the floor to uncover the discharge opening during the initial movement of the actuator.

FIG. 4 is a view showing the subsequent movement of the ejector plate upon continued expansion of the actuator to complete discharge of the material through the opening.

FIG. 5 is a view showing the floor returned to its enclosing position and prior to the return of the ejector plate to the position of FIG. 2.

While the invention is described in connection with a preferred embodiment it will be understood that we do not intend to be limited to the particular form of the invention shown in the drawings but intend on the contrary to cover the various alternative and equivalent constructions included within the spirit and scope of the invention as expressed in the appended claims.

Turning now to FIG. 1 of the drawings there is shown a tractor 11 connected by a horizontally and vertically articulated draft frame 12 to a scraper 13, the tractor and scraper having the usual ground engaging wheels 14, 15. The front end of of the scraper is fitted with a scraper blade 16 which may be lowered into scraping engagement with the ground by extension of a pair of actuators 17, only one of which is visible in the drawing.

Arranged above, and extending upwardly and rearwardly from, the scraper blade 16 is a power driven conveyor or elevator 18 having flights for conveying the dirt and debris loosened by the blade, and accumulated in front of the blade, rearwardly for depositing in the scraper bowl 19 (FIG. 2). The scraper bowl has a floor generally indicated at 25 and a pair of vertical sidewalls 26, 27.

For enclosing the rear of the scraper bowl and for subsequent use in ejecting material accumulated in the bowl, a vertically extending ejector plate 28 is provided which spans the distance between the sidewalls and which is movable horizontally, backwardly and forwardly in the bowl.

In order to guide the ejector plate 20 in its course of horizontal movement, guide rails 31, 32 are provided on a

rearward extension of each of the sidewalls 26, 27 engaged cooperating rollers 33, 34. Rollers 33 are mounted at each lateral edge of the ejector plate. To hold the plate steady against toppling as it is thrust forwardly the guide rails are horizontally offset and the rollers 34 are supported at the ends of rigid cantilevered arms 34a which project rearwardly from the ejector plate, only one of the arms being visible in the drawings.

The floor 25 is made up of two transversely extending sections. The first, or rear, section 35 is fixed to the sidewalls 26, 27, while the forward section 36 is mounted for movement between a forward position, shown in FIG. 2, in which the section encloses a discharge opening, and a retracted limit position shown in FIG. 3 in which the opening is uncovered for discharge. Conventional means are provided for guiding the movable floor section 36 between its limits of movement, the rearmost position of the floor section being determined by a suitable limit stop such as that shown at 37. For reciprocating the floor section 36 a floor link 38 is pivoted to the floor section at a pivot 39.

In accordance with the present invention a floating lever is provided having a normal position in which it extends generally vertically behind the ejector plate and which is pivoted at its upper end to the ejector plate and its lower end to the floor link, a fluid actuator being interposed between the ejector plate and the lever for rocking the lever about its upper pivot to change the angle between the plate and the lever. In the preferred embodiment the two portions of the actuator are respectively pivoted to the ejector plate and the central portion of the lever. Thus, as shown in the drawings, the floating lever indicated at 50 has an upper pivot 51 which is connected to a bracket 52 rigidly secured to the ejector plate while the lower end of the lever is connected, by a pivot pin 53, to the rear end of the floor link 38. The actuator, indicated at 60, and which occupies a generally horizontal position, has a cylinder 61 and a piston 62 connected to a forwardly projecting piston rod 63. The forward end of the piston rod is connected by a pin 64 to a small bracket 65 secured to the ejector plate at a position below the main bracket 52. The cylinder of the actuator is pivotally connected, by pin 67, to the central portion of the floating lever 50. It will be seen that the lever 50, as a result of the described connections, is truly floating since all of its points of connection, 51, 53, and 67 move, relative to the bowl or frame, during an operating cycle.

The actuator 60 will be understood to be of the "reversible" type having hydraulic connections at its opposite ends connected to supply lines (not shown) fed from the usual hydraulic control valve (also not shown).

The advantages of the arrangement will be apparent upon considering a typical operating sequence. During the normal operation of the scraper, the actuators 17 are extended so that upon forward movement of the vehicle 11 the blade 16 projects into the ground piling up soil and debris ahead of the scraper which is engaged by the flights of the conveyor 18, causing the material to be transported upwardly and rearwardly for deposit in the scraper bowl, the elevator being so constructed that the material tends to collect in the rear portion of the bowl. During the scraping and accumulation, the actuator 60 is in its contracted state in which the pivot points 64 and 67 on the ejector plate and lever respectively are drawn into close proximity so that the plate is fully retracted and the floor section 36 is fully extended to close the discharge opening 70.

When an adequate load has been accumulated, fluid pressure is applied to the actuator 17 to contract it to raise the blade out of contact with the ground, and the vehicle is driven to a receiving area. There the actuator 60 is pressurized by application of fluid to the rear end by a suitable valve (not shown) causing the actuator to expand. Because of the large amount of resistance provided by the load in the bowl, the ejector plate 28 is, during the initial expansion of the actuator, relatively immobile so that the upper pivot 51 acts as a fixed fulcrum for swinging of the lever 50 rearwardly away from the

plate. This causes the pivot **53**, at the lower end of the lever, to pull the floor link **38** rearwardly, resulting in rearward sliding movement of the floor section **36** to uncover the opening, indicated at **70**. Such movement continues until the floor section strikes the fixed stop **37**. The material in the bowl is thus free to begin its escape and as it does so it is spread, by reason of the forward movement of the scraper, to an even depth **71** determined by the height, above the ground, of the forward edge of the floor section.

After the floor section **36** strikes the stop **37**, no further movement of the floor section can occur so that the pivot **53** at the bottom end of the floating lever becomes fixed as far as rearward movement is concerned. Thereafter as pressure fluid is additionally fed to the rear end of the actuator, the floating lever **50** continues to be forceably swung, or scissored, away from the ejector plate. The ejector plate must maintain its generally vertical orientation because of the action of the rollers and rails **31–34**. The rigid arm **34a**, which supports the roller **34** against the rail **32** has a high bracing moment to maintain the ejector plate in its generally vertical position and to resist any tendency toward toppling in the face of applied thrust. Consequently if the angle of the floating lever about the pivot **51** is to change, the lower pivot **53** being blocked against further rearward movement by the stop **37**, the entire floating lever and actuator assembly has no alternative except to crowd forwardly against the ejector plate **28**. The guided translatory movement of the plate with respect to the scraper bowl **19** causes progressive discharge of the remaining material through the opening **70**, for deposit to a depth **71**, until, at the end of the stroke, the ejector plate occupies its full forward position, with the bowl empty, as shown in FIG. **4**.

In picturing the operation it may be seen that the lever, ejector plate, and actuator in the present embodiment are in an "A" configuration, with the lever and edge profile of the plate forming the sides of the "A" and with the actuator occupying the "cross bar" position. Expansion of the actuator serves to vary the angle at the apex of the "A," widening it during the power stroke. The left hand side of the "A" is connected, at its foot, to the floor link.

During the first portion of the power stroke the apex of the "A" remains relatively fixed so that the increase of the apex angle tensions the floor link to uncover the discharge opening. But when the stop **37** is engaged, the "A" can no longer expand rearwardly but must expand forwardly against the contained load. It is this expansion which results in dumping.

It is to be noted that while the lower end of the lever **50** is blocked against continued rearward movement by reason of bottoming engagement of the stop **37**, the link **38**, being pivoted to the floor section, is free to swing upwardly to accommodate the swinging movement of the lever **50** as the lever is rocked into near-horizontal position. Although stop **37** is shown for simplicity of understanding, any suitable stop capable of limiting the rearward movement of link **38** without inhibiting its upward swing may be used.

After the material has been distributed and the bowl is empty, the pressure on the actuator is reversed causing it to contract to swing the lever **50** forwardly and downwardly about the upper pivot **51**. This causes both the ejector plate and the movable floor to be restored into the position shown in FIG. **2**. It is however, immaterial whether the floor is restored first or the ejector plate is restored first or, indeed, whether the two members complete part of the return movement at the same time, since the relative forces will depend upon the minor variations in the disclosed geometry, including the angling of link **38** (FIG. **4**), the relative friction, and whether the bowl is fully upraised or bumping along the ground. Where the floor offers the lesser resistance to return movement, contraction of the actuator will cause the movable floor to move into its forward limit position enclosing the opening **70** thereby blocking the lower end of the lever **50** against further forward movement as shown in FIG. **5**. As the actuator continues to contract the ejector plate is pulled backwardly into its rearmost position closely adjacent lever **50** to restore the elements to the normal position shown in FIG. **2**. Restoration is accomplished very quickly so that the scraper is immediately freed to take on another load.

It will be apparent that while the desirability of sequential action has been recognized in the past, the mechanism described above for bringing this about is distinguished by extreme simplicity, requiring in addition to the actuator, only a connecting link and a single lever which insures positive sequencing on the discharge stroke with efficient application of forces and using an actuator no larger than the actuators employed in prior, more complex systems. The arrangement is inherently durable and the linkage occupies a closely nested and hence protected position with respect to the ejector plate during the scraping operation. Maintenance is reduced to a minimum.

While the invention has been described in connection with a preferred embodiment in which an actuator, arranged generally horizontally, is interposed between the center portion of the lever and the back of the ejector plate, it will be understood by one skilled in the art that this mode of connection of the actuator is not essential to the invention in its broader aspect and that the actuator may be mounted on the ejector plate and coupled to the lever in any way which will produce a high-torque rearward swing of the lever about pivot **51** away from the plate toward a horizontal position in the discharge mode, with movement of the parts in the opposite direction in the return mode.

The term "ejector plate" as used herein refers to any member presenting an area against the accumulated material and which is moveable to thrust the material to a region of discharge regardless of its shape or degree of flatness. The term "actuator" while specifically described in terms of an hydraulic cylinder or ram, is intended to include any motor capable of producing a powerful and reasonably rapid thrust in opposite directions. The terms "expand" and "contract" are relative terms to denote motion in opposite directions.

What is claimed is:

1. In a scraper type of earthmoving machine, the combination comprising

a bowl having a scraper blade along its forward edge and a vertically articulated draft frame for connecting the bowl to a tractive vehicle,

said bowl having vertical side walls and a transversely extending horizontal floor section along the rear portion thereof,

a vertical ejector plate extending between the side walls and occupying a normal retracted position in which the ejector plate forms the back of the bowl for containment of material,

means for guiding the ejector plate for horizontal reciprocating movement,

a movable transversely extending floor section mounted on the bowl for horizontal reciprocating movement between a normal forward position in which the floor of the bowl is substantially completely enclosed and a rearward limit position for uncovering a bottom discharge opening,

a rearwardly extending floor link pinned to the movable floor section,

a vertically extending lever arranged in a position behind the ejector plate,

A bracket on the ejector plate pivotally connected to the upper end of the lever,

the rear end of the floor link being pinned to the lower end of the lever,

a fluid actuator having two portions including a cylinder and piston, the actuator occupying a generally horizontal position behind the ejector plate with one portion of the actuator being pivotally connected to the central portion of the lever and the other portion of the actuator being pivotally connected to the ejector plate at a position below the bracket so that when the actuator expands the lever is swung rearwardly from the ejector plate, with the material in the bowl causing the ejector plate to remain

relatively stationary with the result that the movable floor section is pulled to its retracted position to uncover the discharge opening,

the floor member having a limit stop effectively interposed in the path of opening movement for blocking the lower end of the lever against continued rearward movement so that continued expansion of the actuator and continued rearward swing of the lever with respect to the ejector plate causes forward movement of the ejector plate relative to the bowl with progressive discharge of the material through the opening.

2. In a scraper type of earthmoving machine, the combination comprising

a bowl having a scraper blade along its forward edge and a vertically articulated draft frame for connecting the bowl to a tractive vehicle,

said bowl having vertical side walls and a transversely extending horizontal floor section fixed along the rear portion thereof,

a generally vertical ejector plate extending between the side walls and occupying a normal retracted position in which the ejector plate forms the back of the bowl for containment of material,

means for guiding the ejector plate for horizontal reciprocating movement,

a movable transversely extending floor section mounted on the bowl for horizontal reciprocating movement between a normal forward position in which the floor of the bowl is substantially completely enclosed and a rearward limit position for uncovering a bottom discharge opening,

a rearwardly extending floor link connected to the movable floor section,

a vertically arranged lever pivoted to the back surface of the ejector plate and extending downwardly for pivoted connection to the rear end of the floor link,

and an actuator mounted on the ejector plate and coupled to the lever for swinging the lever toward and away from the ejector plate so that when the lever is swung way from the ejector plate with material in the bowl the ejector plate remains relatively stationary with the initial result that the movable floor section is pulled to its retracted position to uncover the discharge opening, the movable floor section having a limit stop effectively interposed in the path of opening movement for blocking the lower end of the lever against continued rearward movement so that continued rearward swing of the lever with respect to the ejector plate causes forward movement of the ejector plate relative to the bowl with progressive discharge of the material through the opening.

3. The combination as claimed in claim 2 in which the guiding means includes horizontal rails on the bowl horizontally offset from one another and cooperating rollers mounted on the ejector plate and in which the ejector plate has a rigid, rearwardly projecting arm for supporting one of the rollers.

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