Sept. 23, 1958 T. O. DAVIDSON ET AL 2,853,201

DOUBLE-ACTING HYDRAULIC DIRT EJECTOR

Filed Oct. 15, 1953 3 Sheets-Sheet 1

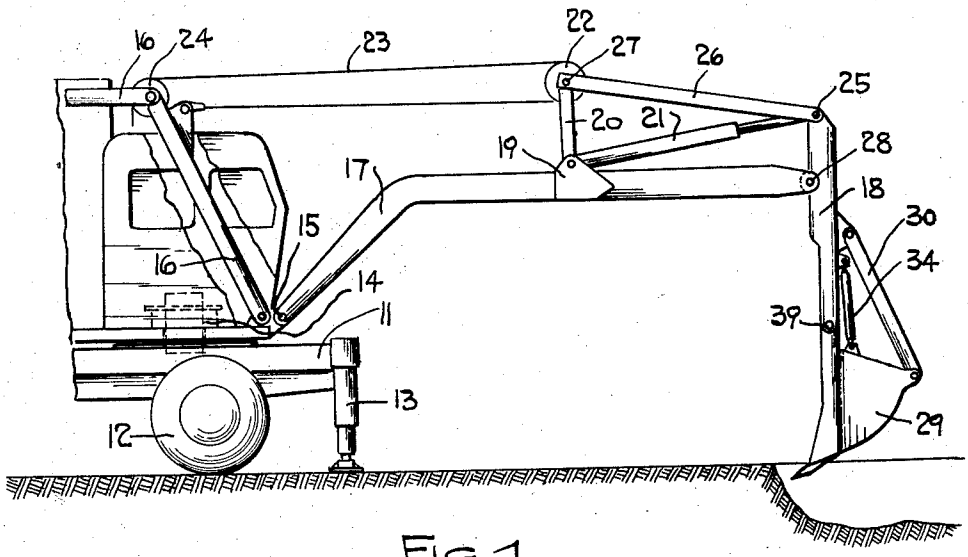


FIG. 1.

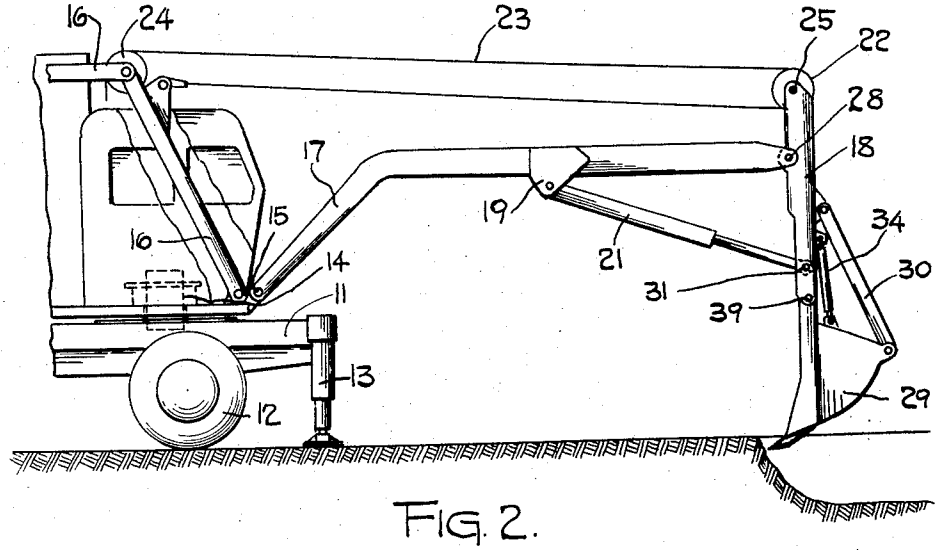


FIG. 2.

INVENTORS,
TREVOR O. DAVIDSON,
JAMES E. ROCHE,
BY
Roger Sherman Hoar
ATTORNEY.

Sept. 23, 1958 T. O. DAVIDSON ET AL 2,853,201

DOUBLE-ACTING HYDRAULIC DIRT EJECTOR

Filed Oct. 15, 1953 3 Sheets-Sheet 2

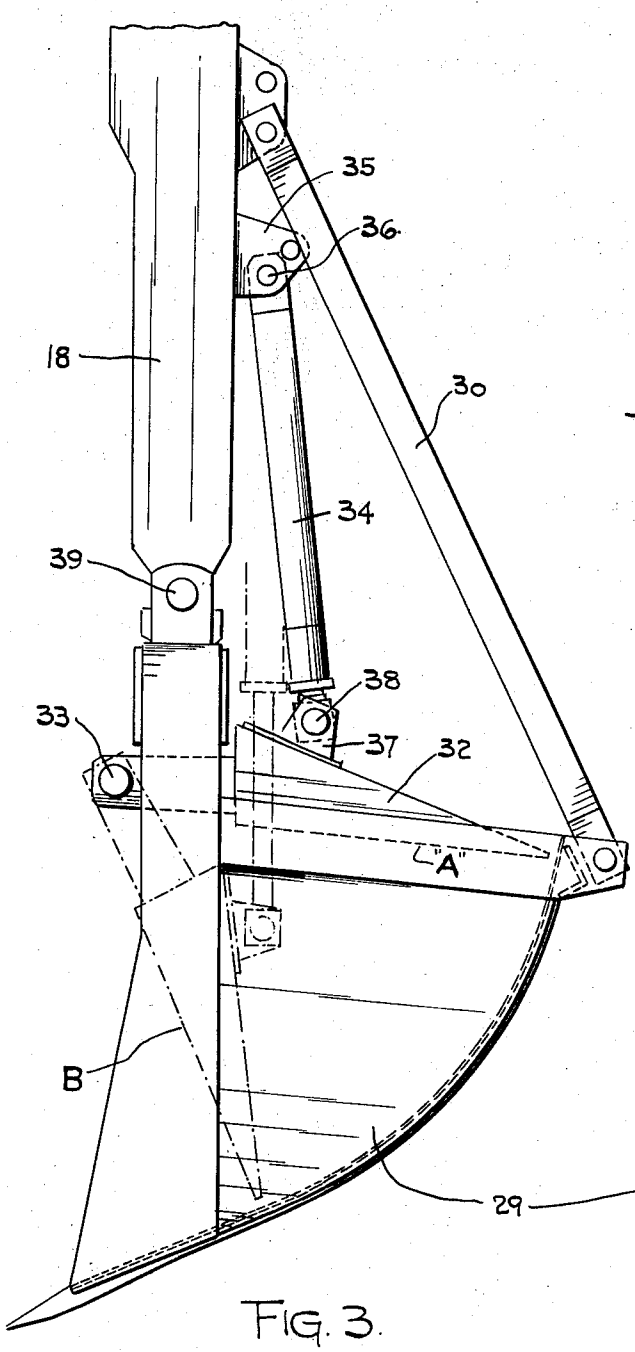
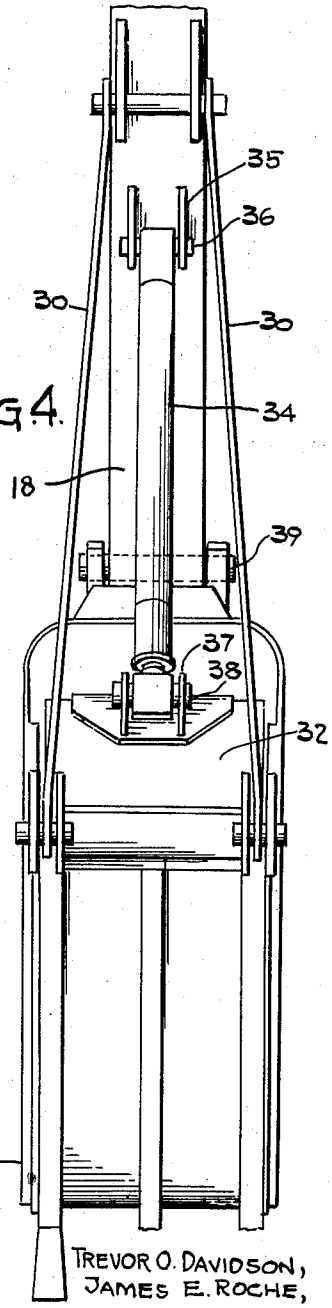


FIG. 3.

FIG. 4.



TREVOR O. DAVIDSON,
JAMES E. ROCHE,
INVENTORS

BY Roger Sherman Hoar

ATTORNEY.

Sept. 23, 1958 T. O. DAVIDSON ET AL 2,853,201

DOUBLE-ACTING HYDRAULIC DIRT EJECTOR

Filed Oct. 15, 1953 3 Sheets-Sheet 3

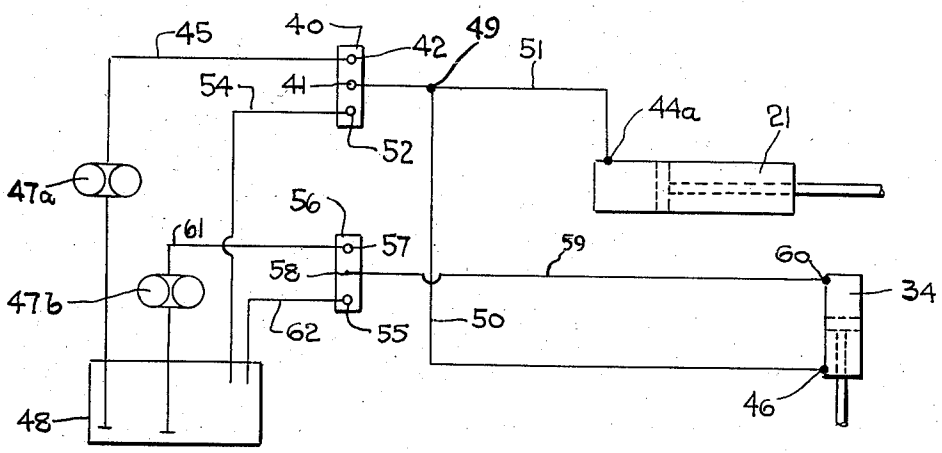


FIG. 5

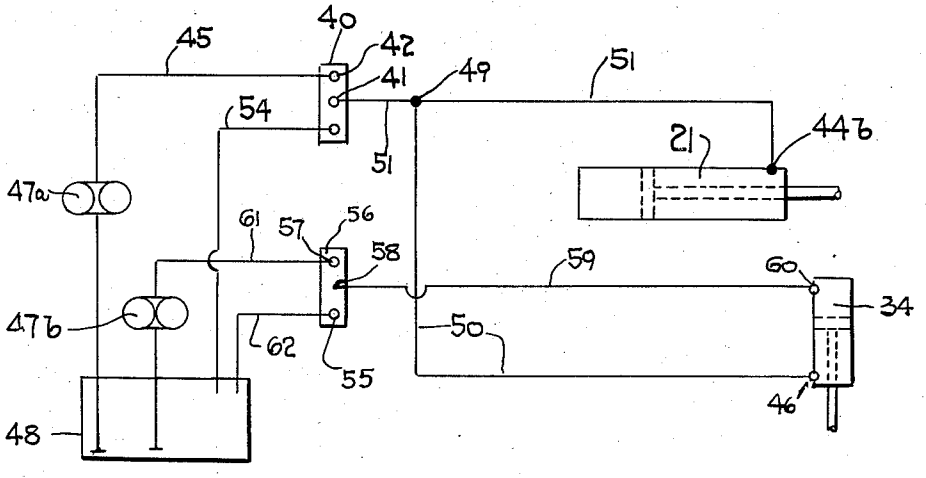


FIG. 6.

TREVOR O. DAVIDSON,
JAMES E. ROCHE,
INVENTORS.

BY Ryan Sherman Hoar

ATTORNEY.

United States Patent Office

2,853,201

Patented Sept. 23, 1958

2,853,201

DOUBLE-ACTING HYDRAULIC DIRT EJECTOR

Trevor O. Davidson and James E. Roche, Milwaukee, Wis., assignors to Bucyrus-Erie Company, South Milwaukee, Wis., a corporation of Delaware

Application October 15, 1953, Serial No. 386,195

8 Claims. (Cl. 214—510)

This invention relates to new and useful improvements in backhoe-type excavators and more particularly to an hydraulic dirt ejector to be used on the dipper thereof.

Hydraulic backhoe-type excavators are generally used for ditching and trenching operations. They are desirable for digging narrow, shallow trenches, but the machine cannot dig a trench more narrow than the narrowest feasible dipper-width. The narrower the dipper, the more difficulty is encountered in emptying the dirt from the dipper; especially when the dirt is sticky and wet, such as wet clay, gumbo, and the like.

In the prior art, narrow dippers have been utilized for trenching and the difficulty of dumping the dirt from the dipper has been overcome by using a dirt ejector, consisting of a plate structure on the inside of the dipper constructed in such a manner so as to be pivoted at the open upper end of the dipper so that, when moved, it will sweep through the dipper cavity to eject the dirt therefrom. Heretofore, this ejector has been power-actuated in its positive motion for dumping and cleaning out the dipper, and then returned to its normal digging position by a spring. This spring-return has proved insufficient, in that dirt, stones, and debris have backed up behind the ejector plate, resulting in jamming the ejector in the dumping position preventing its return to the retracted or digging position. Thus, digging must be interrupted by stopping the machine and manually cleaning the bucket.

It is the general object of this invention to provide an efficient hydraulic ejector for a power-backhoe that will return itself automatically by power means to the digging position after dumping the dipper but before the dipper is to be reloaded. It will be seen that this is achieved in this invention by a double-acting hydraulic cylinder-piston assembly interconnected into the hydraulic circuit of the digging ram hydraulic cylinder-piston assembly so that the resistance differential between these assemblies will normally allow return of the ejector to the retracted position before digging another dipper full of material.

A further object of this invention is to utilize the hydraulic pressure of the main hydraulic system of the excavator to return the ejector to the retracted position, but to utilize an auxiliary hydraulic source to supply power to operate the ejector in its positive or dumping movement so that the ejector may be selectively used or not used whichever the need may be.

A still further object is to interconnect the retract end of the double-acting hydraulic cylinder-piston assembly connected to the ejector with the hydraulic cylinder-piston assembly furnishing the digging force so as to reduce the number of conduits necessary and eliminate unnecessary wear and duplication of parts.

A still further object is to eliminate the loaded spring ejector return and thus reduce the size of the hydraulic cylinder-piston assembly used on the ejector. This is made possible by the fact that this cylinder-piston assembly does not have to overcome the force of a spring while ejecting the dirt from the dipper.

In addition to the objects stated above, a number of novel and useful details have been worked out, which will be evident as the description progresses.

This invention consists in the novel parts, and in the combination and arrangement thereof, which are defined in the appendant claims, and of which two forms are exemplified in the accompanying drawings, which are hereinafter particularly described and explained.

Throughout the description, the same reference number is applied to the same improvement or to similar improvements.

Figure 1 is a side elevation of an hydraulic backhoe-type excavator, showing the digging ram located on the top of the boom.

Figure 2 is a side elevation of the same type excavator, except that the digging ram is shown as located on the bottom of the boom and further, that the dipper sheave is fastened directly to the dipper handle.

Figure 3 is an enlarged side elevation of the dipper of Figures 1 and 2, showing the ejector and double-acting hydraulic ejector ram.

Figure 4 is a rear elevation of the dipper and ejector shown in Figure 3.

Figure 5 is a schematic diagram of the hydraulic system showing the interconnection of the hydraulic conduits of the digging ram and the double-acting ejector ram for the first embodiment of this invention corresponding to Figure 1.

Figure 6 is a schematic diagram of the hydraulic system showing the interconnection of the hydraulic conduits of the digging ram and the double-acting ejector ram for the second embodiment of this invention corresponding to Figure 2.

Referring now to the figures, and more particularly to Figures 1 and 2, we find that **11** is the main frame of the excavator (shown in outline only), **12** is the nearer one of the two rear wheels of a conventional mounting for this type excavator, and **13** is the nearer of the two out-rigger ground-supports which act to stabilize the excavator mounting while the excavator is in use. The upper works is connected to the lower works by a pintle **14** so that the upper works may rotate with respect to the lower works. An A-frame **16** comprises a part of the upper works, and the boom **17** is pivotally connected at its inner end to the front end of the upper works, by transverse horizontal pin **15**. The dipper handle **18** is pivoted at the outer end of boom **17**, by transverse horizontal pin **28**. The description thus far applies to both Figures 1 and 2.

Turning now to Figure 1, we find that linkage **20** is fastened at one of its ends to boom **17** midway along its span by a brace plate **19**. The other end of linkage **20** has a sheave **22** rotatably connected thereto. One end of cable **23** is fastened to the A-frame **16** at a dead-end connection, then passes around sheave **22**, then around the A-frame sheave **24**, and is spooled onto the excavator winch (not shown).

The hydraulic digging cylinder-piston assembly **21** is pivotally connected at its cylinder end to brace plate **19** and the ram and is pin-connected to the upper end of the dipper-handle **18** by pin **25**. Linkage **26** is also pin-connected by pin **25** at one end, and its other end is pin-connected to sheave **22** and to one end of linkage **20** by pin **27**.

The dipper-handle **18** rotates about the outer end of boom **17** on pin **28**. The dipper **29** is fastened at the lower end of the dipper-handle **18** by a pin **39** and braces **30**, so that the dipper may be easily removed from the dipper-handle. Inasmuch as, in the present invention, the handle and dipper operate together, they will be treated

in the claims to some extent as a single integral instrumentality, sometimes referred to as the "handle-dipper assembly."

In Figure 1, tension in cable **23** due to winding-in the cable or to the weight of the boom or both will, if hydraulic fluid is free to flow out of the hydraulic digging cylinder, tend to rotate the dipper-handle **18** counterclockwise and the digging cylinder-piston assembly **21** will retract (piston will move to the left in Figure 1).

If cylinder-piston assembly **21** is locked against retraction and cable **23** is wound-in by the winch, the boom will be raised about its pivotal connection at the front end of the upper works. Similarly, if the assembly is locked against retraction and the winch pays-out cable **23**, the boom **17** will be lowered.

When the cylinder-piston assembly **21** is extended by introducing pressure fluid into the assembly, the dipper-handle will rotate clockwise (Figure 1) and if the cable **23** is held fixed the boom **17** will be raised slightly.

The combination of the hydraulic digging cylinder-piston assembly and the winch comprises the means for moving the dipper through its various cycles.

Figure 2 shows an alternative form of excavator. The two forms of the machine are identical with the following exceptions. In Figure 2, the linkages **20** and **26** are eliminated and sheave **22** is fastened directly to the upper end of the dipper-handle at pin-connection **25**. The hydraulic digging cylinder-piston assembly **21** is shifted from the top of the boom to the bottom of the boom, so that it is fastened at one of its ends to brace plate **19** on the bottom of the boom and the other end is fastened to the dipper handle **18** by pin-connection **31** at a point below the dipper-handle pivot-pin **28** and preferably near the lower end of the dipper-handle.

In Figure 2, tension in cable **23** due to winding-in the the cable or to the weight of the boom or both, when the digging cylinder-piston assembly **21** is free to extend, will cause the dipper-handle **18** to rotate counterclockwise. If the cylinder-piston assembly is locked or fully extended winding-in the cable **23** will raise the boom.

In Figure 1, the digging force is applied when the hydraulic digging cylinder-piston assembly **21** extends whereas in Figure 2, the digging force is applied when the hydraulic digging cylinder-piston assembly **21** contracts.

Now turning to Figures 3 and 4, we find the details of dipper **29** and dirt-ejector **32**.

Dipper **29** has a movable wall **32** (hereinafter called the dirt-ejector), pivoted about hinge **33** at its open upper end. This dirt-ejector when swung about hinge **33** (from position A to position B in Figure 3) will sweep through the cavity of the dipper and clean out the contents. The ejector may then be swung back to the retracted or full-dipper position (position A in Figure 3). The ejector is moved about its axis (on hinge **33**) by the double-acting ejector cylinder-piston assembly **34**. One end of the hydraulic ejector cylinder-piston assembly **34** is connected by pin **36** to a bracket **35** which is part of the dipper-handle **18**. The other end of cylinder-piston assembly **34** is connected by pin **38** to bracket **37** which is part of the back face of the dirt-ejector **32**.

The hydraulic diagram shown by Figure 5 corresponds to the showing of Figure 1. From Figure 5, we find that **48** is the main fluid tank and pump **47***a* is the main source of pressure for the excavator hydraulic system. A fluid conduit extends from the main tank to the inlet of pump **47***a* to furnish fluid to the pump. **40** is a three-position hydraulic selector valve as shown. By three-position valve is meant that the valve has three setting positions, namely: (1) a "power-on" position whereby pressure-fluid flows through the valve and into the cylinder-piston assembly, thereby furnishing it with power; (2) a "hold" position which prevents fluid from either entering or leaving the cylinder; and (3) "exhaust" position, whereby fluid will flow from the cylinder back into the main reservoir. A fluid conduit **45** extends from the main pump to selector valve **40**. Selector valve **40** is connected to port **44***a* on the hydraulic digging cylinder-piston assembly **21** and to port **46** on ejector cylinder-piston assembly **34** by fluid conduits **51** and **50**, conduit **50** being T-connected to conduit **51** at some convenient point **49** intermediate its ends. An exhaust conduit **54** extends from valve **40** to the main tank **48**.

A fluid conduit extends from the main tank to an auxiliary source of hydraulic fluid pressure, pump **47***b*, which furnishes power to move the dirt-ejector to dump the dipper. An alternative arrangement could easily be contrived, whereby pump **47***a* could furnish pressure for the purposes stated herein as served by pumps **47***a* and **47***b*. A fluid conduit **61** extends from the auxiliary pump **47***b* to a second selector valve **56**. Selector valve **56** is a two-position hydraulic-selector valve as shown. By two-position valve is meant that the valve has two setting positions, namely: (1) a "power-on" position whereby pressure fluid flows through the valve and into the cylinder-piston assembly, thereby furnishing it with power, and (2) an "exhaust" position, whereby fluid will flow from the cylinder back into the main reservoir. Selector valve **56** is connected to port **60** on the hydraulic-ejector cylinder-piston assembly **34** by fluid conduit **59**. An exhaust conduit **62** extends from selector valve **56** to main tank **48**.

When it is desired to dig, selector valve **56** is set to the "exhaust" setting which connects port **58** with port **55**, and selector valve **40** is set to the "power-on" setting, which connects port **42** with port **41**, said settings being made in that order. Pump **47***a* supplies pressure fluid through conduit **45** into port **42**, then into port **41**, and through conduit **51**. Conduit **50** connects to port **46** on the cylinder of ejector cylinder-piston assembly **34** and conduit **51** connects to port **44***a* on the cylinder of digging cylinder-piston assembly **21**. If the dirt-ejector **32** is not in the fully-retracted position, the pressure-fluid will first cause the ram of cylinder-piston assembly **34** to move to the fully-retracted position, due to the fact that the piston of this cylinder will normally offer less resistance in this position than the piston of the digging cylinder-piston assembly **21**. As pressure fluid enters port **45**, cylinder-piston assembly **34** retracts. Fluid is exhausted through port **60** of cylinder-piston assembly **34**, through conduit **59**, into selector valve **56** at port **58**. Thus, exhaust fluid flows from port **58** into port **55**, through conduit **62** into main fluid tank **48**. After the ejector ram has been fully retracted (position A in Figure 3), pressure-fluid from the pump will flow only through conduit **51** and into port **44***a*, thus moving the piston of the digging cylinder-piston assembly **21** causing the assembly to extend and rotate the dipper-handle clockwise (Figure 1). By this arrangement, whenever selector valves **40** and **56** are thus set, hydraulic power will be furnished to the hydraulic digging cylinder-piston assembly **21** to dig, and the dirt-ejector **32** will always be first returned to the fully-retracted or digging position (position A in Figure 3) before pressure fluid is supplied to the cylinder of the digging cylinder-piston assembly **21** for digging.

Return of the ejector and dumping of the dipper are produced with the above-described hydraulic circuits by the action of gravity. When selector-valve **40** is in the "hold" position so that fluid-port **52** is blocked off, the weight of the boom will tend to retract cylinder-piston assembly **21** (Figure 1) thereby setting up fluid pressure in circuits **51** and **50**. Then if selector valve **56** is in the "exhaust" position, pressure fluid will flow from conduit **51** through connection **49**, through conduit **50** and through port **46** of cylinder **34** causing said cylinder to retract and thereby return the ejector. Return fluid from cylinder **34** flows from port **60** through conduit **59** through ports **58** and **55** through conduit **62** into tank **48**. When selector valve **40** is set in the "exhaust" position so that fluid from piston **21** will flow through conduit **51** through ports **41** and **52** through conduits **54** into tank **48**, the

weight of the boom will retract cylinder-piston assembly **21**, and the handle-dipper assembly will rotate anticlockwise about pivot pin **28**. Thus it can be seen that by making use of the potential energy of the boom in its raised position, dumping of the dipper and return of the ejector are accomplished. This has the advantage that both digging and dumping are produced with one single-acting hydraulic cylinder having one hydraulic pressure-fluid connection, and ejection and return of the ejector are also both produced by a single hydraulic cylinder.

After the dipper has taken a cut of earth, the boom is raised under power of the winch and the upper works is swung on pintle **14** by conventional means to a dumping position. One method of raising the boom is to set the selector valve **40** in the hold position. This will lock the fluid in cylinder-piston assembly **21** and prevent the dipper handle from rotating. The winch is then actuated to haul-in on cable **23**, thus raising the boom. Also, the boom may be raised while cylinder-piston assembly **21** is being extended. This is done by winding-in cable **23** on the winch.

Tension in cable **23** due to the weight of the boom will cause the handle-dipper assembly (Figure 1) to rotate anticlockwise into a dumping position when selector valve **40** is set to connect port **41** to port **52**, so that the fluid in the digging ram cylinder may exhaust back through selector valve **40**, through conduit **54** into main fluid tank **48** to allow the digging cylinder-piston assembly **21** to retract, i. e., piston moves to the left in Figure 5.

When it is desired to dump dirt from the dipper **29** by use of the ejector **32**, selector valve **56** is then set to the "power-on" setting so that port **57** is connected with port **58**. This causes pressure-fluid from pump **47***b* to flow through conduit **61** into port **57**, to port **58**, and through conduit **59** into port **60** of the double-acting ejector cylinder-piston assembly **34**, and thus cause the ram to extend downward and pivot dirt-ejector **32** about its axis (at hinge **33**) to the dipper-emptying position (position B in Figure 3); which will dump and clean the dipper cavity. The fluid on the exhaust side (lower side in Figure 5) of the cylinder of ejector cylinder-piston assembly **34** will flow out through port **46**, then through conduit **50**, through joint **49** into conduit **51**.

If the piston of digging cylinder-piston assembly **21** is not fully extended the selector valve **40** will generally be set to the "hold" position. This will control the dipper-handle, whereby the position of the handle in relation to the boom will remain unchanged after valve **40** is set in the "hold" position. The exhaust fluid from assembly **34** will exhaust through conduit **51**, through port **44***a*, and into cylinder-piston assembly **21**. This will cause the ram of assembly **21** to extend slightly; since the area of the rod end of the piston of ejector cylinder-piston assembly **34** is small in comparison to the area of the piston of assembly **21**, such extension will not be objectionable as it is very small. If it is desirable to release the dipper-handle so that it will be free to rotate about its pin **28** on the boom, then the selector valve **40** may be set to the "exhaust" setting by connecting port **41** to port **52** and thus exhaust fluid from the cylinder of ejector cylinder-piston assembly **34** and exhaust fluid from the cylinder of the digging cylinder-piston assembly **21** will flow from port **41** into port **52** on valve **40**, through conduit **54**, and into the main fluid tank **48**.

The combined effect of the two alternative settings of selector valve **40** (described above), i. e., (*a*) set in the "hold" position, or (*b*) set in the "exhaust" position, may be achieved through "cracking" valve **40**. By "cracking" valve **40** is meant to set it to the "hold" position, then momentarily set it in the "exhaust" position, and then move it back to the "hold" position. By doing this the dipper-handle position can be maintained in a relatively-fixed position, and through "cracking" valve **40**, a certain amount of exhaust fluid in conduit **51** will be allowed to flow back to the main tank. This method of control is desirable when the ram of cylinder-piston assembly **21** is fully extended or almost fully extended.

The hydraulic diagram shown in Figure 6 corresponds to the second embodiment of this invention as shown by Figure 2. The diagram of this Figure 6 is the same as Figure 5 except as follows. Port **44***b* is located at the opposite end of the cylinder of digging cylinder-piston assembly **21**, as compared to port **44***a* of Figure 5, so that when pressure fluid flows through conduit **51** from pump **47***a*, the digging cylinder-piston assembly will retract (piston will move towards the upper works in Figure 2) instead of expand (piston moving away from the upper works in Figure 1). The flow of fluid and the control valve settings are the same for both Figures 5 and 6.

Having now described and illustrated two forms of this invention, let it be understood that this invention is not to be limited to the specific form or arrangement of parts hereinbefore described, except insofar as such limitations are specified in the appendant claims.

The number of positions recited in the claims for any valve, is to be considered as the necessary and sufficient number of positions, and to include valves having a greater number of positions for any additional functions which may be desired.

The best mode contemplated by the inventor for carrying out the invention is that shown in Figures 1, 3, 4, and 5.

We claim:

1. In an hydraulically-operated excavator, having: a main frame; a boom having its foot pivotally supported by the main frame; a handle-dipper assembly, comprising a handle and a digging-dipper secured to the lower end of the handle; a pivotal connection between the outer end of the boom and the handle; first power means, connected to a portion, remote from said pivotal connection, of the handle-dipper assembly and to the main frame, for raising and supporting the boom; and second power means, hydraulically connecting the handle-dipper assembly to the boom, for swinging the assembly about its pivotal connection on the boom in a direction to cause the dipper to dig; the combination therewith of: an ejector, associated with the digging-dipper; means shiftably connecting the ejector to the handle-dipper assembly; third power means reversible hydraulic, for shifting the ejector alternatively to eject dirt and to retract the ejector; hydraulic fluid pressure source means; hydraulic circuit means connecting the pressure-source means to the two hydraulic power means; control means, interposed in said circuit means to provide or block at will communication between said pressure-source means and said two hydraulic power means; and fluid conduit means interconnecting said two hydraulic power means to produce interaction therebetween in at least one power function of said two hydraulic power means and to actuate the third power means by hydraulic fluid under pressure of the weight of the boom displaced by the second power means.

2. In an hydraulically-operated backhoe excavator, having: a main frame; a boom having its foot pivotally supported by the main frame; a handle-dipper assembly, comprising a handle and a digging-dipper secured to the lower end of the handle; a pivotal connection between the outer end of the boom and the handle; first power means, connecting the handle-dipper assembly to the main frame, for raising the boom; and second power means, hydraulic, connecting the boom and the handle-dipper assembly, for swinging the assembly about its pivotal connection on the boom; the combination therewith of: an ejector, associated with the digging-dipper; means pivotally connecting the ejector to the handle-dipper assembly; third power means reversible hydraulic, connecting the ejector to the handle-dipper assembly, for pivoting the ejector alternatively to eject dirt and to retract the ejector; hydraulic fluid pressure means; hydraulic circuit means connecting the pressure means to the two hydraulic power means to actuate said hydraulic power means; conduit means inter-

connecting the second and third power means, the relative forces of the second and third power means, and the normal relative loads to be moved by each, being such that when the third power means is actuated to retract the ejector, the third power means is normally operated before the second power means; and control means, including a selector valve, for controlling the flow of fluid to each hydraulic power means and to the interconnecting conduit means, interposed in the hydraulic circuit means, for at will either (1) sequentially actuating the third power means to retract the ejector and then actuating the second power means to cause the dipper to approach the main frame, or (2) permitting the second power means to permit the dipper to be swung away from the main frame and permitting the third power means to move the ejector to eject dirt, or (3) preventing both foregoing alternatives and at will either (*a*) actuating the third power means to move the ejector to eject dirt, or (*b*) permitting the third power means to retract the ejector.

3. An hydraulically-operated backhoe excavator according to claim 2, further characterized by the fact that the second power means comprises: a single-acting hydraulic cylinder-piston assembly, expandable under hydraulic pressure; means pivotally connecting one end of said hydraulic cylinder-piston assembly to the boom at a point intermediate the ends of the boom; means connecting the other end of said hydraulic cylinder-piston assembly to a pivotal connection adjacent the upper end of the handle; whereby the expansion of said hydraulic cylinder-piston assembly under hydraulic pressure can swing the handle about its pivotal connection on the boom in a direction to cause the dipper to approach the main frame.

4. An hydraulically-operated backhoe excavator according to claim 2, further characterized by the fact that the second power means comprises: a single-acting hydraulic cylinder-piston assembly, contractable under hydraulic pressure; means pivotally connecting one end of said hydraulic cylinder-piston assembly to the boom at a point intermediate the ends of the boom; means connecting the other end of said hydraulic cylinder-piston assembly to a pivotal connection on the handle-dipper assembly at a point intermediate the pivotal connection of the handle to the boom and the lower end of the handle-dipper assembly, whereby the retraction of said hydraulic cylinder-piston assembly under hydraulic pressure can swing the handle about its pivotal connection on the boom in a direction to cause the dipper to approach the main frame.

5. An hydraulically-operated backhoe excavator according to claim 2, further characterized by the fact that the second power means is an hydraulic cylinder-piston assembly, that its points of connection to the boom and to the handle-dipper assembly are both remote from the pivotal connection of the handle on the boom; and that the control means, hydraulic pressure means and the hydraulic circuit means comprise: a main tank; a fluid-pressure source; fluid conduit means extending from the main tank to the pressure source; a three-position selector-valve; fluid conduit means extending from the pressure source to said selector-valve; fluid conduit means extending from the selector-valve to the main tank; a port on the hydraulic cylinder of the second power means, for the admission of fluid to actuate said power means; a first port on the hydraulic cylinder of the third power means, for the admission of fluid to actuate said power means to retract the ejector; fluid conduit means interconnecting the selector-valve, the port on the second power means, and the first port on the third power means for common control of said second and third power means; and selective means to at will actuate said third power means to cause the ejector to eject dirt.

6. In an hydraulically-operated backhoe excavator having a main frame, a boom pivotally mounted on the main frame, a handle-dipper assembly pivotally connected to the outer end of the boom; a dipper connected to the lower end of the handle-dipper assembly; an ejector shiftably connected to said handle-dipper assembly; the combination of: first power means connecting the main frame to the boom, for raising and lowering the boom; second power means, hydraulic, connecting the handle-dipper assembly to the boom to rotate said assembly about its pivotal connection on the outer end of the boom; third power means, reversible hydraulic, pivotally connected to the handle-dipper assembly and to the ejector for shifting the ejector with respect to the handle-dipper assembly, alternatively to clean the dipper or to retract the ejector; the relative forces of the second and third power means, and the normal relative loads to be moved by each, being such that when the third power means is actuated to retract the ejector, the third power means is normally operated before the second power means; and means interconnecting said second and third power means for common actuation of said second power means sequentially to rotate said assembly and of said third power means to retract the ejector.

7. In an hydraulically-operated backhoe excavator the combination of: a main frame, a boom pivotally supported by the main frame, a handle-dipper assembly pivotally connected to the boom for fore-and-aft jackknife swinging motion with relation thereto; a dipper suspended at the lower end of the handle-dipper assembly; an ejector shiftably connected to the handle-dipper assembly; first power means connected to the main frame and to the boom to raise and lower and support the boom, said first power means including a first cylinder-piston assembly; a second hydraulic cylinder-piston assembly, connecting the handle-dipper assembly to the ejector for shifting the ejector alternatively to eject dirt or to retract the ejector; hydraulic fluid-pressure source means; hydraulic circuit means connecting the fluid-pressure source means to the two cylinder-piston assemblies; control means interposed in the fluid-circuit means to provide or block at will communication between said source means and said first cylinder-piston assembly; fluid connections independent of said control means interconnecting said first and second cylinder-piston assemblies whereby, when the control means blocks communication from said source means to the first cylinder-piston assembly the second cylinder-piston assembly will be actuated by fluid under pressure of the weight of the boom displaced by and passing from the first cylinder-piston assembly to the second cylinder-piston assembly.

8. An hydraulically-operated backhoe excavator according to claim 7, further characterized by the fact that the first hydraulic cylinder-piston assembly is connected to the handle-dipper assembly and to the boom to swing the handle-dipper assembly about its pivotal connection on the boom.

References Cited in the file of this patent

UNITED STATES PATENTS

D. 162,873	Pilch	Apr. 10, 1951
2,418,299	Gorsuch	Apr. 1, 1947
2,613,822	Stanley	Oct. 14, 1952
2,638,237	Struthers et al.	May 12, 1953
2,742,165	Pilch	Apr. 17, 1956