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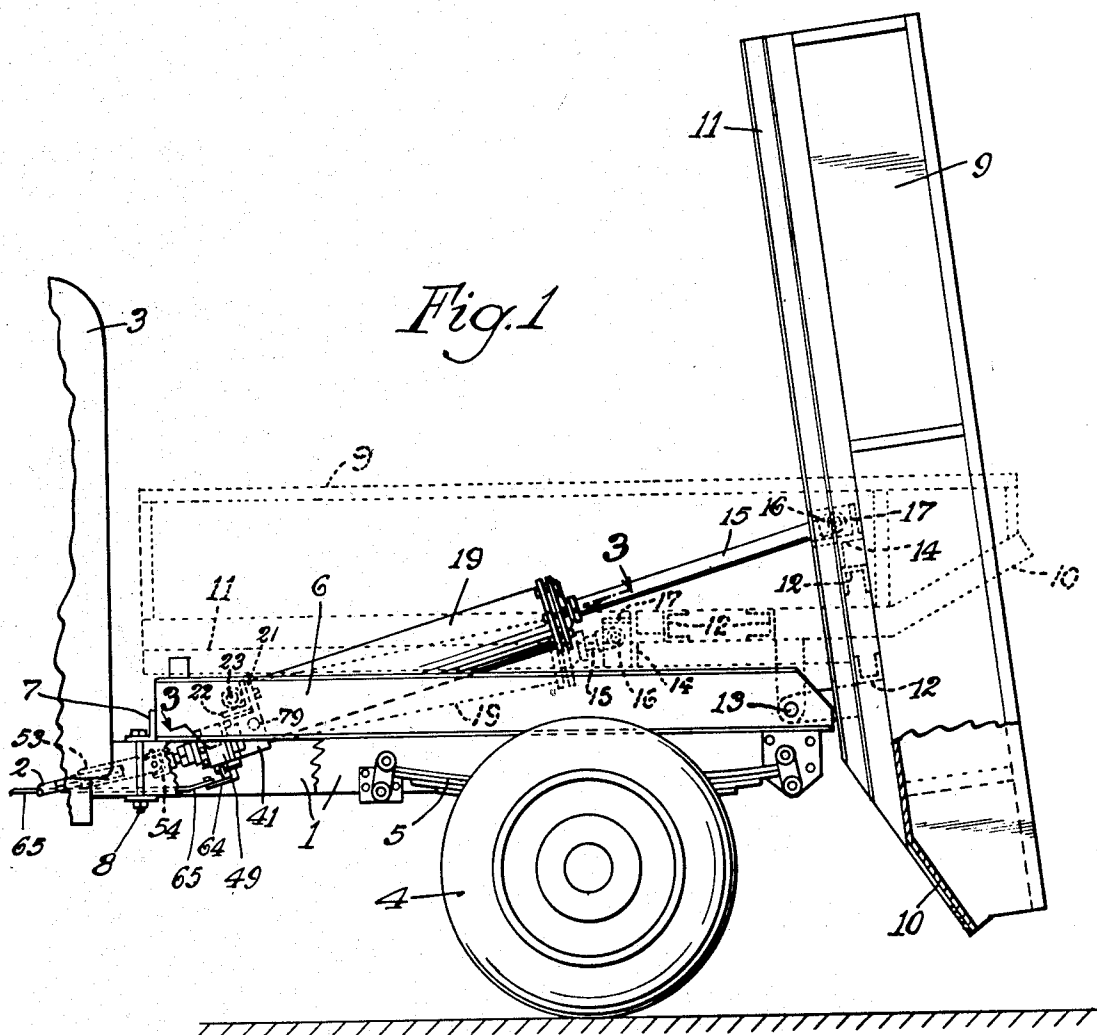
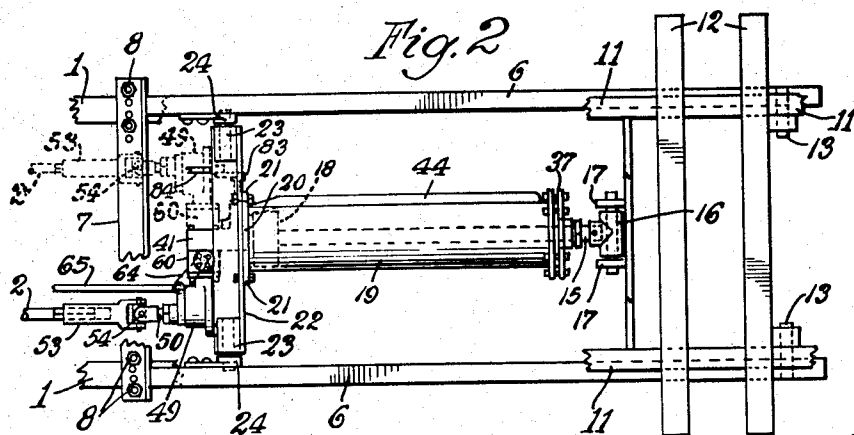
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2,146,166

TIPPING MECHANISM

Filed March 19, 1937

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

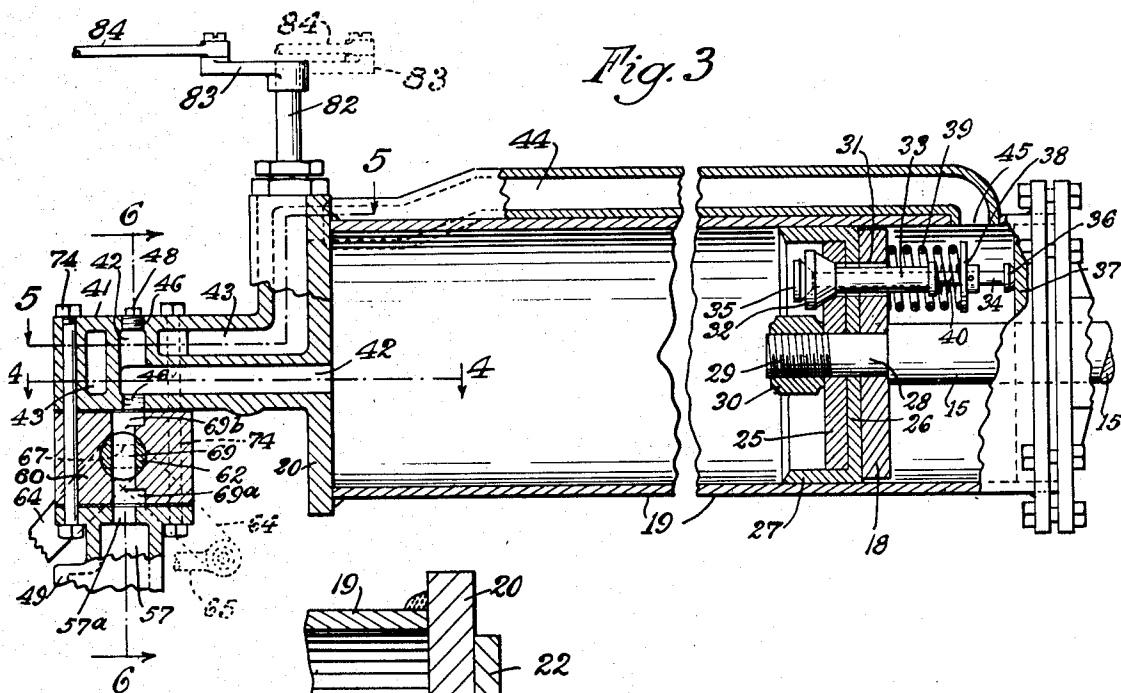
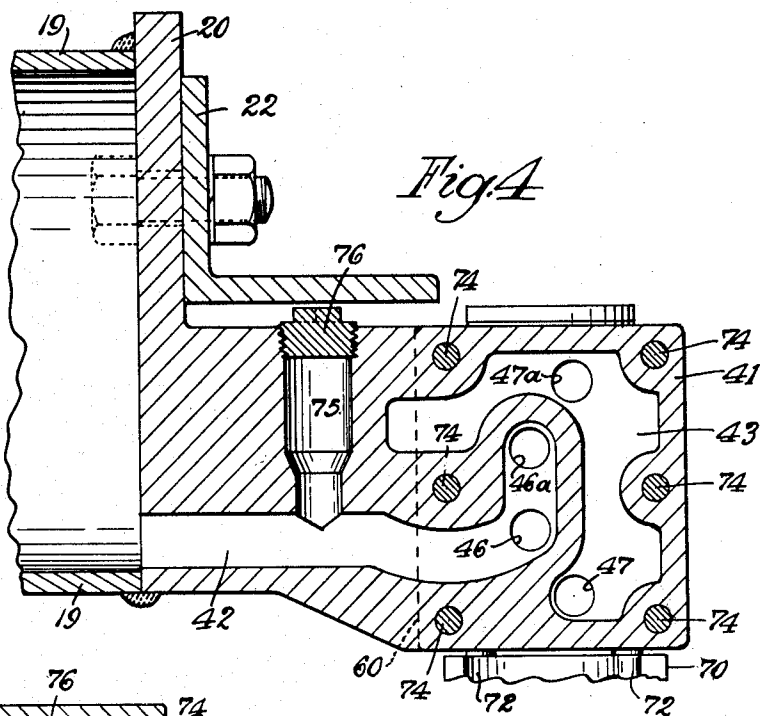
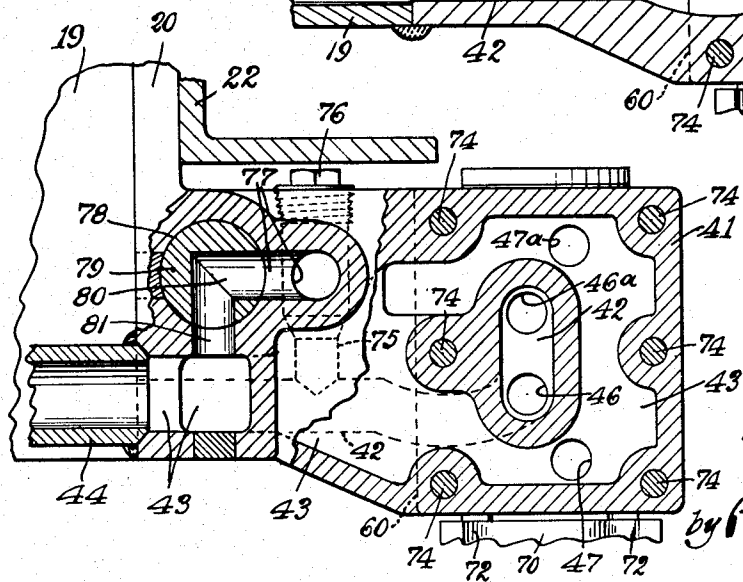


Fig. 5

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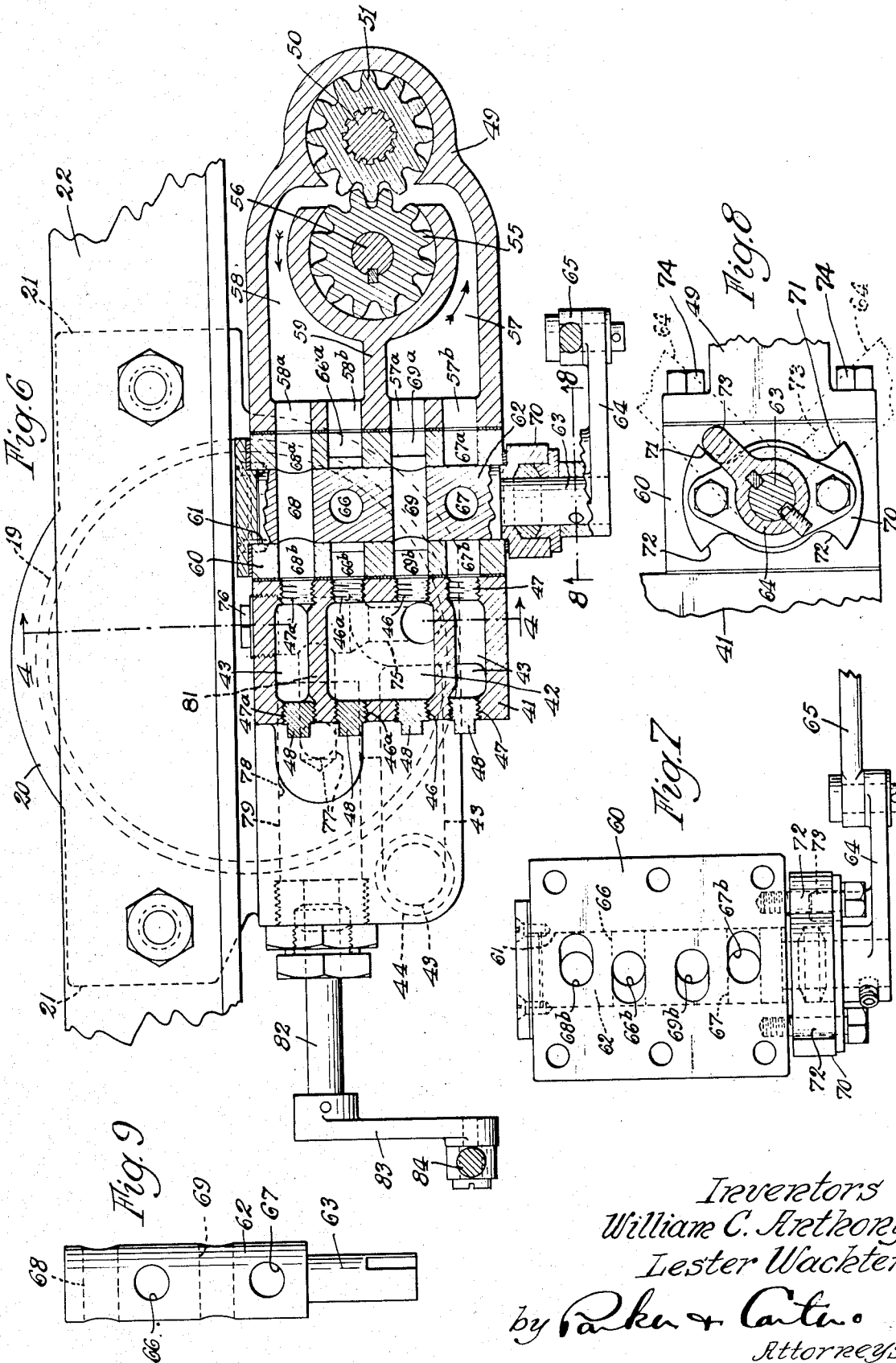
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TIPPING MECHANISM

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,146,166

TIPPING MECHANISM

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10 Claims. (Cl. 60—52)

This invention relates to a tipping mechanism and particularly to a mechanism designed for use in tipping a receptacle. In one form, such as that illustrated herewith, the invention may be embodied in a dumping or tipping truck and comprises means for tipping a body or receptacle mounted on the truck.

One object of the invention is to provide positive means for tipping a truck body and positive means for returning it to the untipped position. Another object is to comprise in a single tipping mechanism means for positively tipping and positively returning the body to its original position. Another object is to provide in connection with a hydraulic tipping mechanism means whereby the hydraulic mechanism is caused to tip the body positively and to return it positively. Another object is to provide in connection with a hydraulic dumping mechanism to which fluid is furnished under pressure by a rotary pump, means for positively reversing the direction of positive action of the tipping means without altering the direction of rotation of said pump.

Other objects will appear from time to time in the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:—

Figure 1 is a side elevation of the body and tipping mechanism in the full dumped position, with parts broken away and parts in section, and with the body and tipping mechanism shown in the undumped position in dotted lines;

Figure 2 is a plan view of the sub-frame with parts broken away;

Figure 3 is a generally horizontal section on an enlarged scale taken at line 3—3 of Figure 1, showing the cylinder and a portion of the control means;

Figure 4 is a longitudinal sectional detail through a portion of the control mechanism taken on an enlarged scale at line 4—4 of Figure 3 but reversed from left to right, with respect to Figure 3. This section also lies on line 4—4 of Figure 6;

Figure 5 is a longitudinal sectional detail taken on an enlarged scale at line 5—5 of Figure 3 but reversed from left to right, with respect to Figure 3;

Figure 6 is a transverse sectional detail taken at line 6—6 of Figure 3 with parts in elevation, the assembly being rotated through an angle of 90° with respect to the position shown in Figure 3;

Figure 7 is an elevational view of the control assembly alone;

Figure 8 is a transverse sectional detail taken at line 8—8 of Figure 6; and

Figure 9 is the control valve shown in elevation as removed from its housing.

Like parts are designated by like characters throughout the specification and drawings.

The invention is shown as mounted on an automotive vehicle although it might be mounted on any other support, stationary or moving. When mounted on an automotive vehicle the engine of that vehicle will ordinarily be used to furnish motive power for operating a source of hydraulic pressure which in the form here shown is preferably a rotary gear pump. The invention is, however, not limited to this particular form of pressure-producing means.

As shown, 1 is the frame of an automotive vehicle such as a truck. Any suitable driving means, usually an internal combustion engine, is provided and this is not shown because its details form no part of the present invention. A power take-off is provided to which a shaft 2 is secured. 3 indicates a cab which may be used if desired. Wheels 4 carried upon suitable running gear, including springs 5, support the frame.

The mechanism of the present invention is preferably supported upon the frame of the truck or other vehicle by means of a sub-frame which includes side frame members 6, a forward frame member 7, adjustably secured to the vehicle frame by bolt assemblies 8. The sub-frame may also include other transverse or cross members, if desired. The dumping receptacle proper may be of any desired shape. As here shown it is an open topped body 9 sloped or inclined at its rear end as at 10. In the particular form here shown the dumping body is supported upon longitudinal frame members 11 and transverse frame members 12, 12. The longitudinal members 11 are hinged or pivoted as at 13, 13 to the sub-frame members 6. An additional transverse member 14 may be mounted on the body 9 or upon any of the frame members which carry it and a piston rod 15 is trunnioned as at 16 to ears or bearing supports 17 secured to the member 14.

As shown, the tipping mechanism includes a hydraulic cylinder and piston assembly. The piston rod 15 has already been mentioned. It carries at its inner end a piston 18, a cylinder 19 has a cylinder head 20, which is provided with an enlargement forming ears 21, 21, which enlargements are bolted or otherwise secured to a transverse frame member 22, which, as here

shown, is in the form of an angle and is trunnioned as at 23 to supports 24 which are themselves secured to the sub-frame members 6. Thus the forward or downward end of the cylinder is given a pivotal support on the sub-frame and the pump and other control parts, which will be described below, move as the cylinder moves up and down.

Returning now to the details of the piston, while these may be varied, a preferred form is shown in detail in Figure 3 and as there shown the piston 18 has associated with it a second plate 25 and between the two is mounted a member 26 which has a flange 27. This may be a leather cup or other suitable means for preventing leakage past the piston. As shown, the piston rod may be reduced as at 28 and threaded as at 29 to receive a nut 30 by means of which the parts mentioned are held in proper assembled position. A perforation 31, preferably passes through the composite piston. A poppet valve 32 carried on a hollow stem 33 is mounted in the perforation 31. Within the hollow of the stem 33 is a second stem 34 carrying a second poppet valve member 35. The stem 34 has a head 36 which may contact the upper or outer cylinder head 37 when the piston approaches the outer limit of its excursion. A collar 38 is mounted on the stem 34. A helical spring 39 is positioned about the stems 33 and 34, bearing at one end against the piston 18 and at the other against the collar 38. It tends to hold the valve assembly closed and yields to permit opening only when sufficient mechanical or hydraulic pressure is applied. A relatively lighter spring 40 is positioned between one end of the hollow stem 33 and the collar 38 and tends to hold the parts in closed position when free to do so.

The cylinder head 20, previously mentioned, preferably includes an extension within which a number of fluid passages are formed. This extension is designated generally by the numeral 41. This extension 41, as shown in generally horizontal section in Figure 3, is so arranged that a rotary hydraulic pump may be secured on either side of it, as indicated in dotted lines in Figure 2, and thus it is readily adaptable to use in connection with an engine having a power take-off either to the left or to the right and the position of the pump on one side or another of the extension 41 is chosen in accordance with the location of the power take-off of the engine and its direction of rotation. In general the extension 41 includes a pressure inlet passage or conduit 42 and a return conduit or passage 43. This latter is in communication with a return flow pipe 44, which as shown in Figures 2 and 3 in particular, extends throughout the major part of the length of the cylinder 19 and at one end communicates with the passage 43 and at the other communicates with an opening 45 in the cylinder wall which is preferably positioned beyond the maximum outward excursion of the piston 18 so that fluid which has passed through the piston when the poppet valve is opened returns to the pump through the pipe 44 and the passage 43 in the extension 41.

The extension 41 is provided on each side with two perforations 46 and 46a each of which passes through both vertical walls of the extension 41 and communicates with the passage or conduit 42. Similarly each of the generally vertical walls of the extension 41 is pierced by two perforations 47 and 47a, each of which communicates with the return passage 43.

Since only a single pump is positioned on the extension and since it may lie on one side or the other, the perforations on the side not occupied by the pump are closed by suitably shaped plugs 48. Such plugs are shown in Figure 3 and Figure 6.

A pump 49 may be attached to the extension 41 but there is preferably interposed between the pump and the extension a direction control assembly which will be described below. The pump preferably includes a driven shaft 50, carrying a gear 51. The driven shaft is secured by means of a telescopic connection 53 to the power take-off drive shaft 2. A universal joint 54 may be interposed between the shaft 50 and the telescopic connection 53. Another universal joint may be inserted. The particular details of the connection between the pump shaft and the power take-off form no essential part of the present invention. It is sufficient for the present purposes that some means is provided for driving the pump shaft.

A second pump gear 55 meshes with the gear 51 and is carried on a suitable shaft 56. A suitable pump housing is provided which includes in general means for providing a chamber 57 and a second chamber 58, a partition member 59 serving to separate them from each other. Each of the chambers 57 and 58 has two discharge passages. Thus the chamber 57 has a passage 57a and a second passage 57b. Similarly the chamber 58 has a passage 58a and a second passage 58b. The passages just mentioned are so positioned that when the passage 57a is aligned with the passage 46 in the extension 41 the passage 58b is aligned with the passage 46a, and similarly the passage 57b is aligned with the passage 47 and the passage 58a is aligned with the passage 47a. Thus unless some control means is provided, each of the chambers 57 and 58 would be in communication with each of the chambers or passages 42 and 43. This obviously would produce an inoperative arrangement because one side of the pump must function as the suction side and the other side must function as the pressure side and to produce proper operation of the piston these sides must be connected to different chambers or passages 42 and 43. If no control assembly were used, that is to say, if the pump were secured directly to the extension 41, then one of the passages 58b and 57a would be plugged up and one of the passages 58a and 57b would be plugged. This might be done by plugging the passages in the pump housing or by plugging the corresponding openings in the extension 41.

In the present form of the invention, however, a control assembly is provided and is interposed between the pump housing and the extension 41. This control assembly includes a housing member 60 which includes a cylindrical bore 61 within which a rotary valve member 62 is positioned. This valve member may be provided with a reduced external end 63 to which a handle 64 may be mounted. At the outer end of the handle 64 an operating rod or link 65 may be attached if desired. The body of the valve member 62 is provided with two perforations 66 and 67 which are parallel to each other, and two additional perforations 68 and 69 which are parallel to each other and whose axes are at right angles to the axes of the perforations 66 and 67. As shown particularly in Figure 6, these perforations last mentioned are positioned and dimensioned so that they may selectively be brought into align-

ment with corresponding perforations in or passages through the walls of the housing member 60. Thus there are four such perforations in each of the walls of the housing: perforations 68a and 68b with which the perforation 68 may be brought into communication; perforations 66a and 66b with which the perforation 66 may be brought into alignment; perforations 69a and 69b with which the perforation 69 may be brought into alignment, and 67a and 67b with which the perforation 67 may be brought into alignment.

In view of the fact that the perforations 46, 46a and 47, 47a as shown in Figures 4 and 5, are not in vertical alignment, the perforations 66b, 67b, 68b, 69b are laterally cored out or inclined as shown particularly in Figure 7 to provide proper registration.

It is to be noticed, as shown in Figure 3 particularly, that on both sides the perforations through the walls of the housing 60 are cored out so that that housing may be secured to either side of the extension 41 as shown in dotted lines in Figure 2, and similarly, in each case the pump is mounted on the side of the control assembly away from the extension 41.

As a control for the direction and extent of movement of the valve member 62 a stop plate 70, which may also serve as a packing gland, is used. This stop plate is provided on one side with a pair of shoulders or stop portions 71, 71 and is similarly provided on its opposite side with similar shoulders 72, 72. These shoulders are positioned to contact a pin 73 which may be cast on the controlling handle or arm 64 and the shoulders not only limit the swinging movement of the handle and of the valve body but indicate the full upper and lower positions. The two sets of shoulders are provided so that the stop plate is usable no matter upon which side the control assembly is mounted. It also serves to permit mounting the control arm on either side of the assembly and increases the flexibility and adaptability of the assembly to possible vehicles upon which it may be mounted.

The extension 41, the pump housing 49 and the control housing 60 are all provided with suitable perforations through which bolts 74 pass in order to hold the parts in position. Such bolts are shown particularly in Figures 3, 4 and 5. Gaskets may be used if desired.

As a further control and particularly to make it unnecessary to stop the vehicle or pump driving engine when the body is in the untipped position, a by-pass valve is provided in the extension 41. Thus when for any reason it is desired to prevent fluid under pressure entering the cylinder and yet to keep the engine and pump in operation, fluid may be by-passed from the cylinder and is circulated by the pump without entering the cylinder. To accomplish this a cavity 75 is formed in the extension 41 and may be closed by a plug 76 on its outer end. It communicates with the passage 42 and through a duct 77 with a bore 78 in which is mounted a control valve 79. This valve as shown has a passage 80 formed through it, which passage comprises two arms lying in the form shown at right angles to each other, and arranged to communicate with the duct 77 and with a second duct 81 lying generally at right angles to the duct 77. This latter duct 81 communicates with the passage 43 and thus when the valve 79 is in the position shown in Figure 5, fluid entering under pressure from the pump through the passage 42, instead of going into the cylinder, is by-passed

through the cavity 75, the duct 77, the valve 79, the duct 81 to the return passage 43 and the pump thus, if its rotation is continued when the valve is in this position, merely circulates the fluid without discharging it into or creating pressure within the cylinder.

The valve body 79 may be reduced as at 82 or a shaft may be attached to it. This shaft extends out of the housing and has at its end an operating lever or handle 83 to which may be attached any form of operating link or connection 84.

The use and operation of the invention are as follows:

When a dumping assembly is installed on a vehicle or other support the sub-frame comprising the members 6 and other parts will ordinarily be mounted on some support such as a vehicle frame. The sub-frame carries the body and the cylinder with its pump and other associated parts. The particular location of the pump and control assembly on one side or the other of the extension 41 from the cylinder head is determined by the location of the power take-off and the direction of rotation. It may be positioned on either side as shown for example in full lines in Figure 2, or in dotted lines in that figure. Upon whichever side it is positioned, the perforations on the opposite side of the extension 41 are closed by plugs 48 or otherwise. The control assembly is mounted on the same side of the extension as is the pump, that is to say, it must be interposed between the pump and the passages within the extension through which the pressure fluid passes in moving to and from the cylinder. The control assembly thus lies in the paths of this fluid and is used to control them.

With the parts assembled as shown in the figures, when it is desired to raise the body to cause tipping, the pump is driven from the power source and the control assembly occupies a suitable position to cause fluid to move from the pressure side of the pump into the cylinder through the passage 42 on the lower side of the piston, and to force the fluid upward to cause tipping. To prevent excess movement the poppet valve in the piston is provided. Before it reaches its extreme limit the head 36 of the stem 34 strikes the outer cylinder head 37, and the poppet valve is knocked open against the resistance of the spring 39 and as long as the valve remains open the fluid passes through the perforation 31 in the piston and returns through the pipe 44 to the passage 43 and back to the suction side of the pump.

Because of the extreme angle of tip the body may not return to the undumped position under the influence of gravity alone and for that purpose it may be desirable to reverse the direction of pressure flow so that fluid under pressure is forced into the cylinder above or on the outer or upper side of the piston and thus the piston is caused to return toward its downward position, pulling the body back. Thus by means of the control assembly the mechanism can be so manipulated as to cause positive drive of the piston up and down and a mechanism, which without the control assembly could be used quite satisfactorily, but only to put pressure on one side of the piston, can, by the insertion of this control assembly, be converted into a device in which pressure may be applied both above and below the cylinder and in which a positive dump and a positive return may be accomplished where originally only a positive dump and a gravity return were possible.

For some purposes it is desirable to keep the

pump operating when hoisting is not to take place or when for any purpose it is desirable to have the pump remain in operation without forcing fluid under pressure into the cylinder. For this purpose the construction shown in detail in Figure 5 is designed. The valve member 79 may be manipulated to short circuit the fluid so that it moves merely from the pressure side of the pump to the conduit 42, through the passage 75, the passage 77, the opening 80 in the valve member 79, the passage 81 and to the return conduit 43. This device is preferably built into the extension 41 and may be used whether or not the control assembly is included in the final device.

A pump of the type shown in Figure 6 will operate ordinarily satisfactorily no matter what its direction of rotation. The direction of rotation usually depends on the particular installation. As shown the rotation of the gear 55 is opposite to the direction of the arrow of Figure 6, that is to say clockwise. With this direction of rotation the position of the valve member 62 and the control assembly is such that pressure fluid is passing through the chamber 58, through the openings or passages 58a, 68a, 68, 68b, 47a to the passage 43 and the pipe 44, so that fluid is thus being supplied under pressure to the upper or outward face of the piston to cause a positive return of the body to its undumped position and correspondingly fluid can return to the suction side of the pump through the conduit 42, which now becomes a suction or return conduit instead of serving as the pressure fluid conduit which it does in the tipping operation when it is desired to apply fluid pressure to the inner or downward face of the piston. The path of the return fluid, when the control valve 62 occupies the position of Figure 6, is through the conduit 42 and the following passages: 46, 69b, 69, 69a and into the suction chamber 57 of the pump.

When it is desired to reverse the direction of the flow of pressure fluid the valve member 62 is moved to the opposite position and the passages 68 and 69 become closed and the passages 66 and 67 become open, and the direction of flow through the system is reversed and pressure fluid is supplied to the under side of the piston for a positive hoist.

Irrespective of the positions of the valve member 62, the short circuiting valve 79 may be moved so that the pressure fluid may be short circuited from the cylinder and still may be properly circulated no matter what the setting of the valve member 62 in the control assembly may be.

Should pressure fluid continue to be supplied on the upper side of the piston after the body has been returned to the down position, the poppet valve in the piston serves as a safety valve and the strength of the spring 39 is such that long before a dangerous pressure can be built up within the cylinder the spring yields and the valve moves open and escape of the pressure fluid past the valve and through the perforation 31 occurs freely. The strength of the spring is such that it does not yield at pressures which will occur for normal return movement of the body but does yield after these pressures have been exceeded and long before dangerous pressures have been built up.

We claim:

1. In combination with a hydraulic cylinder, a piston therein and means unitary therewith for introducing fluid under pressure selectively upon either side of said piston, said means comprising a source of pressure fluid and members defining

passages from said source of pressure fluid to points within said cylinder on either side of said piston, said passage-defining means comprising a cylinder head, an extension projecting rearwardly therefrom in line with said cylinder and a conduit extending from said cylinder head toward the opposite end of said cylinder.

2. In combination with a hydraulic cylinder, a piston therein and means for introducing fluid under pressure selectively upon either side of said piston, said means comprising a source of pressure fluid and members defining passages from said source of pressure fluid to points within said cylinder on either side of said piston, said passage-defining means comprising a cylinder head, an extension therefrom and a conduit extending from said cylinder head toward the opposite end of said cylinder, and a unitary control means defining parts of said passages, said control means being supported upon and moving bodily with said cylinder and being adjustable to alter the direction of flow of fluid under pressure through said passages to cause said fluid to move into the cylinder under pressure upon one side of said piston or the other, selectively.

3. In combination with a hydraulic cylinder, a piston therein and means for introducing fluid under pressure selectively upon either side of said piston, said means comprising a source of pressure fluid and members defining passages from said source of pressure fluid to points within said cylinder on either side of said piston, said passage-defining means comprising a cylinder head, an extension therefrom and a conduit extending from said cylinder head toward the opposite end of said cylinder, and a unitary control means defining parts of said passages, said control means being movable to alter the direction of flow of fluid under pressure through said passages to cause said fluid to move into the cylinder under pressure upon one side of said piston or the other, selectively, said control means comprising a control assembly including a hollow, perforated housing and a movable ported valve member therewithin, said housing adapted to be attached upon either side of said extension and to receive a pump housing upon the side opposite said extension.

4. In combination in a hydraulic mechanism, a cylinder mounted for movement, said cylinder having two heads, an extension formed on one head, fluid inlet and return passages formed in said extension, openings on each side of said extension communicating with said passages, a single, unitary control assembly formed as a unit, having a housing and attachable to either side of said extension to register with said openings.

5. In combination in a hydraulic mechanism, a cylinder mounted for movement, said cylinder having two heads, an extension formed on one head, fluid inlet and return passages formed in said extension, openings on each side of said extension communicating with said passages, a control assembly formed as a unit, having a housing and attachable to either side of said extension to register with said openings, a plurality of passages through said control assembly, a valve member positioned within said control assembly and provided with passages adapted to register with the openings through said control assembly housing.

6. In combination in a hydraulic mechanism, a cylinder mounted for movement, said cylinder having two heads, an extension formed on one head, fluid inlet and return passages formed in said extension, openings on each side of said ex-

tension communicating with said passages, a control assembly formed as a unit having a housing and attachable to either side of said extension to register with said openings, a plurality of passages through said control assembly, a valve member positioned within said control assembly and provided with passages adapted to register with the openings through said control assembly housing, the passages in said valve member being positioned some at angles to each other, whereby when some register with openings in the assembly housing others close other openings in said housing, and a gear pump having a suction and a pressure chamber, a plurality of passages communicating with each of said chambers, the passages shaped and arranged to register with the passages through said control assembly.

7. In combination in a hydraulic mechanism, a cylinder mounted for movement, said cylinder having two heads, an extension formed on one head, fluid inlet on return passages formed in said extension, openings on each side of said extension communicating with said passages, a control assembly formed as a unit having a housing and attachable to either side of said extension to register with said openings, a plurality of passages through said control assembly, a valve member positioned within said control assembly and provided with passages adapted to register with the openings through said control assembly housing, the passages in said valve member being positioned some at angles to each other, whereby when some register with openings in the assembly housing others close other openings in said housing, and a gear pump having a suction and a pressure chamber, a plurality of passages communicating with each of said chambers, the passages shaped and arranged to register with the passages through said control assembly, whereby a passage from each of said chambers is opened and other passages are closed by the valve of the control assembly, and means for moving said valve to close and open, at will, selected passages in said pump housing, to control the direction of flow of pressure flow to said cylinder.

8. In combination in a hydraulic assembly, a cylinder, heads at both ends of said cylinder, one head having formed within it a plurality of passages, one such passage communicating with one end of the cylinder, the other passage communicating with the other end of said cylinder, and a unitary, movable means for directing pressure fluid from a source of pressure into the cylinder selectively through one or the other of said passages, said pressure directing means being at-

tached to and supported by said first mentioned cylinder head.

9. In combination in a hydraulic assembly, a cylinder, heads at both ends of said cylinder, one head having formed within it a plurality of passages, one such passage communicating with one end of the cylinder, the other passage communicating with the other end of said cylinder, and means for directing pressure fluid from a source of pressure into the cylinder selectively through one or the other of said passages, said means comprising a single, unitary control assembly attachable to a portion of said first mentioned cylinder head, and having passages formed in it and a unitary valve controlling said passages, whereby the valve may be moved to direct pressure fluid to one or the other end of said cylinder as desired, said pressure directing means being attached to and supported by said first mentioned cylinder head.

10. In combination in a hydraulic cylinder, a head for one end thereof, a head for the other, an inlet and a return passage formed in said first head, said inlet passage communicating directly with the cylinder, a conduit extending from said return passage to a point adjacent the opposite end of said cylinder, an extension on said head within which said passages lie, openings to said passages formed on opposite sides of said extension, a control assembly comprising a hollow housing and a valve member movably mounted therewithin, openings in said control assembly housing, registerable with the openings in said extension, whereby the openings in said control assembly housing, when the latter is secured to the extension on either side thereof, are in register with corresponding openings in said extension, and a hydraulic pump comprising a suitable casing and a pair of rotary elements, and divisions within said casing forming pressure and return chambers, a plurality of openings through the wall of each of said chambers, said openings shaped and positioned to be registerable with corresponding openings in said extension and in said control assembly housing, the said valve having passages through it registerable with the openings through the walls of the control assembly housing and means for moving the valve to bring desired openings into register and to close undesired openings, whereby to direct the flow of pressure fluid from said pump either to the inlet or the outlet passage through said first mentioned cylinder head.

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