

Jan. 10, 1956

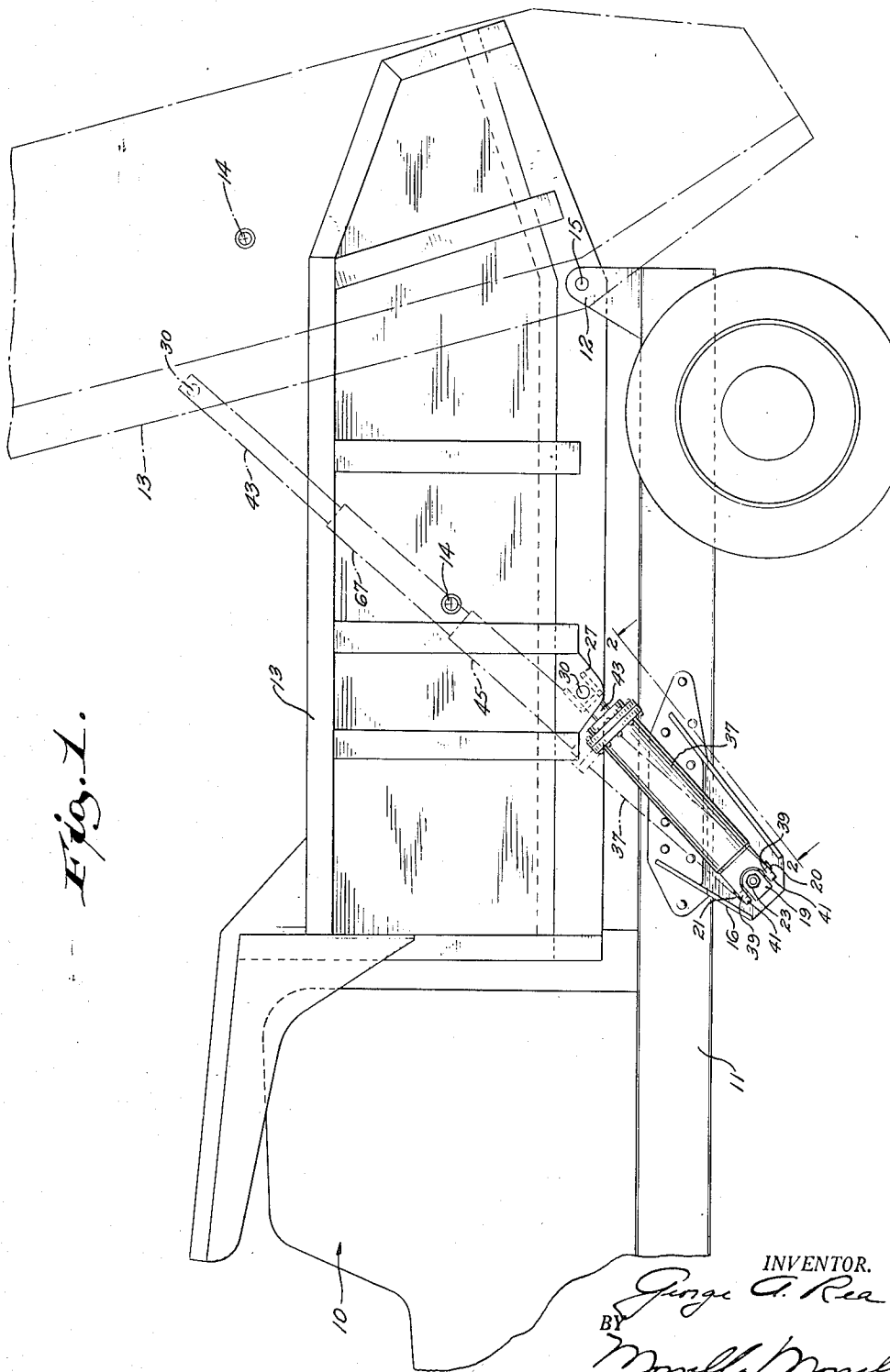
G. A. REA

2,730,401

FLUID PRESSURE OPERATED TELESCOPIC HOISTS

Filed July 13, 1951

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 2.

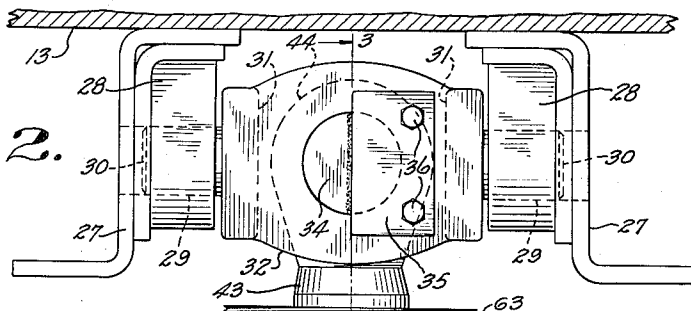


Fig. 5.

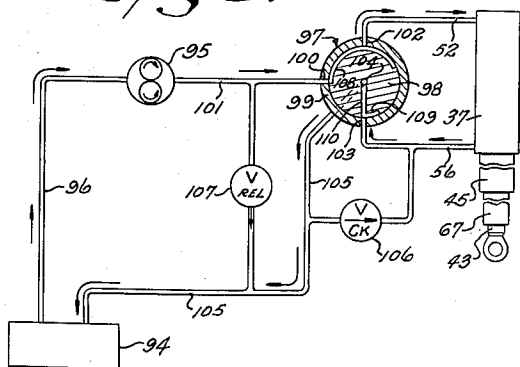


Fig. 6.

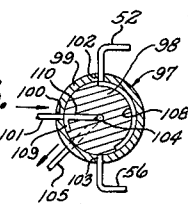
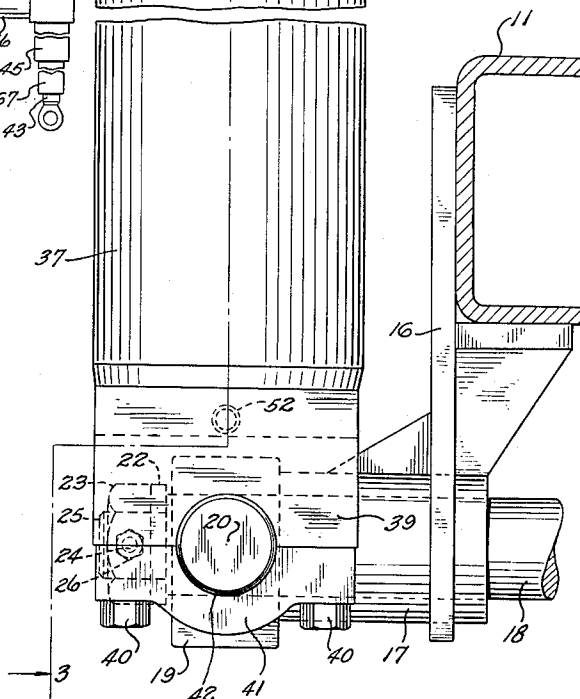
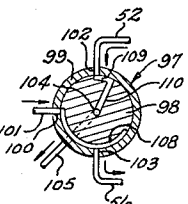


Fig. 7.



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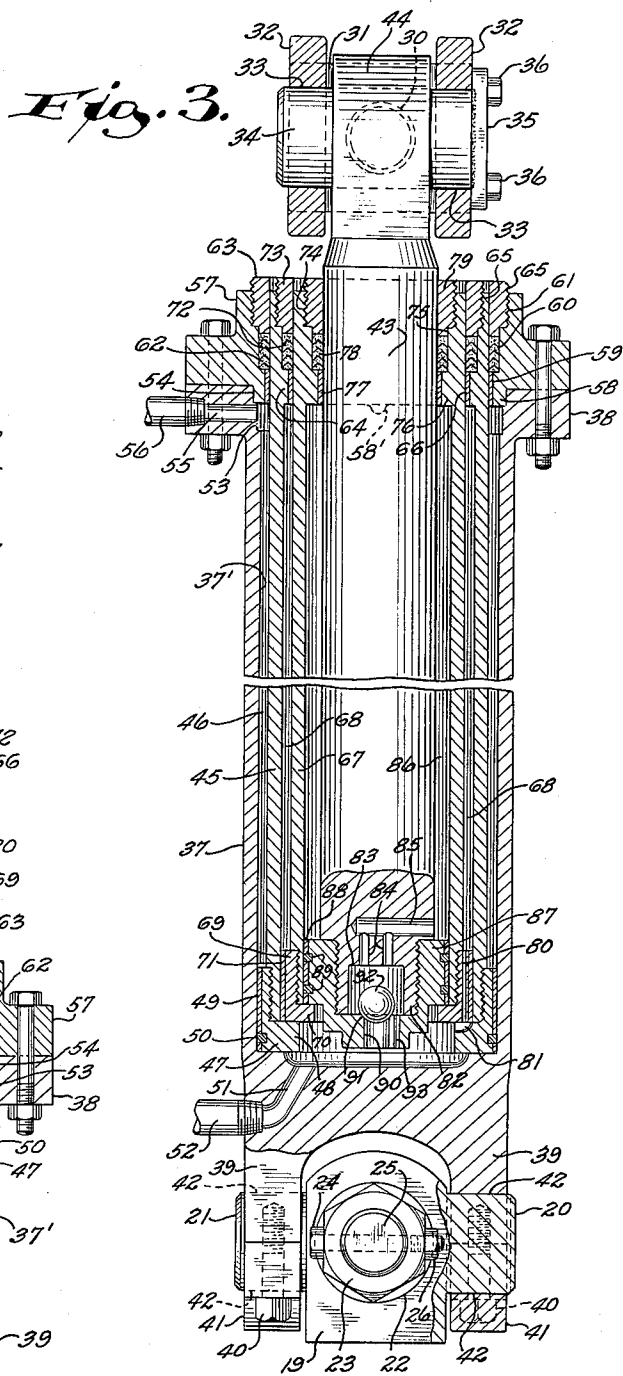
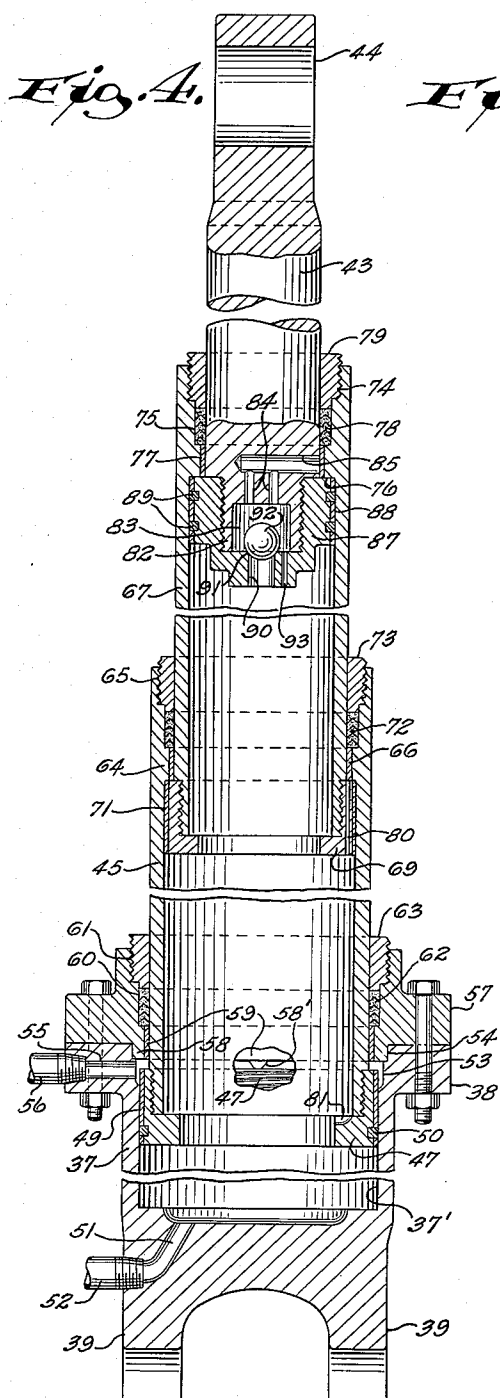
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3 Sheets-Sheet 3



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1

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FLUID PRESSURE OPERATED TELESCOPIC HOISTS

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5 Claims. (Cl. 298—22)

This invention relates to improvements in fluid pressure operated telescopic hoists.

Dumping vehicles in which the dump body is movable from a load carrying position to an over-balanced dumping position are particularly efficient in discharging their loads, even sticky loads being freely discharged because of the angularity of the dump body when in overbalanced dumping position. A dumping vehicle of this general type is shown in Patent No. 2,047,051, issued on July 7, 1936, to George E. and Arthur P. Armington.

With the above in mind it is a general object of the invention to provide an improved fluid pressure operated telescopic hoist which is adapted for use in the overbalancing type of dumping vehicle, the fluid conduits of the improved hoist being connected to a non-extensible portion of said hoist.

A further object of the invention is to provide an improved multiple stage hoist of the class described having a double acting stage provided by the hoist cylinder and by the outermost sleeve within the cylinder, whereby extensible or retractile movement of the hoist may be accomplished by introducing fluid under pressure into a selected end of the cylinder.

A further object of the invention is to provide an improved hoist of the class described which is so constructed that the rate of extensible movement thereof is restricted within safe limits even after the dump body has been overbalanced.

A further object of the invention is to provide an improved hoist of the class described which is provided at each end with a universal joint connection to prevent binding of the movable parts of the hoist when the truck frame is deflected due to uneven ground contours.

A further object of the invention is to provide an improved hoist of the class described which is strong and durable, relatively simple in construction, efficient in operation, and otherwise well adapted for the purposes described.

With the above and other objects in view, the invention consists of the improved fluid pressure operated telescopic hoist, and all of its parts and combinations, as set forth in the claims, and all equivalents thereof.

In the drawings accompanying and forming a part of this specification, wherein is shown one complete embodiment of the preferred form of the invention, and wherein like characters of reference indicate the same parts in all of the views:

Fig. 1 is a fragmentary side elevational view of an over balancing type of dump truck having the improved hoist embodied therein, the over balanced dumping position of the dump body and the corresponding fully extended position of the hoist being shown in dot and dash lines;

Fig. 2 is an enlarged fragmentary bottom view of the improved hoist taken approximately along the line 2—2 of Fig. 1;

2

Fig. 3 is a fragmentary longitudinal sectional view taken approximately along the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary view similar to Fig. 3 and showing the improved hoist in fully extended position;

Fig. 5 is a diagrammatic view of the hydraulic circuit for actuating the improved hoist, the control valve being disposed in body raising position;

Fig. 6 is a diagrammatic view of the control valve of Fig. 5, showing the latter in body holding position; and

Fig. 7 is a view similar to Fig. 6 showing the control valve in body lowering position.

Referring more particularly to Fig. 1 of the drawing, the numeral 10 indicates a truck having longitudinally extending horizontal chassis rails 11 each provided at its rear end with an upstanding apertured lug 12. A dump body 13 having a center of gravity positioned as at 14 is pivoted at its rear end to the lugs 12 by pins 15. Fixed to a side rail 11 is a depending bracket 16 which is formed at its lower end with a transversely extending bearing sleeve 17 clearly shown in Fig. 2. A similar bracket and bearing sleeve (not shown) may be correspondingly fixed to the opposite frame side rail (also not shown). A shaft 18 is mounted in the bearing sleeve 17, and outwardly of said sleeve a block 19 is freely rotatably mounted on the shaft 18 and is formed with a pair of coaxial oppositely directed stub shafts 20 and 21, the axis of which is normal to the axis of the shaft 18. Outwardly of the block 19 the shaft 18 is formed with a portion of reduced diameter 25 carrying a washer 22. A nut 23 is threaded onto the portion 25 for retaining the washer 22 and block 19 in position. A locking screw 24 may extend transversely through the nut 23 and shaft portion 25 as shown in Fig. 3, and the screw 24 may be provided with a lock nut 26.

Referring to Figs. 1 and 2, a pair of spaced depending brackets 27 is mounted on the underside of the dump body 13 above the bracket 16. Fixed to the facing surfaces of the brackets 27 is a pair of bearing blocks 28 formed with transverse coaxial bores 29. A stub shaft 30 is rotatably positioned in each of the bores 29, and formed on each of the stub shafts 30 inwardly of its bearing block 28 is a rectangular bar 31 which lies in a plane normal to the axis of its stub shaft 30. Spaced parallel transverse bars 32 connect corresponding opposite side edges of the bars 31 as shown in Figs. 2 and 3. The bars 32 are formed with coaxial bores 33, the axis of which is normal to the axis of the stub shafts 30. A cylindrical pin 34 is positioned in and extends between the bores 33, and said pin may be retained in position by a keeper plate 35 which is welded to one end of the pin and is removably secured to the adjacent plate 32 by means of cap screws 36.

The improved hoist is provided with a cylinder 37 having an open end formed with an outwardly directed annular flange 38. The opposite closed end of the cylinder is formed with a pair of spaced parallel longitudinally extending lugs 39, to each of which a cap 41 is connected, as by cap screws 40. The lugs 39 and their caps 41 are formed with coaxial transverse bores 42 for rotatably receiving the stub shafts 20 and 21 of the block 19, as shown in Figs. 1, 2 and 3. The improved hoist is also formed with a piston rod 43 having its outer end formed with an eye 44, and said eye is positioned between the plates 32 with the pin 34 extending through its bore. It is apparent that the structure so far described provides a universal joint connection between one end of the improved hoist and the frame of the truck 10, and it also provides a universal joint connection between the other end of the improved hoist and the dump body 13.

Referring to Figs. 3 and 4, it will be noted that a sleeve 45 is positioned coaxially within the bore 37' of the cylinder 37.

der 37 and is smaller than said bore to provide an annular space 46 between the sleeve 45 and the wall of the bore 37' when the parts are disposed as shown in Fig. 3. A stop collar 47, which is threaded onto the inner end of the sleeve 45, has an annular flange portion 48 overlapping the end of said sleeve and projecting radially inwardly. The collar 47 carries an annular bearing shell 49 which slidably engages the wall of the cylinder bore 37', and said collar also carries a piston ring 50 which provides positive sealing engagement between said collar and a cylinder wall.

The cylinder 37 is formed with a passage 51 which affords communication between the inner end of the cylinder bore 37' and the outer surface of the cylinder, there being a tubular connection 52 threaded into the outer terminus of the passage 51. The outer end of the bore 37' of the cylinder is formed with two annular portions 53 and 54 of enlarged diameter. A passage 55 extends radially through the flange 38 and affords communication between the bore portion 53 and a tubular connection member 56 which is threaded into the outer end of said passage. An annular collar 57 is bolted onto the flange 38 at the outer end of the cylinder and has an axially extending tubular portion 58 formed on the inner end surface thereof and seated in the cylinder bore portion 54. The tubular portion 58 may be formed with a lug 58' projecting axially from its inner end surface within the bore portion 53. The collar 57 carries an annular bearing shell 59 which slidably engages the outer surface of the sleeve 45. Above the shell 59 the collar 57 is formed with an annular portion 60 of increased internal diameter. Above the annular portion 60 the collar 57 is formed with a threaded portion 61 of still greater internal diameter. Surrounding the sleeve 45 within the portion 60 of the collar 57 is a packing 62 which may take the form of a plurality of sealing rings of suitable material. Threaded into the portion 61 of the collar 57 and compressibly engaging the packing material 62 is a gland nut 63 for urging the packing into sealing engagement with the sleeve 45.

The sleeve 45 is formed with an internal annular shoulder 64 adjacent its outer end. Spaced outwardly from the shoulder 64 the sleeve 45 is formed with an internally threaded portion 65 of increased diameter which extends to the end of the sleeve. The shoulder 64 carries an annular bearing sleeve 66.

Positioned within the sleeve 45 and slidable in the bearing sleeve 66 is an inner sleeve 67 which is smaller in diameter than the sleeve 45 to form an annular space 68 when the sleeves are positioned as shown in Fig. 3.

Threaded on the inner end of sleeve 67 is a stop collar 69 which is formed with an inwardly directed annular flange 70 overlapping the end of the sleeve 67 and projecting radially inwardly therefrom. The stop collar 69 carries an annular bearing shell 71 which slidably engages the inner wall of the sleeve 45. The stop collar 69 is formed with an axially extending passage 80 extending the full length thereof. The annular flange 48 of the stop collar 47 is formed with a cutaway portion 81 to provide communication between the inner end of the passage 80 and the inner end of the cylinder bore 37' when the parts are in the position of Fig. 3.

Surrounding the sleeve 67 outwardly of the shoulder 64 is a packing 72 which may be formed of a plurality of packing rings of suitable material. A packing nut 73 is threaded into the portion 65 of the sleeve 45 and urges said packing into sealing engagement with the sleeve 67.

The outer end of the sleeve 67 is internally threaded as at 74, and inwardly of the portion 74 the sleeve 67 is formed with a portion of reduced diameter 75. Inwardly adjacent the portion 75 the sleeve 67 is formed with an internal annular shoulder 76 which carries an annular bearing shell 77. The piston rod 43 is normally positioned within the sleeve 67 and is axially slidable in the bearing shell 77, there being an annular space 86 between the piston rod 43 and the sleeve 67 when the parts are positioned

as shown in Fig. 3. Surrounding the piston rod 43 within the portion 75 of the sleeve 67 is a suitable packing 78 which may also take the form of annular sealing rings, and threaded in the portion 74 of the sleeve 67 is a gland nut 79.

The inner end of the piston rod 43 is formed with an externally threaded portion 82 of reduced diameter which is formed with an axial recess 83. A pair of spaced axially extending passages 84 communicate between the recess 83 and a larger transverse passage 85 which opens through the side wall of the piston rod 43 and communicates with the annular space 86 when the parts are positioned as shown in Fig. 3. Threaded on the portion 82 of the piston rod 43 is a cup-shaped piston 87 which carries an annular bearing shell 88 for slidably engaging the inner wall of the sleeve 67. The piston 87 also carries a pair of spaced piston rings 89 for sealingly engaging the wall of the sleeve 67. The closed end of the cup-shaped piston 87 is formed with an axial bore 90 which is provided at its inner end with an annular seat 91 for a ball check valve 92 positioned within the recess 83. The end wall of the piston 87 is also formed with a restricted passage 93 which provides constant communication between the recess 83 and the inner end of the cylinder bore 37'.

Fig. 5 indicates diagrammatically a hydraulic control system for use in operating the improved hoist. The numeral 94 indicates a fluid reservoir from which a positive displacement pump 95 is adapted to draw fluid through a conduit 96. A control valve 97 may be of the disk type, having a rotatable disk valve 98 positioned within a valve body 99. The valve body 99 may be formed with a port 100 which communicates with the outlet of the pump 95 through a conduit 101. The valve body 99 may also be formed with a pair of ports 102 and 103, each offset 90 degrees from the port 100. The port 102 communicates with the tubular connection 52 on the cylinder 37, as shown, and the port 103 communicates with the tubular connection 56 on the cylinder 37, as shown. The valve member 98 may be formed with an axial bore 104, and affording communication between said bore and the reservoir 94 is a conduit 105. A check valve 106 provides one-way communication between the conduits 105 and 56 as shown, and a pressure relief valve 107 is connected between the conduits 101 and 105.

The valve member 98 may be formed with a peripheral groove 108 which is preferably substantially greater than 90 degrees but less than 180 degrees in extent, the groove 108 being so positioned that it is adapted to communicate with the ports 100, 102 and 103 in various positions. Offset approximately 90 degrees from one end of the peripheral groove 108 is a relatively short peripheral groove 109 which is positioned in the same plane with the groove 108. A radial passage 110 affords communication between the groove 109 and the axial bore 104 of the valve member.

In order to raise the truck body 13 from the stable load carrying position shown in solid lines in Fig. 1 to the over-balanced dumping position shown in dot and dash lines in Fig. 1, the valve member 98 of the valve 97 is turned to the position shown in Fig. 5. The pump 95 then draws fluid from the reservoir 94 and delivers it under pressure through the valve port 100, groove 108, port 102, and tubular connection 52, to the inner end of the cylinder bore 37'. Referring to Fig. 3 this causes the sleeves 45 and 67 and the piston 87 and its rod 43 to move outwardly as a unit until the stop collar 47 of the sleeve 45 abuts the lug 58' of the collar 57. The lug 58' holds the collar 47 spaced from the portion 59 of the collar 57, as shown in Fig. 4. During this outward movement of the collar 47 and sleeve 45 fluid within the annular space 46 is forced out through the passage 55 and into the connection 56 from which

5

it flows through the valve port 103, passage 110, axial bore 104, and conduit 105 back to the reservoir 94.

Continued delivery of fluid under pressure into the bore of the cylinder 37 causes the sleeve 67 and piston 87 with its rod 43 to move outwardly as a unit until the collar 69 of the sleeve 67 abuts the shoulder 64 of the sleeve 45. During this movement the fluid in the annular space 68 escapes into the inner end of the cylinder bore 37' through the passage 80 in the collar 69. The piston 87 and rod 43 continue to move outwardly under the force of the fluid pressure until the piston abuts the shoulder 76 of the sleeve 67. Since the hoist when fully extended can accommodate no more hydraulic fluid, any further fluid pumped into the conduit 101 by the pump 95 will bypass back to the reservoir 94 through the pressure relief valve 107 and conduit 105.

As the piston 87 moves outwardly within the sleeve 67, the center of gravity 14 of the truck body 13 passes from a position on the forward side of the axis of the pin 15 to the position shown by dot and dash lines in Fig. 1 where the center of gravity is rearwardly of the axis of the pivot pin 15.

As the piston 87 moves outwardly within the sleeve 67, the fluid from the annular space 86 is forced out through the passage 85, passages 84, recess 83 and restricted passage 93 into the inner end of the cylinder bore 37'. Due to the restricted size of the passage 93, the escape of fluid from the space 86 is limited, and the speed of outward movement of the piston 87, relative to the sleeve 67 is also limited as a result. This provides a dash-pot snubbing action and prevents the piston from being pulled outwardly at excessive speed by the overbalanced pump body 13. Limiting the speed of movement of the piston 87 in this manner lessens the shock on the mechanism when there is an abrupt stoppage of the piston at its outer limit of travel as it engages the shoulder 76. Excessive stresses on the mechanism are thereby prevented.

To hold the body 13 in overbalanced pumping position, the valve member 98 is turned to the position shown in Fig. 6. In this position the valve prevents flow of fluid to or from the cylinder 37 through the tubular connections 52 and 56. Fluid pumped into the port 100 by the pump 95 then flows through the passage 110, bore 104 and back to the reservoir 94 through the conduit 105.

To lower the body 13 from raised position, the valve member 98 is turned to the position shown in Fig. 7. Fluid under pressure from the pump 95 flows from the conduit 101 through the port 100, groove 108, port 103, tubular connection 56 and passage 55 into the annular recess 53 as well as into the annular space between the end of the collar 47 and the adjacent end of the tubular extension 58. The fluid pressure forces the collar 47 inwardly along the cylinder bore 37' and said collar pulls with it the sleeves 45 and 67 as well as the piston 86, piston rod 43 and dump body 13. Fluid escapes from the inner end of the cylinder bore 37' through the passage 51 and tubular connection 52, and flows through the valve port 102, groove 109, radial passage 110, axial bore 104 and back to the reservoir 94 through the conduit 105. When the collar 47 reaches the retracted position shown in Fig. 3, the annular space 46 can accommodate no more fluid. Therefore any fluid delivered to the conduit 101 by the pump 95 will bypass to the reservoir 94 through the pressure relief valve 107 and conduit 105.

As the collar 47 moves from the extended position of Fig. 4 back toward the retracted position of Fig. 3, the dump body 13 is pulled forwardly from overbalanced position to a position where the center of gravity 14 is forwardly of the axis of the pivot pin 15. In this position the weight of the body 13 pushes inwardly on the piston rod 43 to cause the piston 87 to move inwardly along the sleeve 67, as well as to cause the sleeve 67 to move inwardly along the sleeve 45. As the piston 87

6

moves inwardly along the sleeve 67, fluid flows freely from the inner end of the cylinder bore 37' through the passage 90, past ball 92, through recess 83, passages 84 and 85, into the annular space 86. As the sleeve 67 moves inwardly, fluid from the inner end of the cylinder bore 37' flows into the annular space 68 through the restricted passage 80 in the collar 69. By again turning the valve 98 to the position of Fig. 6, the conduits 52 and 56 are sealed off to lock the hoist in retracted position, and the fluid from the pump 95 is pumped directly to the reservoir 94 through the conduits 101 and 105 without passing through the relief valve 107.

Various changes and modifications may be made without departing from the spirit of the invention, and all of such changes are contemplated as may come within the scope of the claims.

What I claim as the invention is:

1. In a fluid operated ram for use in a vehicle having a dump body mounted thereon for movement between a load carrying position and an overbalanced dumping position: a sleeve having an inner and an outer end; means for introducing fluid under pressure into the inner end of said sleeve; a piston axially slidable in said sleeve; a piston rod of smaller diameter than said sleeve projecting through the outer end of said sleeve; means forming a seal between said piston rod and the outer end of said sleeve; a restricted passage affording constant communication between the fluid spaces in said sleeve on opposite sides of said piston; a passage of relatively large cross-section connecting the fluid spaces on opposite sides of said piston; and a check valve in the latter passage permitting fluid flow through said relatively large passage only during retracting movement of said piston.

2. In a fluid operated ram for use in a vehicle having a dump body mounted thereon for movement between a load carrying position and an overbalanced dumping position: a cylinder having a closed inner end with a fluid space thereover and having an open outer end; at least one concentric open ended sleeve axially slidable within said cylinder and slidably projecting from the open outer end thereof; means forming a seal between said sleeve and the outer end of said cylinder; a piston axially slidable within said sleeve; a piston rod for said piston projecting from the outer end of said sleeve and having a diameter smaller than the inner diameter of said sleeve to provide an annular fluid space therebetween; means providing a seal between said piston rod and the outer end of said sleeve; means limiting the extensile movement of said sleeve relative to said cylinder; and means for introducing fluid under pressure into the inner end of said cylinder; said piston being formed with a restricted passage affording only limited communication between said fluid space below the piston adjacent the closed inner end of the cylinder and the fluid space between said piston rod and sleeve whereby a special snubbing action takes place only during extensile movement of said piston relative to said sleeve, said snubbing being effective substantially throughout the length of movement of said piston relative to said sleeve.

3. In a fluid operated ram for use in a vehicle having a dump body mounted thereon for movement between a load carrying position and an overbalanced dumping position: a cylinder having a closed inner end and an open outer end; at least one concentric open ended sleeve axially slidable within said cylinder and slidably projecting from the open outer end thereof; means forming a seal between said sleeve and the outer end of said cylinder; a piston axially slidable within said sleeve; a piston rod for said piston projecting from the outer end of said sleeve and having a diameter smaller than the inner diameter of said sleeve to provide an annular fluid space therebetween; means providing a seal between said piston rod and the outer end of said sleeve; means limiting the extensile movement of said sleeve relative to said cylinder; and means for introducing fluid under pressure into the

7

inner end of said cylinder; means forming a restricted passage affording communication between the inner end of the cylinder and the fluid space between said piston rod and sleeve for limiting the rate of extensile movement of said piston and rod relative to said sleeve; means forming a passage of relatively large cross-section affording communication between the inner end of the cylinder and the fluid space between the piston rod and sleeve; and a check valve in the latter passage permitting fluid flow through said latter passage only during retractile movement of the piston.

4. In a vehicle having a frame, having a dump body mounted thereon and movable between a load carrying position and an overbalanced dumping position, and having a fluid operated ram for actuating said dump body, said ram comprising: a sleeve having an inner end with a fluid space, said space being connected to said frame and having an outer end; a piston axially slidable in said sleeve; a piston rod of smaller diameter than said sleeve projecting from the outer end of said sleeve and connected to said dump body, there being a fluid space between said piston rod and said sleeve outwardly of the piston; means forming a seal between said piston rod and the outer end of the sleeve; means for introducing fluid under pressure into the inner end of said sleeve to cause extensile movement of the piston relative to the sleeve, said ram being connected to said frame and dump body in such a manner that the dump body is moved to overbalanced condition by extensile movement of the piston to a predetermined position spaced from the outer end of said sleeve; and means forming a restricted passage affording only limited communication between the fluid space below the piston adjacent the inner end of said sleeve and the fluid space between said piston rod and sleeve whereby a special snubbing action takes place after said body has become overbalanced said snubbing action being effective substantially throughout the length of travel of said piston relative to said sleeve and only during extensile movement thereof.

8

5. In a vehicle having a frame, having a dump body mounted thereon and movable between a load carrying position and an overbalanced dumping position, and having a fluid operated ram for actuating said dump body, said ram comprising: a sleeve having an inner end connected to said frame and having an outer end; a piston axially slidable in said sleeve; a piston rod of smaller diameter than said sleeve projecting from the outer end of said sleeve and connected to said dump body, there being a fluid space between said piston rod and said sleeve outwardly of the piston; means forming a seal between said piston rod and the outer end of the sleeve; means for introducing fluid under pressure into the inner end of said sleeve to cause extensile movement of the piston relative to the sleeve, said ram being connected to said frame and dump body in such a manner that the dump body is moved to overbalanced condition by extensile movement of the piston to a predetermined position spaced from the outer end of said sleeve, means forming a restricted passage affording communication between the inner end of said sleeve and the fluid space between said piston rod and sleeve for limiting the rate of extensile travel of the piston after said body has become overbalanced; means forming a passage of relatively large cross-section affording communication between said fluid space and the inner end of the sleeve; and a check valve in the latter passage permitting fluid flow through said relatively large passage only during retractile movement of the piston.

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