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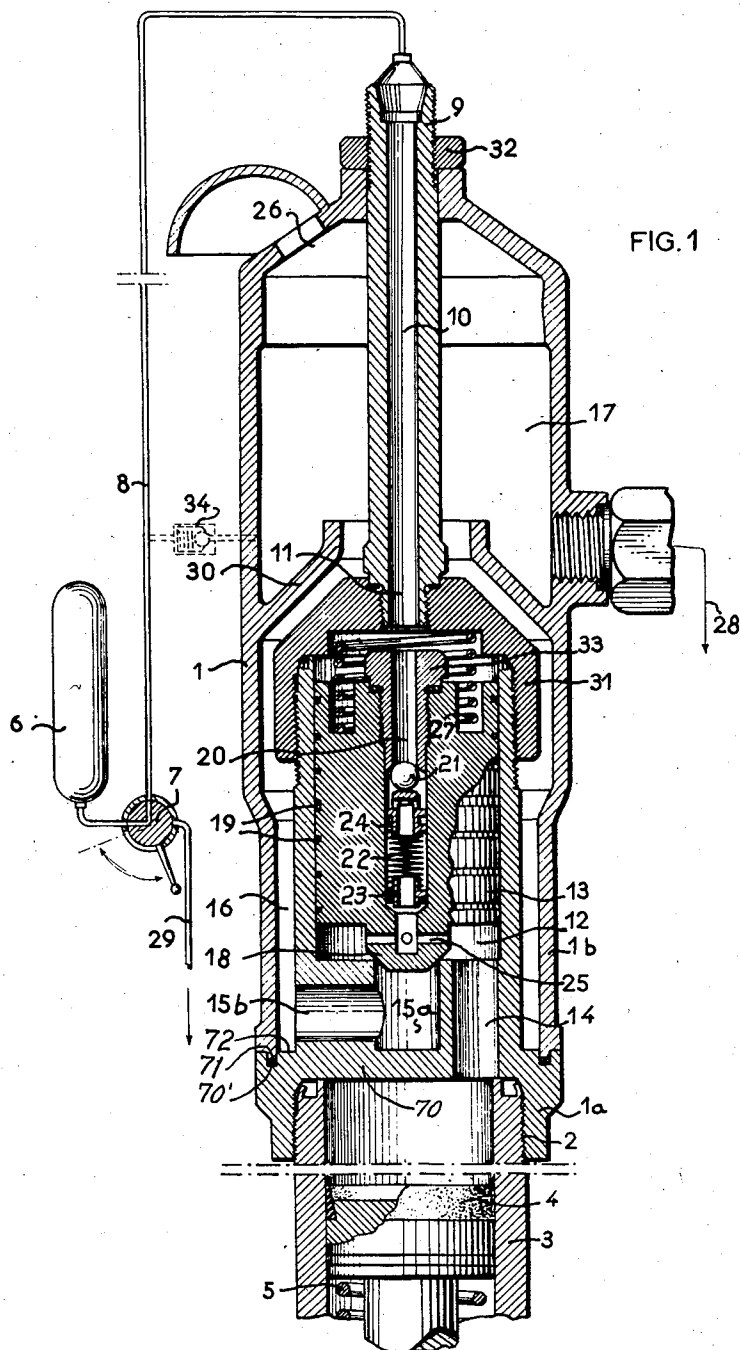
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LIQUID DUMPING VALVE ARRANGEMENT FOR A HYDRAULIC JACK

Filed Dec. 10, 1954

2 Sheets-Sheet 1



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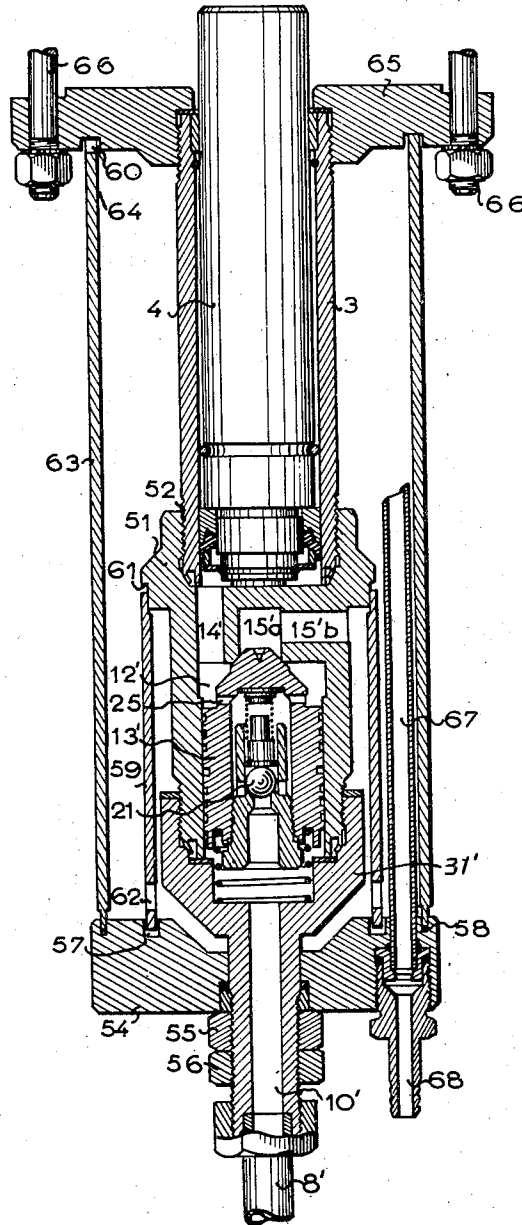
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FIG. 2



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1

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LIQUID DUMPING VALVE ARRANGEMENT FOR A HYDRAULIC JACK

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15 Claims. (Cl. 121—38)

The present invention relates to a control arrangement for a hydraulic jack. More particularly, this invention relates to a remotely controlled liquid dumping valve arrangement for such a jack.

The invention specifically relates to a dumping valve arrangement combined with the cylinder of a hydraulic jack and interposed between the jack cylinder and the source of fluid under pressure that actuates the jack.

In hydraulic jacks that are adapted to be actuated in one direction by liquid under pressure against the action of a counteracting force, it is often necessary that the return stroke of the jack piston be more rapid than its active stroke. This requires that the rate of discharge of liquid contained in the jack cylinder be higher than the rate of feed of liquid to the cylinder. This is especially true in instances where a hydraulic jack is utilized to place a circuit breaker in contact-making relation against the action of elastic means capable of ensuring rapid contact-breaking movement.

In a hydraulically controlled circuit breaker, the liquid flowing from the jack must not establish any resistance capable of delaying the action of the elastic means that effects the contact-breaking movement. To accomplish this, in most cases, implies that the duct that feeds the jack with liquid from source would have to be of a prohibitive size if the jack is discharged or dumped through the feeding duct. On the other hand, the pressure and/or flow conditions of the liquid in the feeding duct can be effectively utilized to obtain a remote triggering of the dumping valve arrangement.

The invention, therefore, has for an object to provide a dumping valve arrangement for the cylinder of a hydraulic jack, the piston of which is to be moved against a counteracting force and which dumping arrangement is interposed between the source of liquid under pressure and the jack cylinder and includes discharge port means dumping the liquid from the cylinder in response to reverse flow of liquid between the dumping valve arrangement and source that is of simple and robust construction.

More specifically, the invention has for an object to provide a dumping valve arrangement in combination with the cylinder of a hydraulic jack which includes a hollow body connected to one end of the jack cylinder, extending coaxially thereof and including a disk shaped partition immediately adjacent the jack cylinder and a cylindrical extension, a movable piston type partition member is slidably disposed in the cylindrical extension, so as to divide the same in two compartments, one adjacent the jack cylinder and the other remote therefrom, the means for feeding liquid under pressure to the jack include a feed pipe in communication with the compartment remote from the jack cylinder, said movable partition having port means therethrough providing communication between the cylindrical extension and the jack cylinder and a second port means providing communication between said first compartment and the exterior of the cylindrical extension, and said movable partition

2

further including a valve body adapted to control fluid flow through said second port means.

It is an additional object of the present invention to provide a tubular means coaxial with the jack cylinder and surrounding in radially spaced relation said cylindrical extension and at least a part of said feed pipe and adapted to receive liquid discharged from the jack cylinder through said second port means in the disk shaped partition, and outlet pipe means in communication with the interior of said tubular member.

It is a further specific object of the invention to provide an arrangement in which the second port means in the disk shaped partition have greater cross sectional area than the first port means therein.

Further and more specific objects will be apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a view partly in longitudinal section and partly in elevation illustrating one form of dumping valve arrangement in accordance with the invention, and

Figure 2 is a similar view illustrating a modified form of the invention.

With reference to the two embodiments of the invention shown in the drawings, it is to be pointed out that each include a dumping valve arrangement for obtaining rapid discharge of fluid from the cylinder of a hydraulic jack, that includes three major components, namely a valve casing and valve body combination, an auxiliary tank surrounding the valve body and a section of feed pipe that is operably related to the valve casing in coaxial arrangement with both the casing and the auxiliary tank.

In Figure 1 the hydraulic jack includes a cylinder 3, and a piston 4 movable therein against the action of a spring means 5. The fluid is fed from a source exemplified by an oleopneumatic accumulator 6 through a feeding duct 8 to the liquid dumping arrangement of the invention from whence fluid passes into the cylinder 3. A three-way valve 7 is associated with the feeding duct 8 and a discharge pipe 29 is operably associated with the valve 7, the body of which can effect flow of fluid through the valve from source into the feeding duct or reverse flow from the feeding ducts into the pipe 29. The embodiment of Figure 1 includes a main part 1 that is formed of two parts, 1a and 1b. The body part 1a is a hollow body that is provided intermediate its ends with a disk shaped partition 70 that is provided with fluid passages as set forth hereinafter. The major extent of the hollow body 1a is cylindrical and defines a cylinder 12 within which is slidably disposed a piston body or movable partition 13. One end of body part 1a is internally threaded at 2 and secured to external threads provided at the upper end of jack cylinder 3. The other end of body part 1a is externally threaded to receive an internally threaded cap element 31. The cap element being secured over the cylinder portion of body 1a after the piston 13 and a compression spring 27 normally biasing the piston 13 downwards has been inserted in the cylinder 12. A feed pipe section 10 is secured to the cap element 31 and extends coaxially thereabove. The body part 1b is tubular and has its lower edge 71 disposed in an annular groove 70' provided on a shoulder or flange 72 extending radially of the cylinder 12. The tubular body 1b is disposed over the upper end of the feed pipe section 10. Since the upper end 9 of the feed pipe is externally threaded, an internally threaded nut 32 is screwed down over the upper end of feed pipe 10 to clamp the tubular body 1b to the hollow body part 1a. The feeding duct 8 is suitably connected to the upper end 9 of feed pipe 10 so that fluid under pressure can flow from the accumulator through the feed pipe 10 and into the upper end of cylinder 12. The movable partition or piston 13

3

divides the interior of cylinder 12 into a first or upper compartment above piston 13 and a second or lower compartment adjacent partition 70. The piston 13 is centrally bored to provide an axial passage that terminates in a projection 18 that forms a valve body. The disk shaped partition 70 is provided with at least one longitudinal port 14 providing fluid communication between the lower compartment of cylinder 12 and the upper end of cylinder 3. The partition 70 is also provided with a blind axial bore 15a and at least one radially extending port 15b communicating with the blind axial bore so that the bore 15a and port 15b constitute a fluid discharge passage controlled by the valve body 18. Within the central bore in the piston 13 is disposed a non-return valve arrangement which includes a lower tubular abutment 23 provided with a flange that receives a compression spring 22, an upper abutment element 24 that is hollow, has radial ports therein and a closed end upon which rests a ball valve 21. The spring 22 normally biases ball valve 21 against the inner end of a tubular plug element 33 which secures the valve assembly in place. The projection or valve body 18 is provided with radial ports 25 so that liquid can flow through the piston 13 past the ball valve 21 out of the radial ports 25, through longitudinal port 14 and into the cylinder 3 to move the piston 4 in its active stroke.

The space between the periphery of the cylinder 12 and the interior of the tubular body part 1b provides a reservoir or auxiliary tank arrangement that is directly coupled to the casing of the dumping valve. The interior of the hollow body part 1b is provided with a frusto-conical wall 30 that surrounds the cap element 31 and provides a collecting zone for any impurities that may be in the fluid in the system. The fluid is discharged from the upper portion 17 of the auxiliary tank through an outlet pipe 28. The reduced upper part of the tubular body 1b is provided with an aperture 26 in communication with atmosphere.

It is to be pointed out that the discharge passage 15a, 15b is of larger cross-section than the longitudinal port 14 and that the upper part of the tubular body 1b forms with the annular passage or space 16, the intermediate or auxiliary tank. The annular space 16 providing a very large cross-section for a discharge of fluid so as to avoid loss of pressure downstream of radial port 15b.

The compression spring 27 continuously urges piston 13 downwards so as to press valve body part 18 in sealing engagement with the upper edge of blind axial bore 15a. This arrangement being intended to prevent the emptying of feeding duct 8 which could occur if valve body 18 were not held on its seat when the system is not under pressure.

If desired, the structure could be modified by discharging fluid from the upper end of hollow body part 1b back into feeding duct 8 through the non-return valve 34 illustrated in dotted lines.

It is clear, therefore, that the form shown in Figure 1 provides a compact assembly of three major components, namely, a valve casing that is secured directly to the cylinder of the jack and is provided with the partition having the inlet port to the jack cylinder and the exhaust port, a movable piston valve 13 provided with packing rings 19 is received in the cylinder portion of the valve casing and a combined cap and feed pipe portion consisting of pipe 10 and cap 31 closes the upper end of the cylinder of the valve casing. The unit further includes the auxiliary tank provided by the hollow body part 1b that is clamped against the flange 71 on the body part of the valve casing.

This device operates as follows:

At rest, the control valve 18 is held seated under the action of the spring 27 to close the blind axial bore or outlet port 15a. The accumulator 6 is placed into communication with the axial feed pipe 10, by actuating three-way cock 7. The liquid under pressure flows

4

into the jack cylinder 3 through the feeding duct 8, the axial feed pipe 10, the axial passage 20, the radial ports 25 in valve body 18, the lower compartment of the cylinder 12 and the longitudinal inlet ports 14. This flow of fluid passes the non-return valve, the ball element 21 of which is moved away from its seat due to the pressure of the incoming liquid.

When the pressure built up in the jack cylinder 3 overcomes the strength of the spring 5, the piston 4 travels its active stroke and compresses the said spring.

As soon as there occurs a reverse flow of fluid in the feeding duct 8, the piston 13 is displaced upwardly (in Fig. 1) and the control valve body part 18 is lifted off its seat, thus opening the outlet passage 15a, 15b.

This takes place, in particular, whenever the feeding duct 8 is unloaded e.g. by actuating the cock 7 to place feeding duct 8 in communication with pipe 29 that discharges to a suitable tank or reservoir not shown.

In the embodiment of Fig. 2, the device is inverted with respect to that of Fig. 1. The combined valve containing cylinder and partition including body 51 is internally threaded at 52 and connected to the lower externally threaded end of the cylinder 3 of the jack, the piston of which is shown at 4.

As in the first embodiment, the feeding duct 8' is connected to an axial feed pipe 10'. In this form of the invention feed pipe 10' is an integral extension of an internally threaded cap 31' that is threaded over the lower end of hollow body 51. Within the cylinder 12' of the hollow body 51 is slidably mounted a piston 13' constituting the active member of the control device. In the example shown in Fig. 2, the axial feed pipe 10' is externally threaded at its lower end, and supports an annular flange 54 through a nut 55 and counter-nut 56.

The upper face of the flange 54 is provided with two concentrically arranged annular grooves 57, 58. In the inner groove 57 is engaged the lower edge of a jet-regulating tube 59, the upper end of which is engaged over a reduced portion of body part 51 that is defined by an integral shoulder 61 extending around the body part 51 of the device. Near its lower end, the tube 59 is provided with a plurality of openings 62.

In the outer annular groove 58 in the flange 54 is engaged, under interposition of a suitable packing ring, a tubular member 63, the upper edge of which is engaged in an annular groove 64 provided in the lower face of an annular flange 65 screwed on the upper end of the jack cylinder 3. The top edge of the tubular member 63 is provided with a small notch 60 to place the interior of tubular member 63 in communication with atmosphere. As an illustration, the drawing has been completed by two bolts 66 passing through the upper annular flange 65 and which may be used to support the whole assembly including the hydraulic jack cylinder 3 and the control device according to the invention.

It is to be noted that the upper flange 65 may be first screwed home on the cylinder 3 of the jack, whereupon the position of the lower flange 54 along the axial feed pipe 10' may be adjusted so as to securely clamp the tubular member 63 between both flanges. To ensure that the clamping action exerted on the outer tubular member 63 and not on the jet-calibrating or regulating tube 59, the latter is freely mounted between the groove 57 and the annular shoulder 61. An overflow discharge pipe 67 is mounted in the flange 54 and constitutes together with the tubular member 63 the intermediate collecting tank. The overflow or discharge pipe 67 is disposed in the annular space between the jet-regulating tube 59 and the outer tubular member 63, preferably up to a level located above the upper end of the tube 59. The discharge pipe 67 is connected at its lower end to a tube-union 68 adapted to receive, for example, a flexible pipe for returning the liquid to a tank or storage container not shown.

In the embodiment shown in Fig. 2, once the jack

emptying process is triggered, which takes place upon any reverse flow in the feeding duct 8', for example due to a remotely controlled unloading of the same, as in the first embodiment, the liquid previously contained in the cylinder 3 of the jack flows through the passages 14', 15'a, 15'b into the annular space comprised between the cylinder defining part of body 51 and the jet-regulating tube 59 and; hence, through the opening 62 in the said tube, into the annular space comprised between tube 59 and the outer tubular member 63, until it reaches the upper end of the overflow pipe 67. If its level further rises the liquid collected in the intermediate tank can then return to a storage container through the discharge pipe 67 and the union 68. It is to be noted that this arrangement permits the return to the container of liquid from the intermediate tank at a level therein where there are practically no eddies, so as to avoid introduction of air bubbles into the liquid storage container.

What is claimed is:

1. In combination with a hydraulic jack, including a cooperable piston and cylinder means, at least one of which is adapted to be displaced against a counteracting force by liquid under pressure fed to said means, a duct for feeding liquid to said cylinder and piston means, mechanism for dumping the liquid contained in the jack after the displacement of one of said piston and cylinder means without passing the liquid being dumped through said duct, said mechanism comprising a hollow body defining a chamber that is coaxial with said cooperable cylinder and piston means, said body including a disk shaped partition separating the chamber from the cylinder and piston means, a movable partition within the chamber and dividing the same into a first compartment adjacent the duct and a second compartment adjacent the cylinder and piston means, means placing said first compartment in communication with said duct, said disk shaped partition having a blind axial bore therein opening into the second compartment of said chamber and at least one radial port communicating at one end with said blind axial bore so as to provide a liquid dumping passage, said disk-shaped partition further having at least one longitudinal port therethrough providing fluid communication between the second compartment and the cylinder and piston means of the jack, a control valve body integral with said movable partition and extending into said second compartment and adapted to seat against said blind axial bore to control fluid flow through said liquid dumping passage, said movable partition having passage means therethrough interconnecting said first and second compartments, and a non-return valve means in said last mentioned passage means to prevent liquid from flowing back toward said first compartment from said second compartment, whereby upon the occurrence of reverse flow in said duct said movable partition moves away from said blind axial bore to move said valve body to expose said liquid dumping passage to provide dumping of the liquid from the cylinder and piston means under the action of a counteracting force applied against one of said cylinder and piston means.

2. A combination as claimed in claim 1 in which the body defining the chamber and including the disk-shaped partition is directly secured to the cylinder means of the jack and said partition constituting a closure for one end of the cylinder.

3. The combination as claimed in claim 1 and an auxiliary tank having a portion of its wall disposed around said disk-shaped partition and spaced from said radial port to receive liquid flowing through said dumping passage.

4. The combination as claimed in claim 1, and including bleeding means to withdraw liquid from said auxiliary tank.

5. The combination as claimed in claim 1 and further comprising an auxiliary tank fed from said liquid dumping passage and means to communicate said auxiliary

tank with said feeding duct through a non-return valve.

6. A liquid dumping arrangement for rapidly effecting discharge of liquid from a hydraulic jack including a cylinder and piston, said dumping arrangement comprising a hollow body member defining a control cylinder and having one end secured in coaxial relationship with said jack cylinder, feed pipe means communicating with the other end of said hollow body member and extending in axial alignment with the control cylinder of the hollow body member, said hollow body member further including a disk-shaped partition separating the jack cylinder from the control cylinder within the hollow body member, said disk-shaped partition having at least one longitudinal bore therethrough providing communication between the control cylinder and the jack cylinder, said partition having therein a blind axial bore opening into said control cylinder and at least one radial port providing communication between said blind axial bore and the exterior of the hollow body member so that the radial port and blind axial bore constitute a liquid dumping passage, a piston valve slidably mounted within said control cylinder and including a body portion adapted to seat against said blind axial bore, said piston valve having a liquid conducting passage therethrough whereby liquid flowing under pressure through said feed pipe can flow to the jack cylinder via said longitudinal bore, with said blind axial bore being closed, and in response to reverse flow of fluid in said feed pipe said piston valve is movable away from said disk-shaped partition to expose said blind axial bore to permit dumping of liquid from the jack cylinder, a flange means axially spaced from said radial port and extending radially beyond said hollow body, a tubular member coaxial with said hollow body and surrounding the same in spaced relation, means coupling one end of said tubular member to said flange means so as to define exteriorly of said control cylinder, a liquid collecting tank and bleeding means for discharging liquid from within said tubular member.

7. A combination as claimed in claim 6 in which said flange means is connected to said jack cylinder, a second flange means mounted on said feed pipe, each flange means having an annular groove therein, said grooves facing one another and the opposite ends of said tubular member being disposed in the respective grooves in the flange means.

8. A device according to claim 6, further comprising a discharge regulating tube mounted around said control cylinder and within said tubular member, said tube being secured at one end on said flange means and having at least one opening therethrough so as to provide communication between opposite sides of the tube, and said bleeding means being located outside said tube.

9. A device according to claim 8, wherein said tube is engaged at one end in a circular groove provided on said flange means and an annular shoulder provided around said cylinder receiving the other end of said tube.

10. A device according to claim 8, disposed with its axis substantially vertical and with said second flange down, wherein said bleeding means are constituted by a vertical port provided through said second flange between said tube and said tubular member and by a vertical overflow pipe implanted in said port.

11. A device according to claim 10, wherein said overflow pipe extends upwardly to a level above the top end of said tube.

12. In a liquid dumping valve arrangement for a hydraulic jack, a tubular body having a transverse partition intermediate its ends dividing said body into a first and a second compartment on opposite sides of the partition, means for connecting one end of the body in fluid-tight relationship with a hydraulic jack of the type including a cylinder and piston means, one of which is movable in response to fluid under pressure against a counteracting force, means connecting the other end of the body in fluid-tight relationship with a source of fluid under pres-

sure, said last mentioned means including a feed pipe fitting coaxial with said body, and said hydraulic jack, said first compartment being adjacent said hydraulic jack and said second compartment being adjacent said feed pipe fitting, said partition means having at least one longitudinal port therethrough establishing fluid communication with said jack, said partition means further having a passage means therein communicating between said second compartment and the exterior of said tubular body, a ported movable valve body within said second compartment and adapted to close said passage means in response to entry of fluid under pressure to said feed pipe fitting and a tubular member disposed coaxially about said tubular body in spaced relation thereto and means connecting said tubular member in fluid-tight relationship to one of said tubular body and feed pipe fitting respectively, whereby fluid can be dumped from said hydraulic jack through said passage means into the space between the tubular body and said tubular member and means for withdrawing dumped fluid from said tubular member.

13. A liquid dumping arrangement for connection between a source of pressure and a hydraulic jack and adapted to exhaust fluid from said jack comprising a vertically disposed tubular body having a partition intermediate its ends, a first passage means through said partition, a second passage means communicating between one side of said partition and the exterior of said body, a movable and ported piston valve disposed within said body on that side of the partition adjacent the last mentioned passage means and adapted to control fluid flow through said last mentioned passage means, a feed pipe fitting means connected to said tubular body adjacent said movable valve and an annular reservoir means connected in fixed relation with respect to said tubular body and having an axial extent at least greater than the distance between said second mentioned passage means and the point of connection of the tubular body to said feed pipe fitting, whereby in response to decrease in pressure upstream of said movable valve said second mentioned passage means is opened and fluid can flow through said first mentioned passage means and said second mentioned passage means into the space beyond said tubular body, as delimited by said annular reservoir

means and means for withdrawing fluid from said annular reservoir means.

14. In combination with a hydraulic jack of the type including a cylinder, a piston movable in the cylinder against the action of the counteracting force, means for rapidly exhausting fluid from said jack cylinder comprising an open ended tubular body, means for connecting one end of said body to said jack cylinder, a partition means extending transversely of the tubular body immediately adjacent said jack cylinder, said partition means having at least one port therethrough providing communication with said jack cylinder, said partition means further having a port therethrough providing communication between the exterior of the tubular body and the space within the tubular body upstream of said cylinder, a ported piston valve within the tubular body adapted to cooperate with said last mentioned passage means, and means connecting the opposite end of said tubular body to a source of fluid under pressure, whereby fluid can be fed through said piston valve and partition into said cylinder to actuate the piston of the jack against a counteracting force and in response to a decrease in pressure on the upstream side of said piston valve, said counteracting force can drive the piston of the jack in the opposite direction with the fluid in the jack cylinder moving said piston valve away from said partition means to expose said second mentioned passage therein.

15. The combination as claimed in claim 14 in which the port through the partition providing communication between the exterior of the tubular body and the space within the tubular body upstream of said cylinder is of greater cross sectional area than the port through the partition that provides communication with the jack cylinder.

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