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POWER CYLINDERS AND PISTONS FOR HYDRAULIC
PRESSES, JACKS AND THE LIKE

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2 Sheets-Sheet 1

FIG. 1

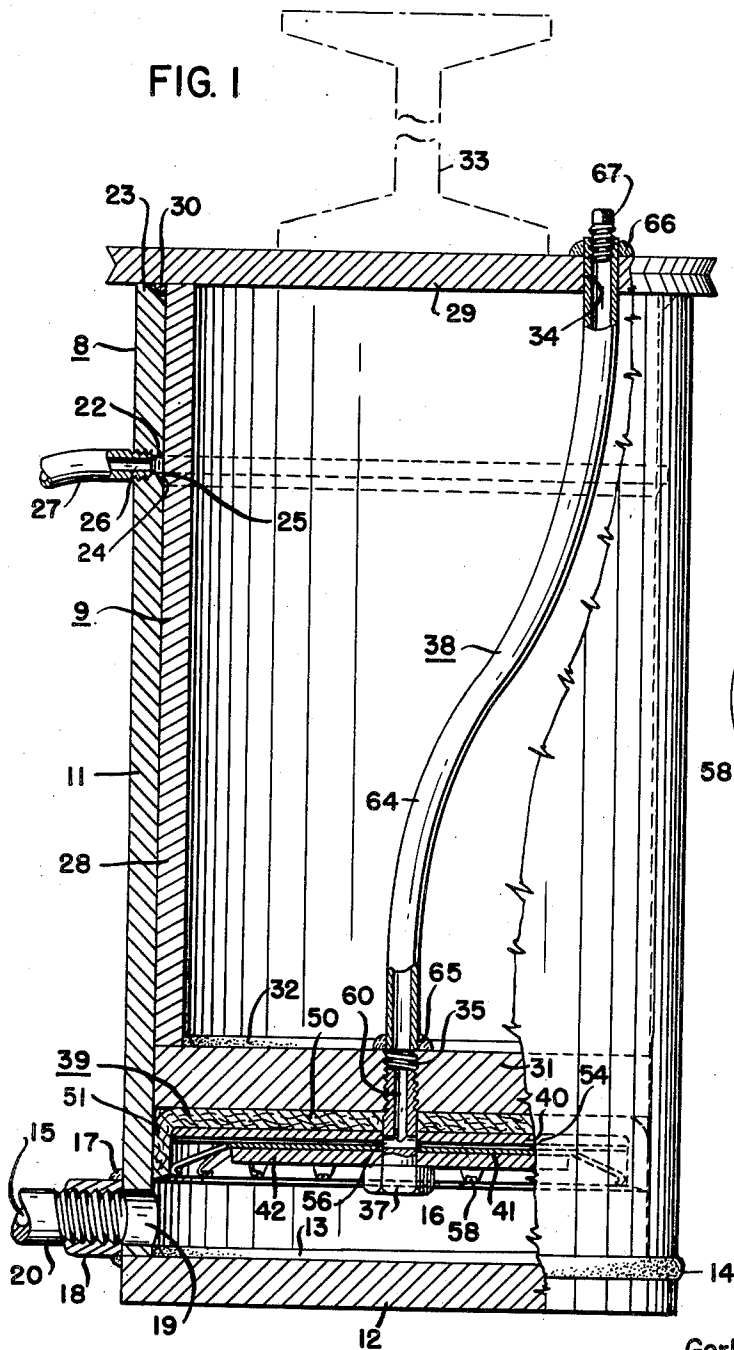


FIG. 2

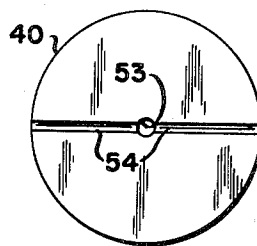


FIG. 3

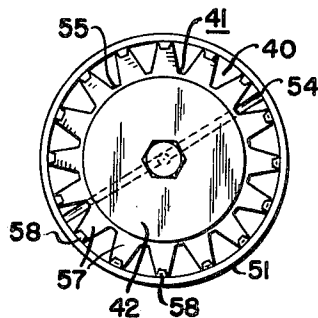
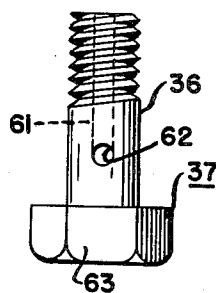


FIG. 4



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POWER CYLINDERS AND PISTONS FOR HYDRAULIC PRESSES, JACKS AND THE LIKE

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This invention relates to units of hydraulic systems and more particularly to improvements in the upright power cylinders and vertically movable pistons of such mechanisms as hydraulic presses, jacks and the like.

The invention has been found particularly useful as a part of the hydraulic systems of machines for cutting stone, of the general character shown in Patent 247,569 to Maxim, dated September 27, 1881. In such machines upper and lower sets of chisels are provided, between which the stone to be cut is disposed, and while the upper set of chisels may be mechanically or hydraulically held against movement after they have been brought into tight engagement with the upper surface of the stone, the lower set of chisels in particular are initially elevated into tight contact with the lower surface of the stone, at which time there is no splitting or dividing pressure exerted upon them, and subsequently pressure applied at about twelve hundred pounds, which, through the chisels, will separate one piece of stone from the other. In such machines a plurality of side-by-side power cylinders and associated pistons are generally provided, because of the width of the machine, and the relatively wide stone slabs to be cut into pieces.

I have discovered that if the power pistons do not apply substantially uniform pressure to the stone to be cut, particularly during this separating phase of the cycle of operation in cutting stone, and throughout the length of the zone where it is desired that the cut occur, unwanted breakage will result, the stone wanted in strip-like form cut from the slab will be in several short pieces. Also if there is not this substantially uniform pressure, the machine will be subjected to undesirable shock, evidenced by a sudden jerk before or when the break occurs in the stone, and the chisels at one zone will be relieved of compression before the compressive force upon the chisels is relieved at another zone or zones.

I have also discovered that this jerky operation and undesirable stone breakages is due in part to air entrained in the hydraulic liquid, such as oil, accumulating beneath the bottom of the piston, in the lower portion of the cylinder. There the air must first be compressed to some extent before the full pressure of the hydraulic liquid is transmitted to the piston.

One of the principal objects of this invention is to provide vertically movable pistons so constructed and arranged that this accumulation of air in the power cylinder may be bled therefrom as soon as the operator notices the system is sluggish, that is, slow in operating or there is this undesirable jerk during operation.

Another object is to provide upright cylinders and companion pistons for use in hydraulic systems, of the character described, constructed and arranged to collect and conserve motive liquid, such as oil, which finds its way past the bottom of the piston to the space between the cylindrical portions of the companion cylinder and piston. This collection and conservation of the motive liquid also promotes cleanliness and reduces the likelihood of the stone being stained by the liquid or the machine and the

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clothing of the workmen becoming unsightly as often occurs where there is leakage of the liquid.

A further object is to provide as a part of a power piston of this character, a flexible cup-disk packing and a spreader for the flange thereof, the spreader being fabricated in such manner as to effectively force the flange into intimate contact with the bore of the companion cylinder, without likelihood of injuring the packing disk.

Other objects and advantages will appear in the following detailed description of two embodiments of the present invention, taken in connection with the accompanying drawings, forming a part of this specification, and in which drawings:

Fig. 1 is a view partly in central vertical section and partly in elevation of one form of combination cylinder and piston for use in a hydraulic system, a typical load member being shown by dot and dash lines.

Fig. 2 is a bottom plan view on a reduced scale of a ported follower for a flexible cup-disk packing forming a part of the piston.

Fig. 3 is a bottom plan view of the piston shown in Fig. 1, on a reduced scale.

Fig. 4 is an enlarged detail view of a ported bolt used to retain the flexible cup-like packing and associated parts to the lower piston head and to provide a way for passage of fluid through said head.

Fig. 5 is a bottom plan view, on a reduced scale, of the flexible cup-disk packing.

Fig. 6 is a plan view, on a reduced scale, of a washer used with a spreader in association with said packing.

Fig. 7 is a view similar to Fig. 1, but showing a modified form of combination cylinder and piston.

In the drawings I disclose an upright cylinder 8 open at its upper end for the reception of a drum-like piston 9, preferably made of steel, as shown in Fig. 1, or a drum-like piston 10, preferably made of cast iron, as shown in Fig. 7.

The cylinder 8 is preferably made to comprise a cylindrical body portion 11, such as of seamless, soft steel tubing and a head 12 at its lower portion, also of steel, welded to the bottom of this body portion, such as by welds 13 and 14. An entrance and exit way 15 for fluid to and from a chamber 16 at the lower portion of the cylinder, above the head 12 is provided, in the example shown, by securing, as by weld 17, a nipple 18 communicating with a hole 19 in the body portion 11, and a pipe 20 screwed into nipple, the pipe being connected to suitable fluid pressure source (not shown).

For a purpose to be subsequently set forth, the cylindrical body portion 11 is provided with a circumferentially extending groove 22 open to its interior adjacent the upper end 23 thereof, the lower wall 24 of the groove being beveled, as at 25, downwardly and inwardly. Also, an exit way 26 leads from groove 22 through the wall of the cylinder and has a pipe 27 communicating with way 26 to carry liquid which finds its way to the groove 22 to any suitable receptacle (not shown).

The piston 9 shown in Fig. 1 is preferably made of three parts, a cylindrical body portion 28 of seamless steel tubing, heat treated to render it very hard, so as to withstand the high pressures and vibration as when breaking stone; an upper head 29 of steel, secured to the upper end of body portion 28 as by weld 30; and, a lower head 31 of steel in the form of a disc, secured to the bottom of body portion 28 as by weld 32. The head 29 in the example shown is a disc of greater diameter than the external diameter of body portion 28 so that it may come to rest upon the upper end 23 of cylinder 8 and limit downward movement of the piston with respect to the cylinder. The upper head 29 may have a load member 33 resting upon it, such as a movable beam of a stone cutting machine (not shown). The head 29 is

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provided with a transverse opening 34, preferably off-set with respect to the axis of the piston and located near the interior of the cylindrical wall of the piston, so as to permit the load member 33 to be centered above the piston and spread a considerable distance toward the opening 34. The lower head 31 is provided with an axial opening 35, preferably screw threaded, so as to receive the screw threaded shank 36 of a ported bolt 37, shown in Fig. 4. This bolt, in the example shown, serves as a part of means 38 for escape of air in chamber 16, entrained by the usual motive liquid, such as oil, to the atmosphere through the upper piston head 29, and also to retain a flexible cup-disk packing 39, a follower 40, a spreader 41 and a washer 42 in place, as shown in Figs. 1 and 3.

I have found, over an extended period of time, that steel is the most satisfactory material for use in making the pistons, since it does not tend to twist or break under strain and the steel parts are more readily welded together than cast iron and steel or even cast iron parts. However, since steel is not at times available for general manufacturing purposes or on the restricted list, such as during war or other emergencies, I have conducted tests using cast iron pistons 10, such as is shown in Fig. 7, where the cylindrical body portion of the piston 45 and a lower head 46 is an integral casting of iron, while an upper 47 may be of cast iron or steel, secured in place as by socket capscrews 48. As in the other form of piston, the upper head 47 is provided with the offset opening 34 and the lower head 46 is provided with the screw threaded opening 35. I have found, however, that the cast iron pistons tend to yield under pressure which causes welding to break.

The flexible cup-disk packing 39 is well known in the art and comprises, as in Figure 5 for example, a flat body portion 50 and a downturned annular flange 51 for intimate contact with the bore of the cylinder 8. The body portion 50 has a centrally located hole 52 through which the shank of bolt 37 extends as shown in Figs. 1 and 7.

As to follower 40, shown particularly in Figure 2, it functions like an ordinary follower associated with a cup-disk packing but in addition thereto serves, in the example shown, as a part of the means 38 as hereinafter described. With this in view, the follower of disk-like shape, has a centrally located hole 53 for the shank of bolt 37, and radially extending grooves 54 open to its lower surface and to the hole 53 as well as the periphery of the body of the follower.

With reference to the spreader 41, it preferably is made of spring steel, and is of improved formation. It comprises a disk-like body 55 (Fig. 3) provided with a centrally located hole 56, for the shank of bolt 37, and fingers 57 extending radially from and disposed in downwardly and outwardly angular relation to the body 55, the outer end portions 58 of the fingers each being curled to substantially a semi-circle with the convex faces of the curls of the fingers engaging the inner face of flange 51 near its free edge. By this construction the life, so to speak, of the cup-disk packing is prolonged, and likelihood of the motive liquid finding its way to the space between the cylindrical portions of the companion cylinder and piston is reduced to a minimum.

The washer 42, shown particularly in Figure 6, is of ordinary formation and may be made of cold rolled steel. It has a central opening 59 through which the shank of bolt 37 extends when the parts are assembled in the relationship shown in Figs. 1, 3 and 7.

The bevel 25 of groove 22 facilitates assembly of the pistons 9 and 10 in their respective cylinders, since the spreader 41 functions to spring the flange 51 of packing 39 outwardly. When the piston is started in the open end of the cylinder, access may be had to the flange 51 to force it inwardly in order to clear the cylinder end, but when the flange 51 reaches the groove 22, it is sprung outwardly to a slight extent and were it not for

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the bevel 25 further descent of the piston in the cylinder would be impeded.

The bolt 37, in order to function as a part of means 38, in the example shown has an axial port 60 in the shank 36 open at the end thereof opposite the bolt head 63, and a diametrical port 62 open to the inner end of port 60. When the bolt is in place in screw threaded engagement with the threaded opening 35 of the piston and the packing 39, follower 40, spreader 41 and washer 42 in proper relationship to one another, the bolt is turned tight with the port 62 in communication with the grooves 54.

The means 38 for escape of air in chamber 16, comprises in the example shown, the bolt 37 and follower 40, previously described, and, as shown in Fig. 1, bleeder pipe 64, the lower end of which is secured to the upper surface of head 31, as by weld 65, and in communication with the opening 35, while the upper end portion of the pipe extends through and beyond the opening 34 in head 29, being welded thereto as by weld 66. The upper end of the pipe 64 may normally be closed by means of a releasable plug 67, such as a plug in screw threaded engagement with the interior of the upper end portion of the pipe. I have found that when the piston is made to comprise the body portion 28, and the heads 29 and 31 of steel, welded together, the pipe 64 may be of solid or rigid material, in contradistinction to flexible pipe, without likelihood of the welds 65 and 66 breaking when the hydraulic system is subjected to high pressure and the stresses and strains, as well as vibration, when the system forms a part of stone cutting machinery.

When the piston is made mainly of cast iron, such as is shown in Fig. 7, I have found the piston would yield under pressure to which it is subjected in stone cutting machinery, and the welding of a solid or rigid pipe, such as is shown in Fig. 1, would break. The means 38 for escape of air in chamber 16 of this type of cylinder and piston combination, where the latter is mainly of cast iron, comprises, in the example shown, the follower 40 and a bolt 37, the shank of which is sufficiently long to extend through and upwardly beyond the opening 35, also an externally threaded nipple 70 which extends through the opening 34 in head 47 and may be in screw threaded engagement with the head or welded thereto, as by welds 71, and a flexible bleeder pipe 72 provided with an upper coupling 73 and a lower coupling 74. The coupling 73 has detachable connection with the lower end portion of nipple 70 and the coupling 74 has detachable connection with the upper end portion of bolt 37. I may also, for convenience, include as a part of means 38, an elbow 75, one leg of which is in screw threaded engagement with the upper end of nipple 70 and the other leg pointed away from the axis of the piston, the latter leg receiving a reducer 76. The outer end of the port of reducer 76 is normally closed by means of a plug 77.

It will be noted that the pipes 64 and 72 are disposed in the space defined by the heads and the body portion of their respective drum-like pistons, where they are in protected positions and no expensive machining or molding of parts is necessary in order to provide this bleeder means in relatively large units.

Should motive fluid in chamber 16 find its way past the packing 39, it is forced upwardly between the cylinder and piston until it enters the groove 22 from which it may be removed, such as by gravity flow, for reuse or disposal as desired and such escaping fluid is not scattered about the machine or workmen in proximity to it.

The bleeding means 38 is normally sealed against escape of fluid therefrom by means of the plugs 67 or 77, as the case may be. When an operator notices that the pressure of the piston, when applied, is slow in its build-up, and then is applied with a sudden jerk, he is apprised that air has entered the system and is below the piston in the chamber 16 of the cylinder. This slowness is caused by the compression of the air which,

when compressed to its maximum, causes the piston to move upward with a jerk. The workman then opens the bleeding means, such as by the removal of the plug 67, or 77, as the case may be, while the piston is in a raised position and pressure is being applied. The air then rushes out of the various ports and ways provided for its escape and when liquid, such as oil, begins to issue from the outlet normally plugged, the bleeding means is closed off, such as by the replacing of the plug. When bleeding means 38 is first opened to the atmosphere, under such conditions as above set forth, liquid will not rush out, because any liquid which has filled the bleeding means as a result of a prior bleeding operation will have found its way back into the chamber 16, because it is heavier than air, and will be displaced by air entrained with the motive liquid.

I claim:

1. In a hydraulic system of the class described, the combination of an upright cylinder open at its upper end and provided with a head at its lower portion and an entrance and exit for liquid to and from a chamber at the lower portion of the cylinder above said head; a drum-like piston reciprocable in said cylinder by said liquid, said piston comprising a cylindrical body portion and upper and lower heads; bleeding means, including a flexible pipe disposed in the space defined by said heads and the body portion of said piston and opening through said heads, carried by said piston providing a way for escape of air in said chamber, entrained with said liquid, said way having an opening to said chamber through said lower piston head and an opening to the atmosphere through said upper piston head; and releasable means normally closing said last mentioned opening.

2. In a hydraulic system of the class described, the combination of an upright cylinder open at its upper end and provided with a head at its lower portion and an entrance and exit for liquid to and from a chamber at the lower portion of the cylinder above said head; a drum-like piston reciprocable in said cylinder by said liquid, said piston comprising a cylindrical body portion, an upper head detachably connected to said cylindrical body portion, and a lower head; bleeding means, including a flexible pipe connected to said heads and disposed in the space defined by said heads and the body portion of said piston, carried by said piston providing a way for escape of air in said chamber, entrained with said liquid, said way having an opening to said chamber through said lower piston head and an opening to the atmosphere through said upper piston head; and releasable means normally closing said last mentioned opening.

3. In a hydraulic system of the class described, the combination of an upright cylinder open at its upper end and provided with a head at its lower portion and an entrance and exit for liquid to and from a chamber at its lower portion and an entrance and exit for liquid to and from a chamber at the lower portion of the cylinder above said head; a drum-like piston reciprocable in said cylinder by said liquid, said piston comprising a cylindrical body portion and upper and lower heads and said piston being provided with a screw threaded hole in the lower head and with a flexible packing at the under portion of the lower head detachably connected thereto by retaining means including a bolt, the shank of which is in threaded engagement with the screw threads of said hole; bleeding means, including a pipe disposed in the space defined by said heads and body portion of said piston, said pipe open to the said way of the said bolt and to the atmosphere through an opening in said upper piston head, said bleeder means being carried by said piston providing a way for escape of air in said chamber, entrained with said liquid, said way having an opening to

said chamber through said lower piston head and an opening to the atmosphere through said upper piston head; and releasable means normally closing said last mentioned opening.

4. In a hydraulic system of the class described, the combination of an upright cylinder open at its upper end and provided with a head at its lower portion and an entrance and exit for liquid to and from a chamber at the lower portion of the cylinder above said head; a drum-like piston reciprocable in said cylinder by said liquid, said piston comprising a cylindrical body portion and upper and lower heads and said piston being provided with a screw-threaded hole in the lower head and with a flexible packing at the under portion of the lower head detachably connected thereto by retaining means including a bolt, the shank of which is in threaded engagement with the screw threads of said hole; bleeding means, including a pipe disposed in the space defined by said heads and body portion of said piston, said pipe open to the said way of said bolt and to the atmosphere through an opening in said upper piston head, said bleeder means being carried by said piston providing a way for escape of air in said chamber, entrained with said liquid, said way having an opening to said chamber through said lower piston head and an opening to the atmosphere through said upper piston head; and releasable means normally closing said last mentioned opening, said bolt being centrally located with respect to said lower piston head and the opening in said upper piston head being eccentrically located, whereby the load upon said piston may engage upon the center of said upper piston head.

5. In a hydraulic system of the class described, the combination of an upright cylinder comprising a cylindrical body member open at its upper end and a head closing the lower portion of said body member, said cylinder provided with an entrance and exit for liquid to and from a chamber at the lower portion of the cylinder formed by said cylindrical body member and head, and said cylindrical body member provided with a circumferentially extending groove open to its interior adjacent the upper end thereof and an exit way for liquid leading from said groove through the wall of said cylindrical body member; and a piston slidably extending into said cylinder, and extending beyond the upper portion thereof, actuated by fluid introduced into said chamber, said circumferential groove adapted to receive liquid finding its way upwardly between said piston and cylindrical body member of the cylinder and exiting from the groove through said piston being provided with a laterally expansible packing at its bottom engaging with intimate contact the bore of said cylindrical body member, and the lower well of said groove being beveled downwardly and inwardly to facilitate insertion of said piston carried packing into the cylinder, past said groove.

References Cited in the file of this patent

UNITED STATES PATENTS

458,223	Crane	Aug. 25, 1891
1,075,468	Edgecomb	Oct. 14, 1913
1,713,907	Lake	May 21, 1929
1,890,244	Barrett	Dec. 6, 1932
2,371,553	Scott	Mar. 13, 1945
2,379,683	Cones	July 3, 1945
2,452,369	Gravenhorst	Oct. 26, 1948
2,455,725	Bell	Dec. 7, 1948
2,596,475	Flygare	May 13, 1952

FOREIGN PATENTS

414,448	France	Jan. 20, 1910
656,338	Germany	Oct. 15, 1936