July 9, 1929. P. WILLMANN 1,720,159

AIR PUMP

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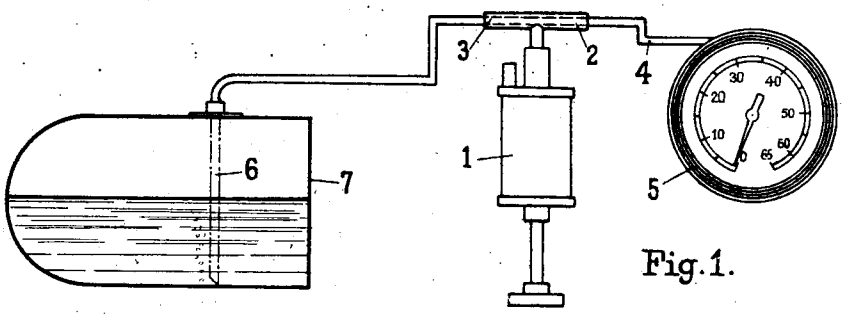

Fig. 1.

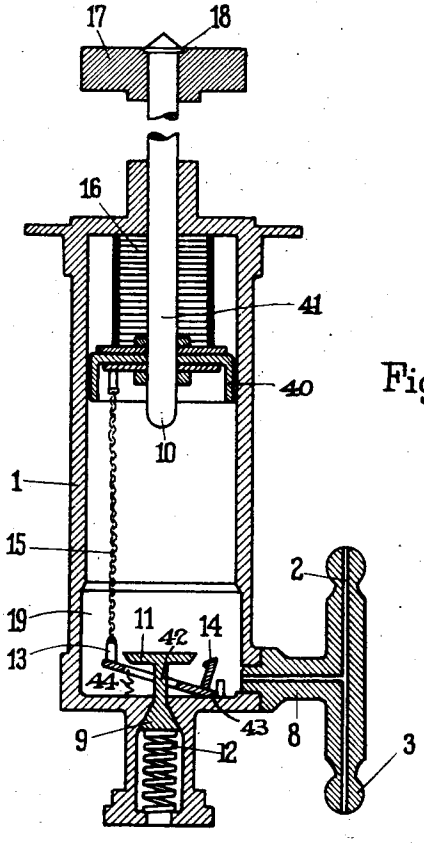

Fig. 2.

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Fig. 3.

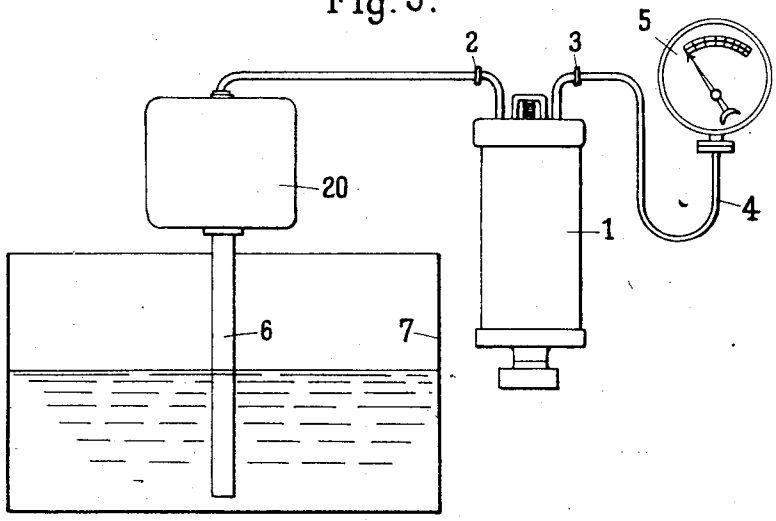


Fig. 4.

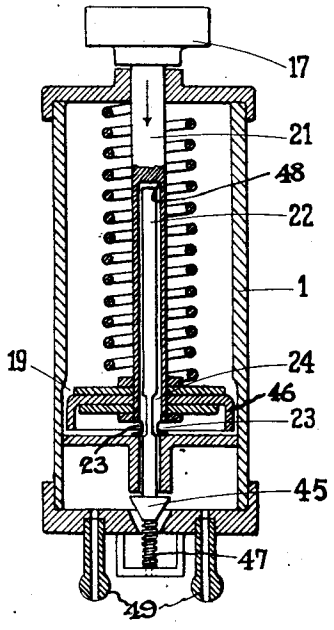
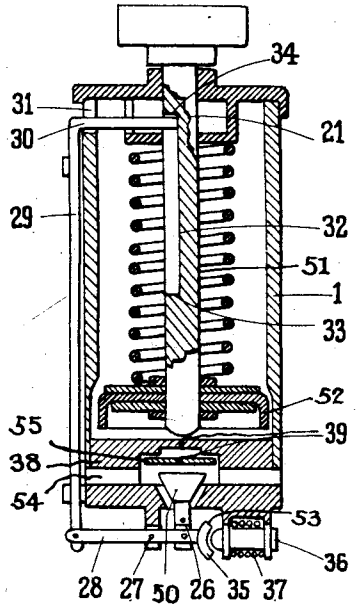


Fig. 5.



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Patented July 9, 1929. 1,720,159

UNITED STATES PATENT OFFICE.

PAUL WILLMANN, OF BERLIN, GERMANY.

AIR PUMP.

Application filed February 9, 1926, Serial No. 87,137, and in Germany April 1, 1925.

My invention relates to improvements in pumps for liquid gages, and more particularly in gages of the type comprising an air pump adapted to deliver air under pressure into the tank containing the liquid at a point near the bottom thereof, and means for measuring the pressure of the said air, which pressure depends on the height of the column of liquid within the tank. One of the objects of the improvements is to provide a system of this type in which the valve of the air pump is controlled from the plunger of the pump through the intermediary of mechanical means, so that the valve is automatically closed immediately at the beginning of the compression stroke and automatically opened immediately at the end of the compression stroke. Another object of the improvements is to provide a pump in which the plunger is automatically moved for performing the compression stroke and retracted by hand for performing the suction stroke. Other objects of the improvements will appear from the following description.

For the purpose of explaining the invention several examples embodying the same have been shown in the accompanying drawings, in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1, is an elevation partly in section showing my improved system,

Fig. 2, is a sectional elevation showing the air pump,

Fig. 3, is a elevation showing a modification of the system, and

Figs. 4 and 5, are sectional elevations showing modifications of the air pump.

In the example shown in Fig. 1 my improved system consists of a tank 7 containing the liquid, an air pump 1 adapted to deliver air under pressure through a pipe 6 and into the tank 7 to a point near the bottom thereof, and means for measuring the pressure of the air delivered from the pump, said means being in the form of a manometer 5. When delivering air from the pump 1 through the pipe 6 the pressure of the said air depends on the height of the column of liquid above the delivery end of the pipe 6. Therefore the said pressure can be used for determining the level of the liquid within the tank.

In the example shown in Fig. 2 the air pump consists of a cylinder 1 provided at its bottom with a tubular member 8 having a small bore and carrying two nipples 2 and 3, the nipple 2 being connected with the manometer by a pipe 4, and the nipple 3 being connected with the pipe 6. Within the pump there is a piston or plunger 40 connected with a rod 41. At the bottom end of the cylinder there is a valve 9 acted upon by a spring 12 tending to close the valve. At its inner end the stem 42 of the said valve carries a disk 11. The rod 41 is provided at its bottom end with a projection 10 adapted to engage the disk 11 for opening the valve 9 against the action of the spring 12. The disk 11 is adapted to be locked when the valve 9 is in depressed, open position by means of a pawl 14 carried by a lever 13 which is rockingly mounted at the end 43 and is acted upon by a spring 44 which tends to hold the pawl 14 in locking position. The lever 13 is connected by a chain 15 with the plunger or piston 40.

Preferably the cylinder 1 of the pump is provided near its bottom with a portion of enlarged inner diameter 19 for the purpose hereinafter stated.

In the operation of the system the projection 10 of the rod 41 engages the disk 11 when the plunger 40 is near the lower limit of its stroke and hence depresses said disc and the valve 9 so that the latter is opened. The disc is locked in such depressed position by the pawl 14 which is moved by the disc against the action of the spring 44, as will be understood. When the plunger 40 moves upwardly the valve 9 is held in open position by said pawl and disc so that fresh air is admitted to the cylinder 1. At the end of the upward or suction stroke of the plunger 40 the lever 13 is pulled upwardly by the chain 15 so as to cause the pawl 14 to release the disk 11 under the action of the spring 44, whereupon the valve 9 is moved to closed position by the spring 12. The valve is closed before the plunger is forced downwardly for delivering air into the tank 7. During the downward or compression stroke the air delivered through the nipple 3 has to overcome the pressure of the column of the liquid confined within the tank 7. The manometer 5 indicates the said pressure and therefore the level of the liquid within the tank. Near the end of the compression stroke the plunger 40 gets into the portion 19 of enlarged diameter so that its frictional resistance is suddenly reduced, and the valve 9 is forced downwardly by the projection

10, the valve 9 being locked in open position by the pawl 14. Now the plunger 40 is again moved upwardly in the manner described above.

In constructions now in use the plunger 40 is forced downwardly by hand. I prefer to provide automatic means for this purpose, and as shown a spring 16 is provided within the upper part of the cylinder 1, which spring serves to force the plunger downwardly. Preferably the handle 17 is not fixed to the rod 41, but is axially shiftable thereon, so that it may be used only for pulling the plunger upwardly, the rod 41 being provided at its top end with a collar 18 which forms a stop for the handle. Therefore no downward pressure can be exerted by hand on the hand piece 17 and hence the plunger 40 is forced downwardly solely by the spring 16.

The modification shown in Fig. 3 is similar to the one described with reference to Figs. 1 and 2, and the same reference characters have been used to indicate corresponding parts. But the pipe 6 is not directly connected with the nipple 3, but through the intermediary of a receptacle 20 the capacity of which is equal to the capacity of the cylinder 1. If by accident the valve 9 should not be opened at the beginning of the suction stroke, the liquid taken upwardly through the pipe 6 by the vacuum within the cylinder 1 fills the receptacle 20 and does not enter cylinder 1.

In Fig. 4 I have shown a modification of the air pump 1 in which the valve 45 is closed by the plunger or piston 46. As shown the valve 45 is acted upon by a spring 47 tending to open the same, and it carries a stem 22 loosely disposed within an axial bore 48 of the rod 21 of the plunger or piston 46. The said stem 22 is formed with a portion 24 of reduced cross-section, and to the plunger 46 two clamping springs 23 are secured, which are adapted for clamping engagement with the main portion of the stem 22. In the position of the plunger 46 shown in Fig. 4 the clamping springs 23 are adjacent to the portion 24 of reduced diameter, and are out of frictional engagement with the rod 22. The spring 47 opens the valve 45. When moving the plunger 46 upwardly by means of the handle 17 for performing the suction stroke of the pump the clamping springs 23 engage the stem 22 thus holding the valve 45 away from its seat. At the beginning of the downward or compression stroke of the plunger the stem 22 is forced downwardly by its frictional engagement with the springs 23, so that the valve 45 is closed, until the springs 23 get into the position shown in Fig. 4, in which the spring 47 opens the valve.

Fig. 4 shows separate nipples 49 for delivering the compressed air to the pipe 6 and the manometer 5.

In Fig. 5 I have shown a modification of the pump in which the valve is positively connected with the plunger for being opened and closed thereby. As shown the valve cone 50 carries a stem 26 jointed to a lever 28 rockingly mounted at 27 and connected with a rod 29. The upper end of the said rod is bent inwardly as is shown at 30, and passes through a slot 31 of the wall of the cylinder 1 and the extreme end of said rod 29 engages slidably in a slot 32 of the piston rod 51.

In the position of the parts shown in Fig. 5, the valve 50 is open. If now the plunger 52 is moved upwardly for performing the suction stroke the walls of the slot 32 slide along the end 30 of the rod 29 without engaging the same, and at the end of the upward movement of the plunger the shoulder 33 which forms the lower end of said slot 32 engages the end 30. Thereby the lever 28 is rocked upwardly at its left hand end and downwardly at its right hand end, thus closing the valve 29. If now the plunger 52 is moved downwardly for performing the compression stroke the slot 32 does not act on the rods 29, 30, until the shoulder 34 at the upper end of the slot engages the arm 30 and moves the left hand end of the lever 28 downwardly and its right hand end upwardly, thus opening the said valve. For locking the valve in either position the lever 28 is formed at its right hand end with a concave portion 35 engaged by a latch bolt 36 adapted to be pressed into the concave portion by a spring 37. Thus the bolt locks the valve cone 50 in the position shown in Fig. 5. When forcing the valve cone 50 downwardly and on its seat the bolt 36 rides on the concave portion 35 and engages an inclined face 53 of the lever 28 thus holding the valve cone on its seat.

In Fig. 5 a partition wall 38 is provided at the lower end of the cylinder 1 and above the intake valve 50 and the outlet passages 54, and in a recess of the said partition wall there is a plate 55. The said plate and the partition wall 38 are provided with small bores 39 adapted to throttle the air forced by the plunger 52 through the outlet passages 54 to the manometer 5 and the pipe 6. By the said bores 39 the flow of the air from the cylinder 1 to the manometer 5 and the pipe 6 is throttled in case the pressure within the cylinder 1 is too high. Hence the pressure transmitted to the pipe 6 and the manometer 5 does not exceed the normal, even if an excessive pressure is exerted on the plunger.

While in describing the invention reference has been made to particular examples embodying the same I wish it to be understood that my invention is not limited to the

constructions shown in the drawings, and that various changes may be made in the general arrangement of the apparatus and the construction of its parts without departing from the invention.

I claim:

1. A hand operated air pump comprising in combination, a cylinder, a piston therein having a rod provided with a handle, a spring active to impart a stroke to the piston in one direction, a valve controlling an inlet port in one end of the cylinder, a spring tending to close said valve, a latch device to hold said valve open, a connection between the latch device and the piston to release the valve by movement of the piston against the tension of the first named spring, means on the piston to reengage said valve and latch device and a fluid outlet in the discharge end of the cylinder.

2. A hand operated air pump comprising in combination, a cylinder, a piston therein having a rod provided with a handle, a spring to impart stroke to the piston in one direction, a valve controlling an inlet port of the cylinder, means cooperative with the piston to operate the valve at the end of a stroke of the piston and a fluid outlet in the discharge end of the cylinder.

3. A hand operated air pump comprising in combination, a cylinder, a piston therein having a rod provided with a handle, a spring active to move the piston in one direction, a valve controlling an inlet port of the cylinder, a spring active to move said valve in one direction, means connecting the valve to the piston for movement by the latter during a part of the movement of the piston and for release of the valve during the remainder of such movement of the piston.

In testimony whereof I hereunto affix my signature.

PAUL WILLMANN.