No. 650,222. Patented May 22, 1900.

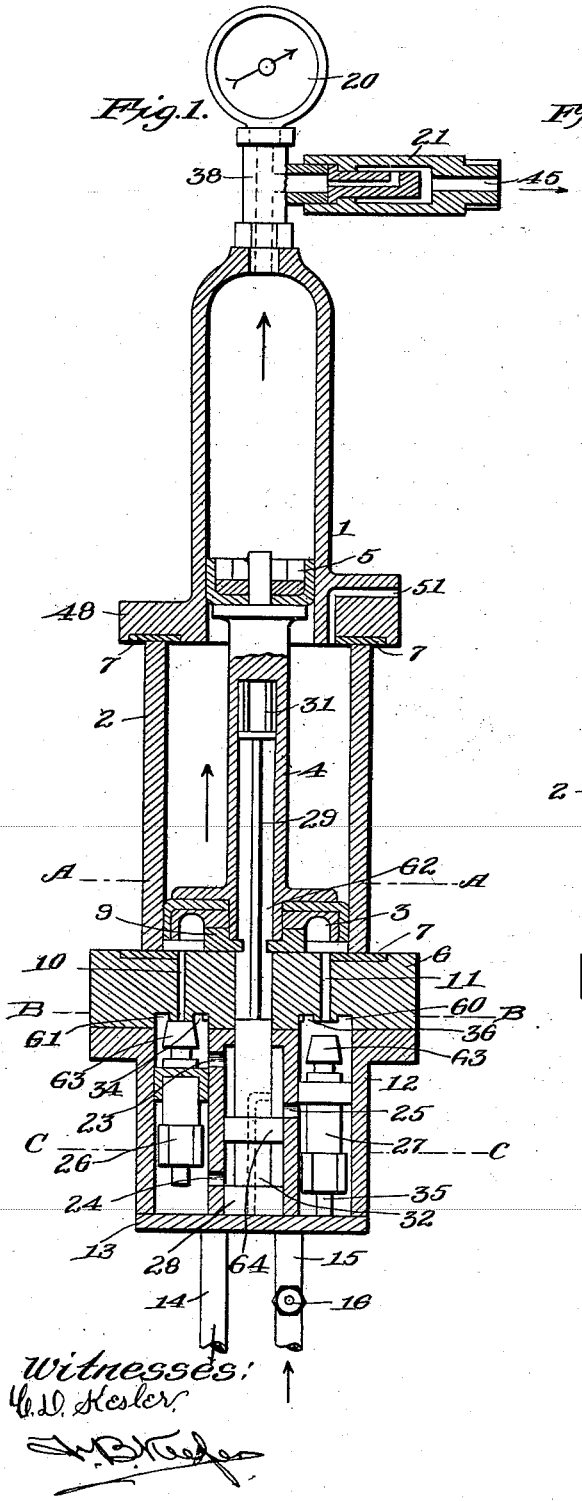
J. F. BEINS.

FLUID PRESSURE ENGINE.

(Application filed Aug. 17, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses:
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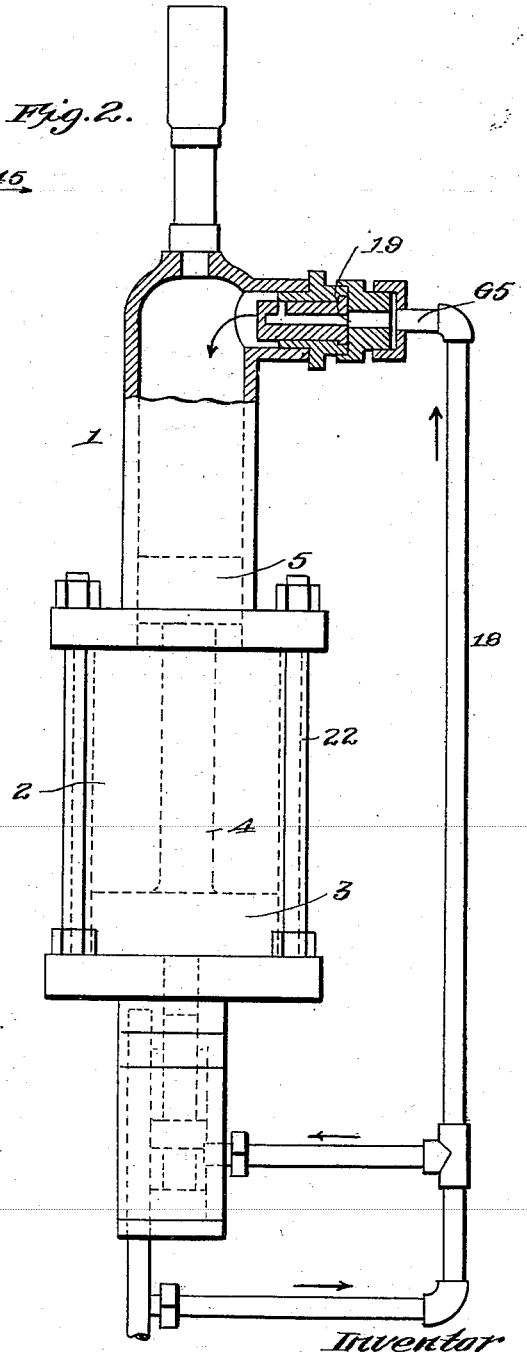
W. B. Taylor

Fig. 2.



Inventor
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Fig. 3.

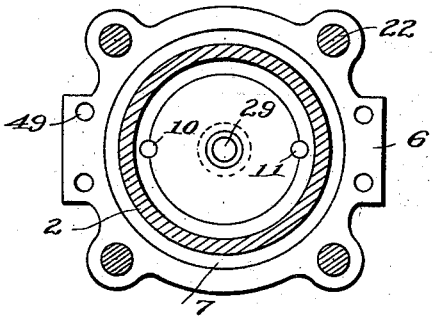


Fig. 4.

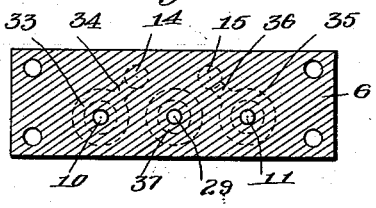


Fig. 5.

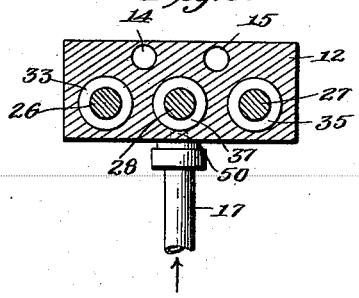
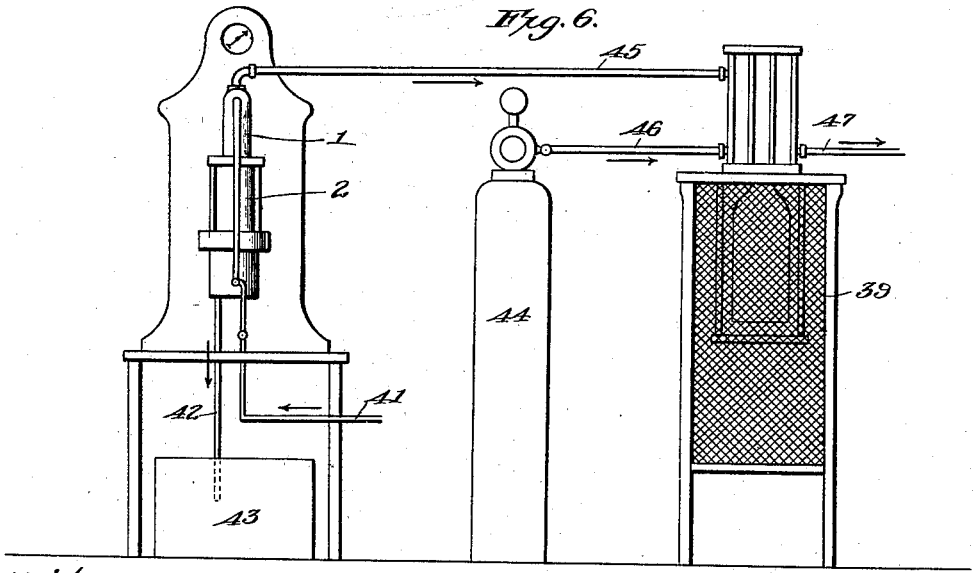


Fig. 6.



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UNITED STATES PATENT OFFICE.

JAN FREDERIK BEINS, OF ROTTERDAM, NETHERLANDS.

FLUID-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 650,222, dated May 22, 1900.

Application filed August 17, 1899. Serial No. 727,559. (No model.)

To all whom it may concern:

Be it known that I, JAN FREDERIK BEINS, analytical chemist, a subject of the Queen of the Netherlands, residing at No. 3 Burgemeester Hoffmanplein, Rotterdam, in the Kingdom of the Netherlands, have invented certain new and useful Improvements in Fluid-Pressure Engines, of which the following is a specification.

My invention resides in an apparatus by means of which the energy which is ordinarily lost in the daily use of water and gases from service pipes or mains may be utilized for industrial purposes. In general such gases or fluids under pressure—for example, water in service pipes and mains—are too expensive for use as motive agents, and my apparatus is especially serviceable in cases where the pressure would otherwise go to waste unutilized or where the cost of the same is of slight importance. As the apparatus is more especially designed for converting a low pressure into a higher one or the reverse, I have called the same a "transformer."

The uses to which the transformer may be put are numerous. For example, it may be utilized in connection with mineral-water plants in the manufacture of mineral waters or in raising water to those stories of a building for which the initial pressure is inadequate, in which instances a motive fluid is utilized the pressure of which would otherwise be unsuitable or lost, or it may be used in extinguishing fires, in which instance the loss of a portion of the water taken from the source of power would be comparatively unimportant.

The object of the invention, therefore, is to provide an apparatus for automatically raising the pressure of water from a conduit or service-pipe to a higher pressure rapidly and in sufficient quantities to meet the requirements.

The invention consists of the construction, combinations, and arrangements of parts, which will be hereinafter more fully described and claimed.

In the drawings forming part of this specification, Figure 1 is a vertical section of the apparatus. Fig. 2 is a sectional elevation at right angles to Fig. 1. Fig. 3 is a horizontal section taken on the line A A of Fig. 1. Fig. 4 is a similar section on the line B B of Fig. 1. Fig. 5 is a similar section on the line C C of Fig. 1, and Fig. 6 is a view illustrative of the application of the device to a mineral-water machine.

Like reference-numerals indicate like parts in the several views.

In carrying out my invention I employ a small cylinder 1 and a large cylinder 2, arranged one above the other, in which are respectively located a small piston 5 and a large piston 3, the said pistons being connected together by a hollow piston-rod 4. The movements of the pistons are controlled by automatic valve mechanism arranged beneath the larger cylinder. The space in the cylinders between the pistons 5 and 3 is maintained in free communication with the atmosphere through the vent or port 51. Water under pressure from the service pipe or main is admitted below the larger piston 3 and water from the same source is forced away from above the smaller piston 5 through the port 45. The pressure of the latter will depend upon the relative areas of the two pistons considered in connection with the pressure in the service-pipe. For example, if the ratio between the piston areas be as one to four and the pressure in the service-pipe be two atmospheres per unit of area a pressure of eight atmospheres per unit of area will be developed above the smaller piston 5.

The admission and exhaust of the pressure fluid are controlled by the piston-slide 28, while the position of the piston-slide itself is controlled by the two pistons 5 and 3.

The pressure of the water from the service pipe or main is employed for driving the two pistons upwardly for operating the inlet and outlet valves 27 26 and for driving the two pistons downwardly. Thus it will be seen that the operation of the device is automatic throughout.

In constructing the apparatus the pistons 5 and 3 are packed with leather, the piston-rod 4, which connects the two pistons together, being hollow for a portion of its length. The larger cylinder 2 is secured by bolts 22 between the flange 48 at the lower end of the small cylinder 1 and an end or

base-plate 6, leather washers 7 being provided to render the joints water-tight. To the end plate 6 is secured a valve-chest 12, the latter being provided with an inlet-passage 14, an outlet-passage 15, and valve-chambers 33 35 37 and closed by a cover or lid 13. The inlet-valve chamber 35 and the outlet-valve chamber 33, wherein the inlet and outlet valves 27 and 26 are respectively located, are disposed one on either side of the chamber 37, within which the piston slide-valve 28 works. The passages 15 and 14 are utilized for the admission and exhaust. The end or base plate 6 of the larger cylinder has depressions 60 and 61, which are in line with the chambers 35 and 33, while a central passage 62, which traverses the said plate 6, coincides with the piston-valve chamber 37.

The inlet-valve chamber 35 is in communication with the admission-passage 15 through a small port 36, located in the upper part of the corresponding depression 60 in the end or base plate 6, the outlet-valve chamber 33 being in similar communication through the port 34 with the exhaust-passage 14. The inlet and outlet valve chambers 35 and 33 are also provided with ports 11 and 10, respectively, which traverse the said base-plate 6 and communicate with the space below the piston 3 in the larger cylinder 2. Both the inlet and outlet valves 27 and 26 are, moreover, formed as small pistons, and each is provided with a leather cup or packing 23. The inlet-valve 27 is of a light, while the outlet-valve 26 is of a heavy, construction. These valves are adapted to slide in the chambers 35 and 33 and are each provided with an india-rubber cap 63 for effecting the closing of the respective ports 11 and 10, which communicate with the larger cylinder 2. The lower portion of each valve is extended to serve as a guide.

The piston slide-valve 28 is provided with a leather cup 64 at its upper and lower extremities. From the upper extremity of the said valve projects a stem 29, which works through a cap or nut 9 at the lower end of the hollow piston-rod 4 and which is provided with a disk 30, the outer extremity of the stem entering a reduced portion of the bore of the hollow piston-rod, or a hollow cylindrical body 31 may be fitted in the said bore, so as to form a shoulder for the disk 30 to abut against. This cap or nut 9, in conjunction with the shoulder 31 in the hollow piston-rod, operates the piston slide-valve 28 according as the one or the other comes into contact with the said disk 30. The disk 30 is made adjustable on the stem 29, so that the stroke of the valve 28 may be accurately regulated. The annular space in the piston-valve chamber 37 between the cupped extremities 64 is permanently in communication with the pressure fluid by means of a branch pipe 17, extending from the service-pipe to a port communicating with the annular space formed by the valve 28 in the valve-chamber and having a nozzle 50 thereon. The said piston slide-valve 28 is perforated at 32, so that the spaces above and below the said valve are in communication with each other. The space in the chamber above the piston slide-valve communicates, through a passage 23, with the space above the piston of the outlet-valve 26.

At a point near the upper end of the smaller cylinder 1 is an inlet 65, furnished with a check-valve 19 and with which the service-pipe 18 is connected. The discharge-orifice 38 is situated at the top of the cylinder 1, is provided with a pressure-gage 20, and communicates with a discharge-pipe 45, which is provided with a back-pressure valve 21.

The operation of the apparatus or transformer is as follows: The starting valve or cock 16 having been opened and assuming the piston slide-valve 28 to be in its lowest position, the port 24 of the chamber 33 below the outlet-valve 26 will be open to the annular space surrounding the piston slide-valve 28 and pressure-water will be admitted to the said chamber 33, the outlet-valve 26 being raised, whereby the exhaust-port 10 of the cylinder 2 is closed. Meanwhile the port 25 between the piston-slide-valve chamber 37 and the chamber 35, below the inlet-valve 27, is uncovered, the pressure-water being thereby exhausted from the said chamber 35 into the space above the piston slide-valve 28. From this space the liquid passes through the port 23, communicating with the space above the outlet-valve 26, from whence it is finally exhausted through port 34 and discharge-passage 14. As the water becomes exhausted the pressure from the service-pipe 15, which is in direct communication through port 36 with the upper end of the inlet-valve chamber 35, causes the inlet-valve 27 to descend and open the port 11 to the cylinder 2. The pressure liquid now gains access to the space in the cylinder 2, below the piston 3, raising the two pistons 3 and 5 and discharging the liquid from above the smaller piston through passage 38, check-valve 21, and pipe 45 at an increased pressure until the piston slide-valve 28 is raised by the cap or nut 9 coming into contact with the disk 30 on the stem 29 of the said valve. The pressure fluid now gains access to the under side of the inlet-valve 27 from the annular space which surrounds the piston slide-valve 28 by way of the port 25, between the slide-valve 28 and the inlet-valve chamber 35. At the same time the pressure liquid is cut off from the under side of the outlet-valve 26, and the port 24 thereto is opened, so as to exhaust, by way of the passage 32, through the body of the slide-valve 28 to the upper part of the slide-valve chamber 37 and from thence, as above described, through port 23 and passage 34 to discharge-passage 14. The pressure on each end of the outlet-valve 26 being in equilibrium this valve falls by its own gravity. The opening of the outlet-port

10 to the exhaust 14 produces a reduction of pressure in the upper space of the inlet-valve chamber 36, while the pressure below the inlet-valve 27, which is of light construction, effects the rise of the said valve, and thereby closes the inlet-port 11. The pressure from the service-pipe 18 being now on the upper side of the smaller piston 5 both pistons 5 and 3 descend, the upper cylinder 1 being thereby recharged, while the liquid from below the larger piston 3 is exhausted. On the cylindrical body 31 in the hollow piston-rod 4 coming into contact with the disk 30 on the slide-valve stem 29 the piston slide-valve 28 is depressed, and the cycle of operations is repeated.

It will be seen that at each upward stroke of the pistons 5 and 3 the water contained in the smaller cylinder 1 is forced at an increased pressure into the discharge-pipe 45 and that a quantity of water corresponding to the capacity of the larger cylinder 2 is discharged. This water may be collected in a tank or cistern and utilized for washing, flushing, or other purposes.

The apparatus can be advantageously applied in the manufacture of mineral waters, the water therefor being usually forced into the saturation-chamber by the pressure of the carbonic-acid gas, a loss in respect of the latter invariably occurring. Such loss of gas is, however, obviated by the employment of my improved automatic apparatus.

The mineral-water machine, as illustrated in Fig. 6, is one of the class in which the water is forced through a porous wall into a chamber containing carbonic-acid gas at a pressure of, say, five atmospheres and wherein such water is saturated with the carbonic-acid gas. Assuming that the pressure in the pipe 41 supplying the water, which pipe is connected to pipe 15 of the transformer, be two atmospheres and that the ratio between the piston areas be one to four, then the water, under an increased pressure, will be forced from cylinder 1 of the transformer through pipe 45 into the mineral-water machine 39 and charged with carbonic-acid gas.

The carbonic acid enters the mineral-water machine under a pressure of, say, five atmospheres, coming through pipe 46 from the receiver 44. The charged water is withdrawn from the apparatus through conduit 47.

The waste water from the transformer flows into the receptacle 43 through the outlet-conduit 42, which is coupled to conduit 14 of the transformer and can be utilized for any purpose.

Where no pressure-water from a main is available, water from any other source or, in fact, any fluid may by means of this transformer be brought to the desired pressure.

The transformer above described may be employed in all cases where a low pressure is available and where it is desired to develop a higher pressure.

In large towns where a system of water-mains exists, but where the pressure in such mains is sometimes insufficient to carry the water to the upper stories of the buildings, this apparatus will be found advantageous. The transformer in this instance is introduced into the water-pipe system at a conveniently-low level to raise the water in the said system to the required pressure. The moment such pressure becomes reduced in consequence of water being drawn from any part of the system or from the cistern served thereby, and which may be at the highest point of such system, the apparatus will operate automatically until the required pressure is restored. The water which has been used in obtaining this increase of pressure may be utilized in the lower stories for flushing and other purposes.

This apparatus is further adapted for use in extinguishing outbreaks of fire, as it enables a supply of water to be at any time ready for use, so that an incipient fire may be suppressed as soon as detected, and if such water be first saturated with carbonic-acid gas the extinguishing effect on the fire will be increased. If carbonic-acid gas under pressure be employed for actuating the transformer, the exhaust-gas may be discharged upon the fire with the water.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

In an apparatus of the character described, two cylinders, one larger than the other, pistons operating therein, the space between said pistons being in communication with the atmosphere, a hollow piston-rod connecting said pistons having internal shoulders at opposite ends, a conduit for fluid under pressure, one branch of which communicates with the smaller cylinder and is provided with a check-valve, a discharge-pipe leading from the smaller cylinder provided with a check-valve, a valve-chest secured to the larger cylinder having inlet and exhaust passages therein, and also having inlet-valve, outlet-valve and piston-valve chambers therein, the inlet-passage and inlet-valve chamber, and the exhaust-passage and outlet-valve chamber being in communication with each other, passages being provided between the piston-valve chamber and the inlet-valve chamber, and between the piston-valve chamber and the outlet-valve chamber, the latter passages being located adjacent to the ends of the chambers with which they communicate, and ports being provided between the larger cylinder and the inlet and outlet valve chambers, inlet and outlet valves adapted to close said ports, a piston slide-valve having a passage therethrough and provided with a closed annular pocket in its outer surface, a stem on said slide-valve extending into said hollow piston-rod, a disk thereon adapted to be engaged by the shoulders on said piston-rod

at opposite ends of its stroke, and branches of said conduit communicating, respectively, with said inlet-passage and with said piston-valve chamber, the branch entering the latter at a point always opposite the pocket in the piston slide-valve.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JAN FREDERIK BEINS.

Witnesses:
S. LISTOE,
LEONARD KOOT.