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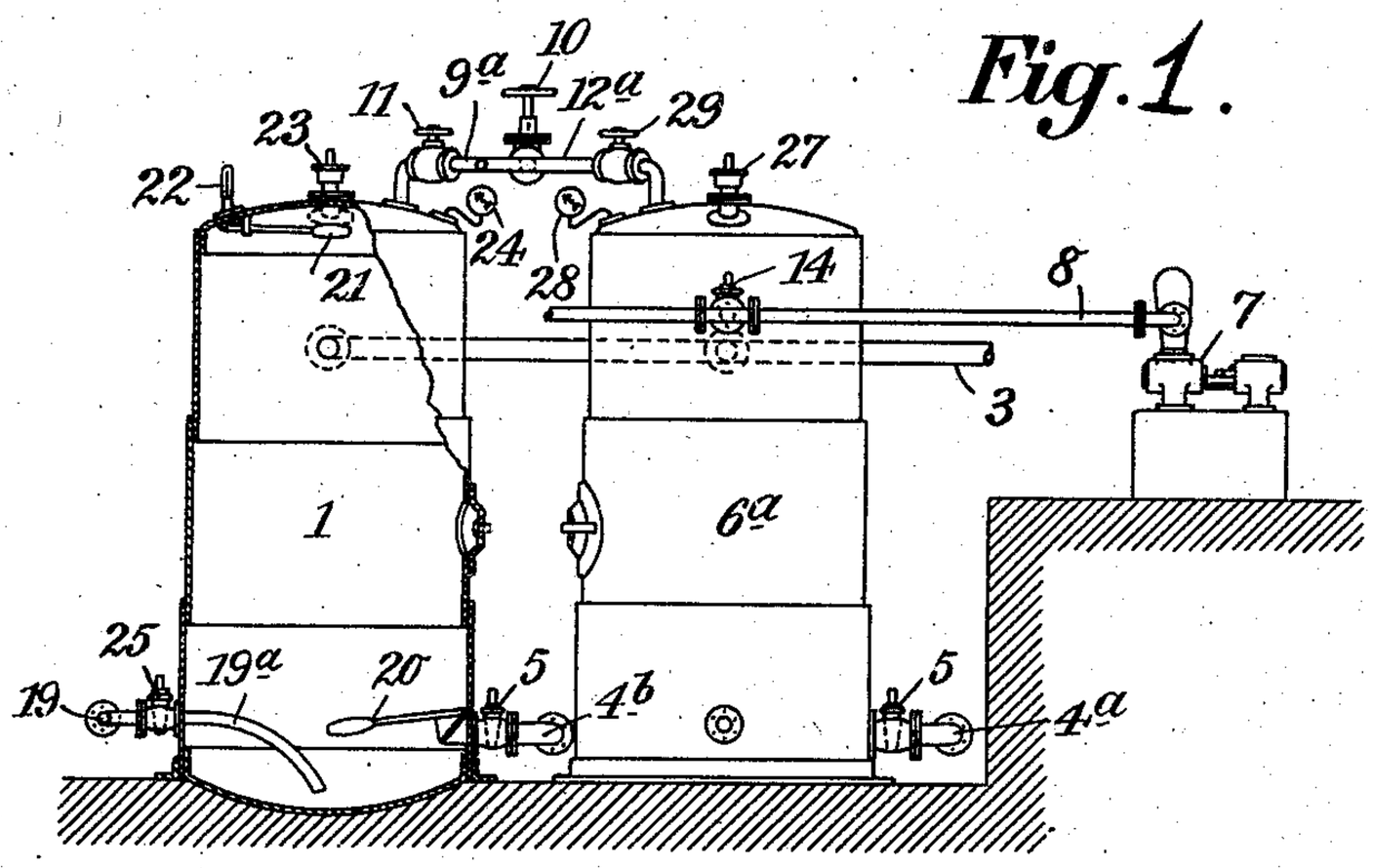
G. HANTKE.

APPARATUS FOR RAISING LIQUIDS.

APPLICATION FILED AUG. 11, 1904.

Fig. 1.



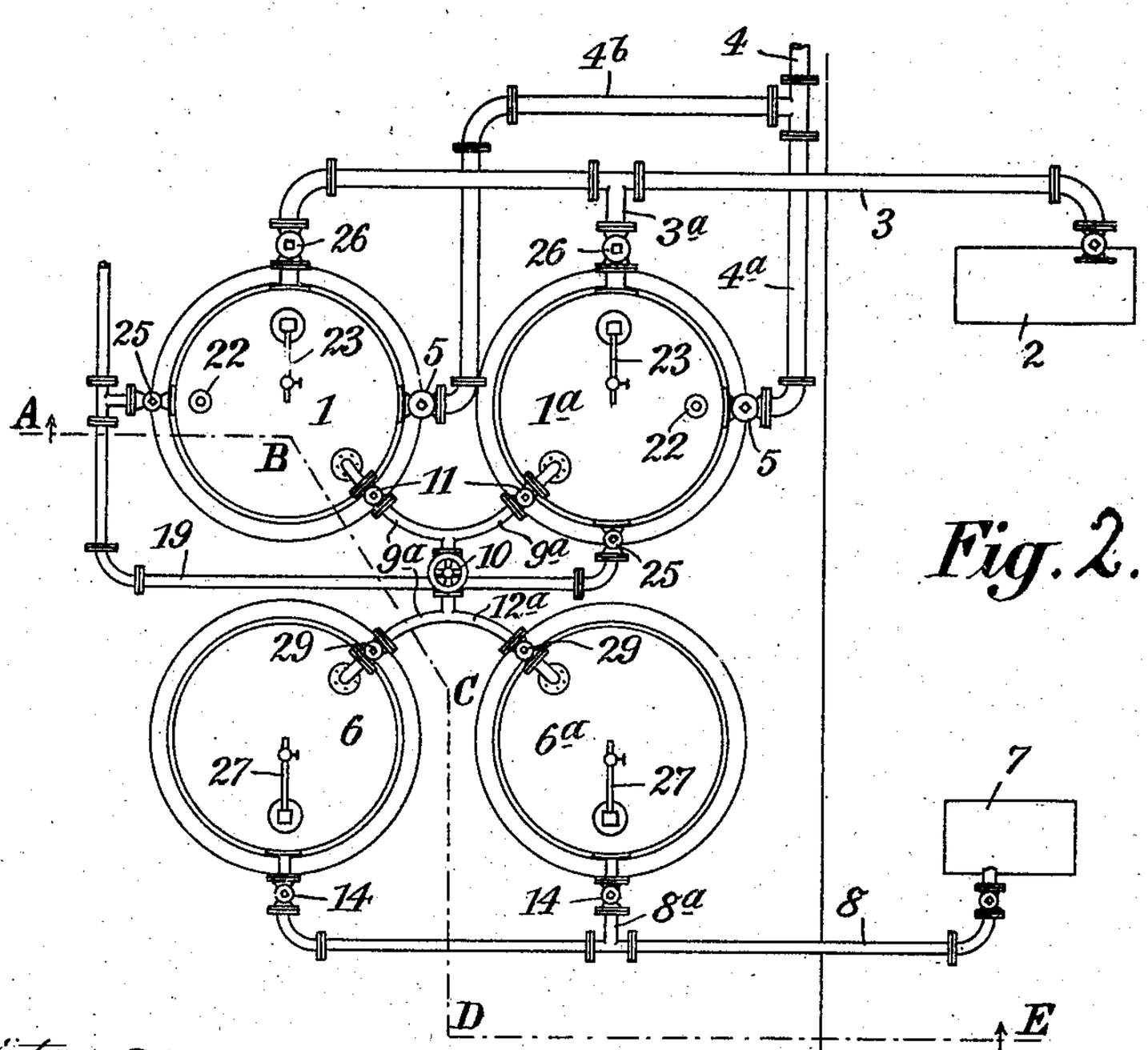


Fig. 2.

Witnesses
H. M. Kuehne
John A. Percival.

Inventor
Gustav Hantke
By Richards & R
Attorneys

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UNITED STATES PATENT OFFICE.

GUSTAW HANTKE, OF WARSAW, RUSSIA.

APPARATUS FOR RAISING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 785,307, dated March 21, 1905.

Application filed August 11, 1904. Serial No. 220,437.

To all whom it may concern:

Be it known that I, GUSTAW HANTKE, a subject of the Emperor of Russia, residing at Warsaw, Russian Poland, in the Empire of Russia, have invented a new and useful Apparatus for Raising Liquids, of which the following is a specification.

According to the apparatus heretofore known the compressed air used for raising liquids was admitted direct to the liquid vessel, so that the varying pressure of the compressed air was at once transmitted to the pipe system, and thereby rendered the speed of the liquid and its quantity irregular. Moreover, a great inconvenience was experienced with this apparatus in that the air-compressor required to be working constantly, so that stoppage of the compressor would at the same time stop the whole pipe system and render the supply of the raised liquid impossible. There are many cases or circumstances in which the apparatus mentioned above would entirely fail. Before all it is in general desirable that in the mouthpieces or outlets of the liquid a uniform pressure of a determined height should be preserved, and besides this it is very frequent that the output or delivery of the plant should be increased at certain periods and reduced at other periods—*i. e.*, that the pressure of the compressed air requires to be made higher for a larger quantity of liquid and lower for a smaller quantity of the same.

My invention relates to improvements in the said apparatus, whereby the delivery of the liquid under the pressure of the compressed air can be regulated according to the requirements.

The objects of my improvements are, first, to store up the compressed air supplied from one or several compressors in one or several special storage vessels; second, to provide one or several liquid vessels supplied with liquid by one or several pumps or other sources; third, to arrange between the one or several compressed-air-storage vessels and the one or several liquid vessels one or several adjustable pressure-reducing valves, and, fourth, to connect the one or several liquid vessels with the pipe system of the plant. I attain these objects by the arrangements illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section through the broken line A B C D E in Fig. 2 and shows the left liquid vessel for the most part in section and the right compressed-air-storage vessel in elevation, and Fig. 2 is a plan view.

Similar characters of reference refer to similar parts throughout both views.

The two liquid vessels 1 and 1ª are shown as cylindrical and constructed of metal plates. They are each provided with a blow-off pipe 19ª and a float 20 near the bottom, a float 21 with alarm device 22, a safety-valve 23, and a pressure-gage 24 at the cover. The lower floats 20 20 are adapted to close the openings of the stop-valves 5 5 on the level of the liquid sinking below a certain limit and to sound alarm devices of any known construction. (Not shown.) The upper floats 21 21 are adapted to sound the alarm devices 22 22 on the level of the liquid exceeding the other limit. The blow-off pipes 19ª 19ª are attached to stop-valves 25 25 on the outside of the liquid vessels 1 and 1ª, and these stop-valves are connected to a pipe 19, leading to a convenient place. The two liquid vessels 1 1ª may be provided with water-gages (not shown) and manhole-covers. They are connected with a common pump 2 by means of a pipe 3 and a branch 3ª, provided with stop-valves 26 26.

The two storage vessels 6 and 6ª are provided with safety-valves 27 27 and pressure-gages 28 28 and are connected with a single air-compressor 7 by a pipe 8 and a branch 8ª, in which stop-valves 14 14 are inserted. At the top the two storage vessels 6 and 6ª are connected with each other by a pipe 12ª and can be disconnected by means of stop-valves 29 29. In a similar manner the two liquid vessels 1 and 1ª are connected at the top with each other by a pipe 9ª and can be discon-

nected by means of stop-valves 11 11. The two pipes 12[a] and 9[a] are connected by a pressure-reducing valve 10.

The two stop-valves 5 5, already mentioned above, are connected with pipes 4[a] and 4[b], leading to the supply-pipe 4.

The plant is operated as follows: The pump 2 is started to supply either the liquid vessel 1 or 1[a] with liquid, and the air-compressor 7 is put into operation for charging either storage vessel 6 or 6[a] with compressed air, the other storage vessel being disconnected by closing its stop-valves 14 and 29. The pressure-reducing valve 10 having been previously adjusted for a convenient pressure will allow compressed air to pass over to the liquid vessel the moment the pressure of the compressed air in the storage vessel exceeds the adjusted pressure. The compressed air admitted under the adjusted pressure to the liquid vessel forces the liquid downward and regulates the uniform delivery of the liquid through the branches 4[a] and 4[b] and the supply-pipe 4 to the pipe system. When the pressure of the compressed air in the storage vessel attains the highest limit allowed by the safety-valve 27, the storage vessel is disconnected from the compressor 7 by closing the stop-valve 14, and the other storage vessel 6 or 6[a] is put into communication with the compressor 7, to be thereby filled. The first storage vessel remains in open communication with the pipe 12[a] and the pressure-reducing valve 10 and continues to furnish compressed air at the adjusted pressure to the liquid vessel 1 or 1[a]. The second storage vessel on being sufficiently charged is disconnected from the compressor 7 and the latter stopped. When in the liquid vessel 1 or 1[a] the level of the liquid reaches the upper float 21 and actuates it, the alarm device 22 will sound and call upon the machinist to close the stop-valve 26 and to open that of the other liquid vessel, whereupon the pump 2 will charge this liquid vessel until its alarm device 22 sounds and it is disconnected. Afterward the pump 2 may be stopped if the first liquid vessel still continues to supply liquid to the pipe system. The moment, however, the lower float 20 of this liquid vessel closes the outlet through the stop-valve 5 and actuates the alarm device the pump 2 must be restarted to charge this liquid vessel with a fresh quantity of liquid, while the other liquid vessel is turned on to the pipe system.

It is possible to conduct compressed air from the storage vessel 6 through the pressure-reducing valve 10 and the pipe 9[a] to either the opposite liquid vessel 1 or the other liquid vessel 1[a], the respective stop-valve 11 being opened. In a similar manner compressed air can be conducted from the other storage vessel, 6[a], to either liquid vessel 1 or 1[a]. In all cases the same pressure-reducing valve may be used. Any sludge may be discharged periodically from either liquid vessel through the blow-off pipe 19[a] and the opened stop-valve into the pipe 19.

It is evident that at times both liquid vessels 1 and 1[a] and both storage vessels 6 and 6[a] may be simultaneously worked in case a larger quantity of liquid is to be supplied to the pipe system. Either liquid vessel may be excluded for repairs while the other liquid vessel remains in working order. Also either storage vessel may be disconnected from the air-compressor and the pressure-reducing valve and be repaired while the other storage vessel may continue to work. Thereby stoppages of the plant, hitherto unavoidable in case of repairs, can be prevented.

The invention therefore presents the following essential advantages: First, the pressure in the storage vessel or vessels and in the liquid vessel or vessels may be increased or reduced at will without the necessity of employing specially large compressors and pumps; second, the pressure in the pipe system can be made uniform while it remains independent of the pressure in the compressor or compressors; third, it is possible to work the plant without any interruption, while repairs may be made at any time and the sludge or dirt can be forced out of the liquid vessels at any moment.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a plant for raising liquids with the aid of compressed air, the combination with a plurality of liquid vessels, of means for charging said plurality of liquid vessels alternately or simultaneously with liquid, a plurality of storage vessels, means for charging said plurality of storage vessels alternately or simultaneously with compressed air under a varying comparatively high pressure, a pressure-reducing valve, means for arbitrarily conducting the compressed air from either a part or all of said plurality of storage vessels through said pressure-reducing valve to either a part or all of said plurality of liquid vessels, and means for allowing the liquid to pass from either a part or all of said plurality of liquid vessels to the pipe system.

2. In a plant for raising liquids with the aid of compressed air, the combination with a plurality of liquid vessels, of means for charging said plurality of liquid vessels alternately or simultaneously with liquid, a plurality of storage vessels, means for charging said plurality of storage vessels alternately or simultaneously with compressed air under a varying comparatively high pressure, a plurality of pressure-reducing valves, means for arbitrarily conducting the compressed air

from either a part or all of said plurality of storage vessels through either a part or all of said plurality of pressure-reducing valves to either a part or all of said plurality of liquid vessels, and means for allowing the liquid to pass from either a part or all of said plurality of liquid vessels to the pipe system.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAW HANTKE.

Witnesses:

CYRYL FREDWICKI,

JOZEF WILLOZY.