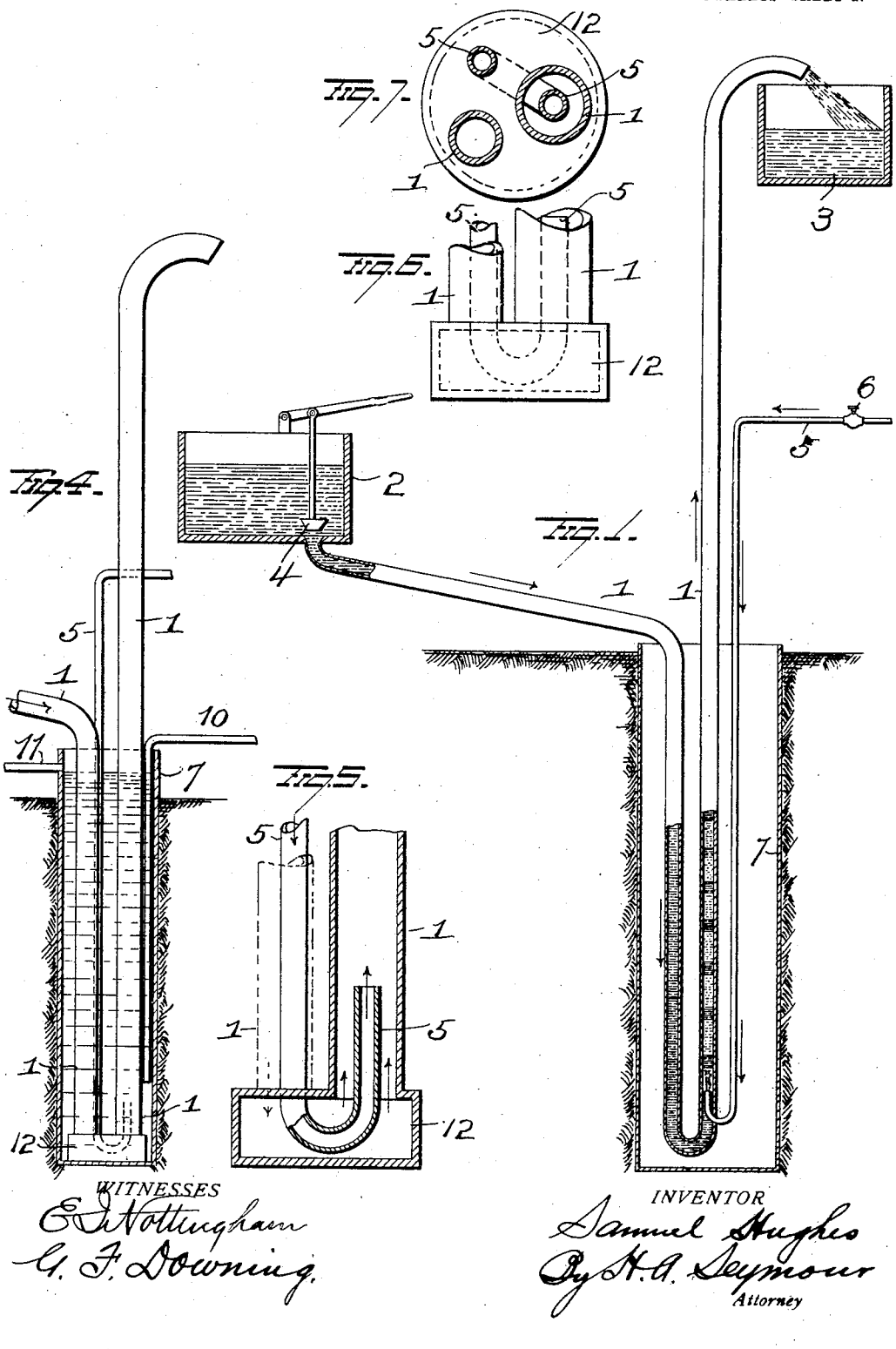
No. 779,941. PATENTED JAN. 10, 1905.

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APPARATUS FOR ELEVATING LIQUIDS.

APPLICATION FILED NOV. 4, 1903.

2 SHEETS—SHEET 1.



WITNESSES

E. D. Nottingham

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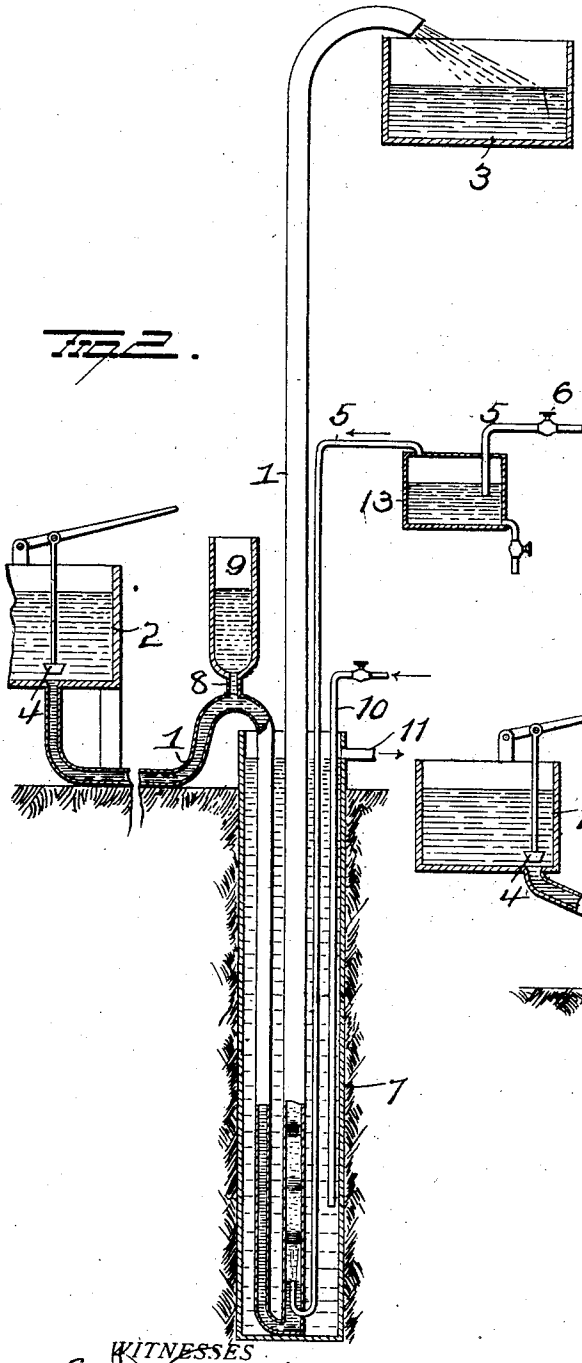


Fig. 2.

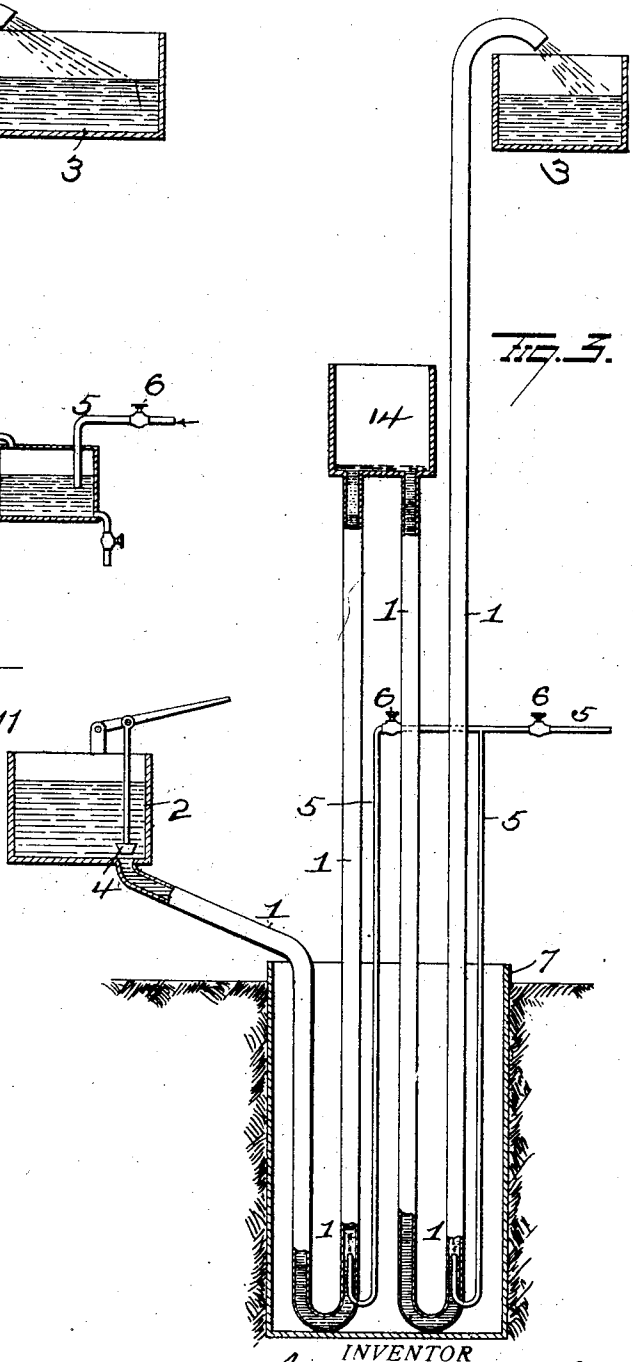


Fig. 3.

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No. 779,941. Patented January 10, 1905.

UNITED STATES PATENT OFFICE.

SAMUEL HUGHES, OF SUMMERVILLE, SOUTH CAROLINA, ASSIGNOR OF ONE-HALF TO EDWARD F. LOWNDES, OF CHARLESTON, SOUTH CAROLINA.

APPARATUS FOR ELEVATING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 779,941, dated January 10, 1905.

Application filed November 4, 1903. Serial No. 179,852.

To all whom it may concern:

Be it known that I, SAMUEL HUGHES, a resident of Summerville, in the county of Dorchester and State of South Carolina, have invented certain new and useful Improvements in Apparatus for Elevating Liquids; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in apparatus for elevating liquids, and more particularly to improvements of this character by means of which acids can be effectually elevated by compressed air; and it consists in certain novel features of construction and combinations and arrangements of parts, as will be more fully hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in section, illustrating the simplest form of my improvements. Fig. 2 is a similar view illustrating additional details. Fig. 3 is a similar view showing my improvements in series, and Figs. 4, 5, 6, and 7 are views illustrating a particular form of box-coupling for the various pipes.

The apparatus in its simplest form, as shown in Fig. 1, consists in a continuous pipe or passage 1, communicating with the bottom of an acid-supply tank 2, extending downward therefrom to the desired level and then upward above a receiving-tank 3, where it is open to the atmosphere. A pipe 5, connected with any source of compressed-air supply (not shown) and having a valve 6 therein, enters pipe or passage 1 near its lowest point and projects up into the portion of said pipe leading to tank 3 and is made perfectly tight where it enters pipe 1. The escape of acid from tank 2 into pipe 1 is governed by a valve 4, and the operation of the apparatus above described is as follows: The supply-tank 2 being full of acid, valve 4 is opened and the acid allowed to flow from the tank into pipe 1 and fill it up to the level of the acid in the tank. Compressed air is then admitted through pipe 5 by opening valve 6 to force the acid up pipe 1 into tank 3, as will be readily understood. When the acid is to be forced to considerable heights, a casing 7 may be employed, as clearly set forth in my pending application, filed September 19, 1903, Serial No. 173,863.

The apparatus as described above and shown in Fig. 1 is complete and sufficient in many cases and by actual test operates with entire satisfaction. I find, however, that in some cases it is impracticable or inconvenient to so arrange the acid-pipe that its trend will be constantly downward from the supply-tank to its lowest point and that where the supply-tank is a considerable distance away from the point at which the elevating is to be done that there will be upward and downward bends in the pipe. For instance, if the pipe is to be laid along the ground the uneven surface will cause bends in the pipe, or the pipe may have to pass over an obstruction, such as the sill of a building, and when a casing is employed the pipe will have to rise up, so as to pass into the casing, the latter being preferably raised above the ground-level to prevent anything on the ground being knocked into it. All such bends form traps, the disadvantage of which must be overcome. Referring to Fig. 2, I have shown one of these bends or traps at the top of the casing, where the pipe rises from the ground-level, so as to enter the casing. One is sufficient to show what is meant, and I will now point out wherein it is objectionable and how its disadvantage is overcome. When the apparatus is started, as above described, we will suppose that instead of opening valve 6 gradually it is opened suddenly or so quickly as to admit more air into pipe 1 than will readily pass upward. In such case a portion of the air will pass upward and a portion will back down into the part of pipe 1 that leads from tank 2, and the apparatus would fail to operate unless some provision is made to allow the air to escape from that part of the pipe. When the valve 6 is opened as above and air enters both parts of pipe 1, valve 6 is closed until the air escapes and the acid settles down to its normal level. Now if no provision is made for the escape of the air it will

remain in one part of the pipe and prevent the apparatus working successfully, since the air cannot go down the pipe and escape above tank 3 and cannot go down over the bend at the top of the casing. In order to allow the air to escape freely and the apparatus to work successfully, I employ an escape-pipe 8 at the top of the bend, through which the air may escape into the atmosphere, and to prevent any acid being carried off by the escaping air I employ a small reservoir 9 at the top of the escape-pipe, as shown, which effectually prevents waste, while it facilitates the escape of air. This reservoir performs another and very important function. It is so placed that the acid therein will be on a level with the acid in tank 2. The object of this is that when the air is admitted to pipe 1 it may and sometimes does force the acid from pipe 1 faster than it is supplied from the tank. This may only last a few moments; but when it does occur the acid will flow downward from the escape-pipe, and air would follow it into pipe 1 unless there was a supply near at hand to draw from until all the acid in the pipe leading from tank 2 is put in full motion. Then as soon as the acid flows freely in the supply-pipe it will rise again in reservoir 9 to its normal level. Without the reservoir air will follow down into the pipe; but with the reservoir it cannot do so. Air in the supply side of pipe 1 is objectionable and interferes with the satisfactory operation of the apparatus. A supply of acid near at hand, as in the reservoir, keeps the supply-column solid, which is necessary for satisfactory working.

As already stated, a casing 7 is used when acid is to be elevated to a considerable height, and the reasons for its use have already been explained; but I now utilize this casing for another and important reason. While sulfuric acid is being manufactured it is very hot, and at certain stages of its production it must be cooled. This is well known in the art of acid-making; but as it has nothing to do with my invention I need not explain further than to say that reducing the temperature of the acid is necessary and that expensive cooling apparatus is employed. So in order to reduce the cost of the cooling apparatus I utilize the casing 7 as a cooler by keeping it supplied with cold water introduced by a pipe 10 and regulate the quantity in the casing by an overflow-pipe 11, which prevents the water filling and flowing over the top of the casing. While this cooling may not be sufficient in all cases, it effects a considerable reduction in the temperature of the acid and reduces the cost of the additional cooling apparatus, which may be necessary. Keeping the pipes cool adds to their life, which is an additional saving. Where the pipes in the casing cannot conveniently be supported from above, I allow the lower portion to rest upon the bottom of the casing, and in order to prevent damage at this point, which may occur in case the pipe rested upon an ordinary bend in the pipe, which is usually made of lead, and also to save the expense of a large casing which would have to accommodate ordinary bends I use a closed chamber, coupling-box, or manifold 12, Figs. 4, 5, 6, and 7, which fits the casing loosely, and I connect the acid and air pipes with this manifold, as shown. By placing the pipes close together at the manifold I save considerable space which would in case of ordinary bends necessitate the employment of a large casing.

Referring again to Fig. 2, I have found that air from a compressor is more or less charged with particles of solid matter drawn into the compressor from the surrounding space carried in with the lubricant, rust from pipes, and matter from other sources and that these particles, acting as a "sand-blast," wear away the lead pipes, particularly at the bends or wherever the air-current is deflected or impinges upon any surface and ultimately seriously damages the pipes and connections. I therefore find it advisable to pass the compressed air through what I call a "washer" 13, which removes practically all of the objectionable matter and avoids the sand-blast action. The washer consists of an air-tight tank partly filled with water. The compressed air enters the tank through a pipe which leads down to or below the level of the water and escapes at the surface after depositing the solid matter in the water. The air is then led off to the air-lift through a pipe connected with the tank at the top. When necessary, the water is drained from the tank, and the solid matter goes along with it. Afterward the tank is refilled with clean water. I have found that compressed air treated in this way has little or no bad effect on the pipes; but when not so treated its destructive effect is very noticeable.

Referring now to Fig. 3, where it is not desirable or convenient to go deep into the earth in order to get the "submergence" due to the height of lift I propose to use the arrangement shown in Fig. 3, which consists of two or more sets of apparatus combined and operating together, the first delivering to the second, and so on. In order to allow the air to escape from the first apparatus and only to deliver acid to the second, I employ a separator 14 to receive the discharge, whence the air escapes and the acid flows to the next apparatus. Without the separator the apparatus would be inoperative, for the reason that the air would form a trap at the top of the pipe such as I have already described.

It will be observed that in Figs. 2 and 4 I have shown pipe 1 of two different diameters, the inlet portion being shown smaller than the outlet portion. This is not essential, but is done for the sake of economy when the sup-

ply-tank is near the lift. The air-pipe is also smaller than the other pipe, since there is no necessity to use a large air-pipe except for long distances. In each case the pipes would be proportioned as dictated by experience.

A great many changes might be made in the general form and arrangement of the parts described without departing from my invention, and hence I would have it understood that I do not restrict myself to the precise details set forth, but consider myself at liberty to make such slight changes and alterations as fairly fall within the spirit and scope of my invention.

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

1. In an apparatus for elevating liquids, the combination with a supply-tank and a receiver above the same, of a continuous passage from the supply-tank downward and thence upward to the receiver, a pipe for conveying compressed air or other gas into that portion of the passage extending up to the receiver, and means for permitting the escape of air from said passage back of the air-entrance pipe.

2. In an apparatus for elevating liquids, the combination with a supply-tank and a receiver above the same, of a continuous passage from the supply-tank downward and thence upward to discharge into the receiver, means for directing compressed air or other gas into that portion of the passage extending up to the receiver, an air-escape pipe communicating with the passage at any elevated point of the passage back of the air-inlet, and a liquid-chamber communicating with said pipe and serving as an emergency or auxiliary supply to the passage.

3. In an apparatus for elevating liquids, the combination with a supply-tank and a receiver above the same, of a casing to be sunk in the ground, a box-coupling in said casing, a pipe extending from the supply-tank to the box-coupling, another liquid-pipe extending from the box-coupling up to and discharging into the receiver, and a compressed-air-supply pipe extending through the box-coupling and discharging into said last-mentioned liquid-pipe.

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

SAMUEL HUGHES.

Witnesses:
W. L. DICK,
R. M. MCDERMID.