J. H. McEVOY.

WELL BLOWER.

APPLICATION FILED JAN. 23, 1906.

906,733.

Patented Dec. 15, 1908.

Fig. 1.

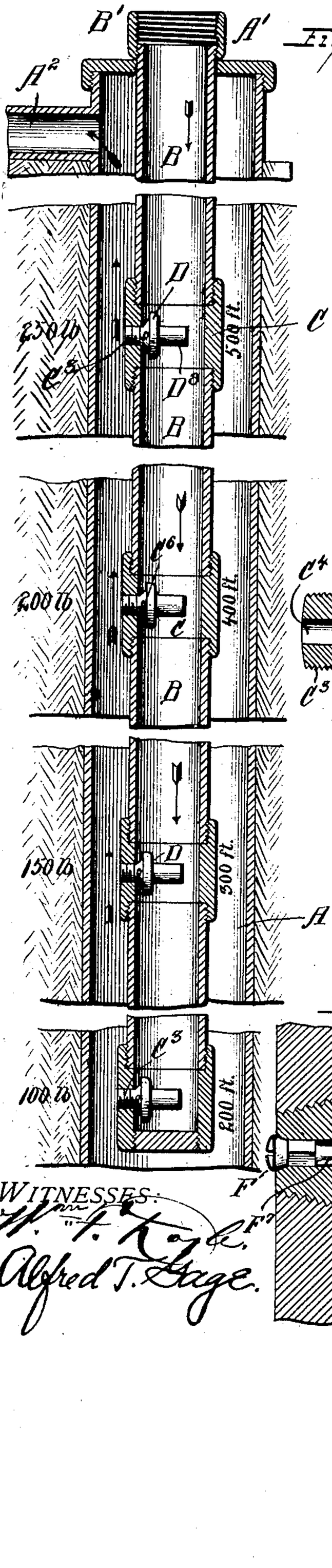

Fig. 2.

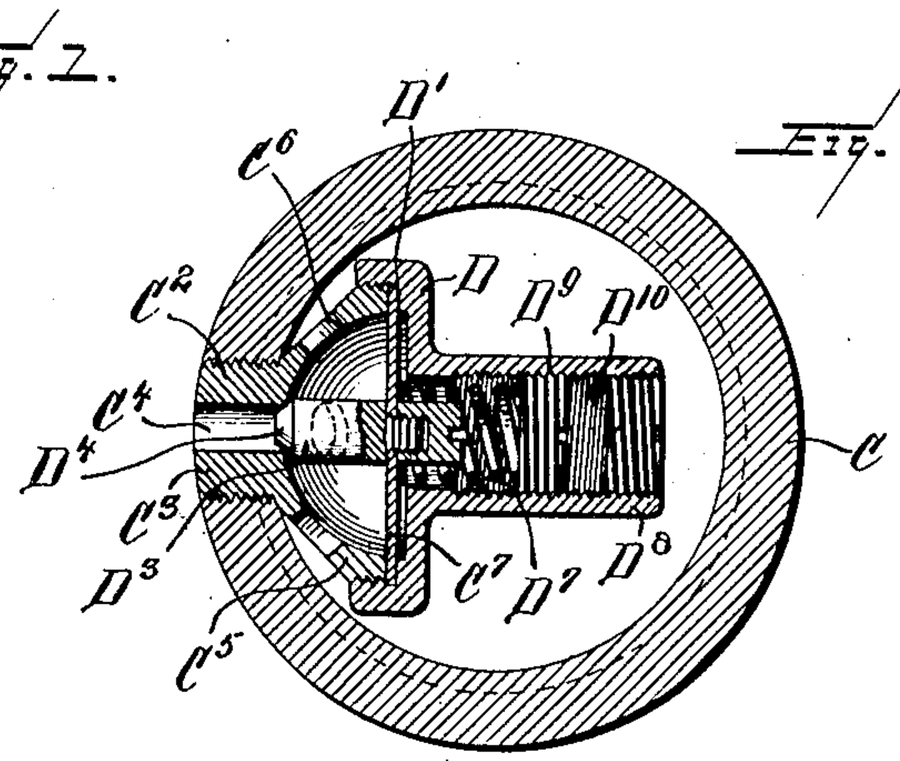

Fig. 3.

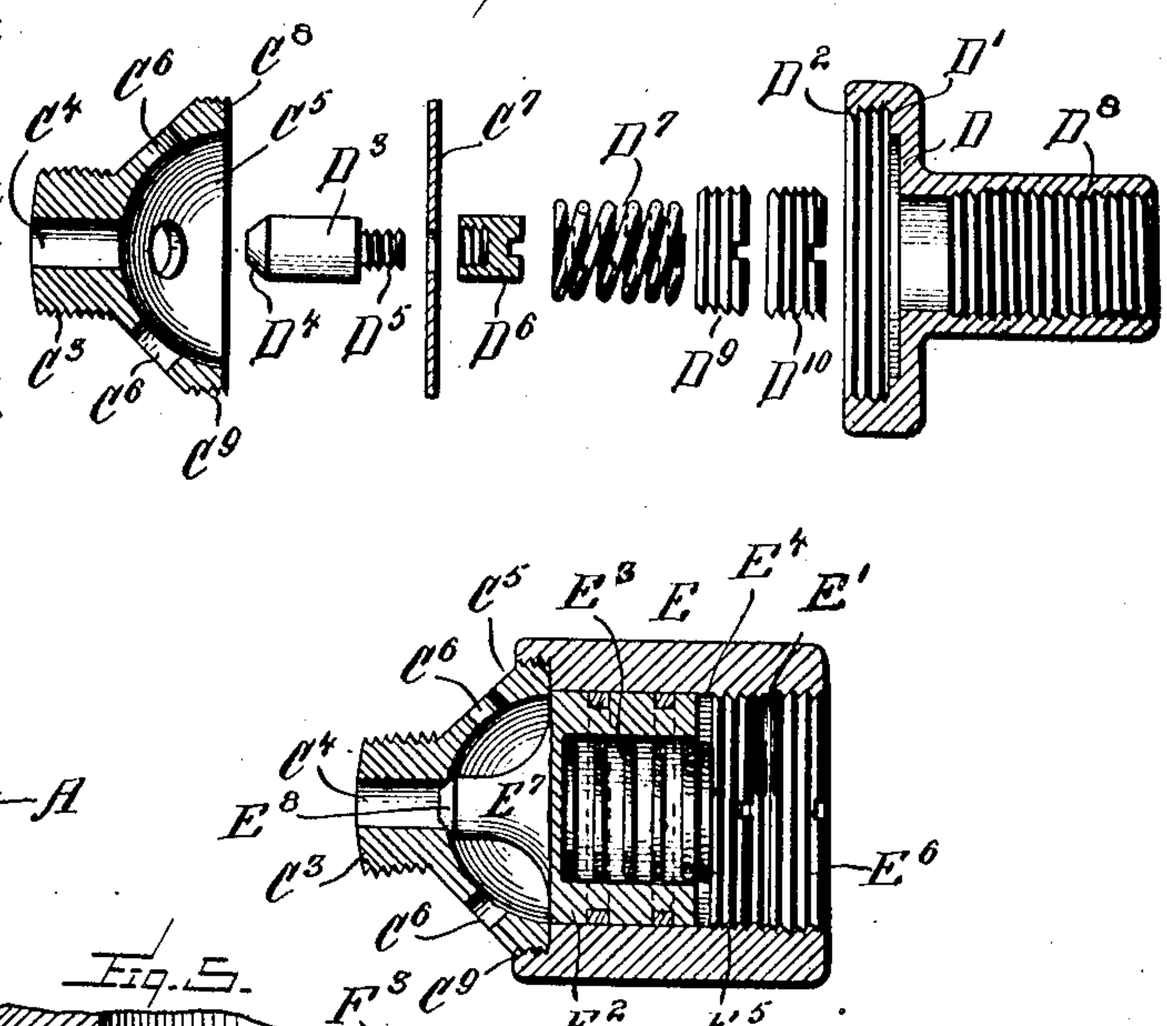

Fig. 4.

Fig. 5.

WITNESSES:

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WELL-BLOWER.

No. 906,733. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed January 23, 1906. Serial No. 297,517.

To all whom it may concern:

Be it known that I, JOSEPH H. McEVOY, a citizen of the United States, residing at Houston, in the county of Harris, State of Texas, have invented certain new and useful Improvements in Well-Blowers, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a well blower, and particularly to a novel construction of valve adapted to be attached to the air pipe of a well for discharging the contents thereof at different levels and air pressure.

The invention has for an object to provide an improved construction and arrangement of the valves disposed at successive points in the length of the air tube so that they will be automatically opened at predetermined pressures of air, the amount of said pressure being decreased in the descending length of the tube.

A further object of the invention is to provide an improved construction and arrangement of these automatic valves by which they serve as a coupling for the sections of the air tube and provide a minimum surface exposed to the liquid in the well, and the maximum exposed surface to the air pressure.

Other and further objects and advantages of the invention will be hereinafter set forth and the novel features thereof defined by the appended claims.

In the drawing:—Figure 1 is a vertical section illustrating the application of the invention to a well; Fig. 2 is an enlarged horizontal section through one of the valves; Fig. 3 is an enlarged detail section of the parts of this valve separated from each other, Fig. 4 is a sectional view of a modified form of the invention, and Fig. 5 is a similar view of a further modification.

Like letters of reference indicate like parts throughout the several views of the drawings.

The letter A designates a well tubing which may be of any desired construction, and is preferably provided at its upper end with a closing cap A′ having an aperture therein to receive the air pipe B which is provided with a coupling B′ above the cap plate for application to any desired source of air supply. The well tubing is also provided with a discharge pipe A^2 at its upper portion in the usual manner. The air pipe B is provided throughout its length at predetermined distances apart with automatically opening valves of any desired construction, these valves being constructed and arranged to open at a predetermined pressure of air, and the necessary pressure for that purpose decreasing downwardly in the length of the air pipe. As showing a preferable form of this valve, I have illustrated in the drawing a coupling C interiorly threaded at its opposite ends to receive the sections B of the air pipe and provided with one or more apertures C^2 in its side wall communicating with the well tube. Inserted in this aperture is an exteriorly threaded valve seat C^3 having an aperture C^4 extending therethrough and provided with a cup portion C^5 upon its inner end within the air pipe. This cup portion is provided with suitable apertures C^6 to permit passage of air within the cup in order that it may bear upon the diaphragm or yielding head C^7 clamped between the inner face of the cup and the cap D. This cap is provided with a clamping face D′ to bear on the edge C^8 of the cup, and with interior threads D^2 to engage threads C^9 on the periphery of the cup and when applied securely retains the diaphragm in position. A valve D^3 is carried by this diaphragm and provided at its outer end with a seating face D^4 adapted to close the inner end of the aperture C^4. This valve is secured to the diaphragm by means of a threaded shank D^5 extending therefrom and through an aperture in the diaphragm to which a clamping nut D^6 is applied on the opposite end of the diaphragm. The valve is normally held in closed position by means of a tension spring D^7 disposed within the interiorly threaded extension D^8 of the cup, and bearing at one end upon the diaphragm, and at its opposite end upon a threaded plug D^9 inserted in the extension D^8 and secured against rotation by means of a contacting locking plug D^{10}. These plugs are used to adjust the tension of the spring upon the diaphragm and the consequent pressure required to open the valve, and the locking plug permits the valve to be set and positively retained at its adjustment.

In Fig. 4 a modified form of the cap and valve is applied to the valve seat C^5 at its cup end, and comprises a cylinder E interiorly threaded at its outer end E′ and provided at its inner end with a packed piston E^2 having an interior recess E^3 into which a tension

spring E^4 extends, the pressure thereof being adjusted by means of the threaded plug E^5 retained in position by the locking plug E^6 inserted in contact therewith. The piston carries at its inner end the valve E^7 having the contact face E^8 for the inner end of the passage C^4.

In Fig. 5 the valve F may open outwardly and its stem F′ is then secured to the diaphragm F^2 carried by casing F^3 and held by perforated cap F^4. The casing is made with a packed nut F^5 and spring F^6 extended therefrom to the diaphragm. The casing is formed with a discharge passage F^7 having a tapered valve seat at its outer end and lateral passages F^8.

In the operation of this invention it will be observed that the face of the valve exposed to the pressure outside of the air tube is much less in area than that of the diaphragm exposed to the interior pressure, there being a difference of approximately one to sixteen. As the result of this construction the exterior pressure of the liquid in the well has little or no effect upon the operation of the valve due to the small exposed area thereof and in the opening movement assists the diaphragm when the requisite pressure is applied thereon from the interior of the air pipe. The arrangement of valve shown in Fig. 1 is such as to require the minimum pressure of air for operating the maximum depth of well which has become filled with liquid, as the pressure required to open the valve and lift the liquid decreases downwardly corresponding to decreasing lengths of pipe section, for instance, the valve disposed at 500′ from the top of the well discharges at a pressure of 250 pounds, this pressure also lifts the body of liquid above said valve so that when the pressure is relieved this first valve closes. The next valve is shown disposed at 400′ below the first valve and adapted to discharge at a pressure of 200 pounds, which also lifts the 400′ of liquid and being less than the pressure required to open the first valve and does not affect the same. Descending further, the next valve is disposed at 300′ below the second valve and only requires a pressure of 150 pounds to discharge from the same and lift the 300′ level of liquid, while the lowermost valve is disposed at 200′ below the third valve and only requires a pressure of 100 pounds for discharging from the same and lifting the liquid. It will thus be seen that the pressure required to discharge from the valve also raises the liquid from the predetermined depth and that a well of the depth of 1400′, of liquid as shown in Fig. 1, can be operated with a maximum pressure of 250 pounds thus greatly facilitating and economizing in the blowing thereof.

The construction of the valve herein shown is such as to exert the minimum resistance against opening the same, and also to expose the smallest possible area to the pressure of the liquid outside of the air pipe, while the enlarged operating diaphragm or head permits a full application of the pressure within the air pipe until such pressure is relieved by the lifting of the liquid above the valve. While these valves are adapted to discharge successively, still the conditions of the air and liquid pressure within the well may be such as to produce a simultaneous operation by opening or partially opening two or more of the valves when the proper pressure is maintained within the air pipe. It will be obvious that the maximum pressure of 250 pounds herein given as an illustration may discharge from all of the valves beneath the uppermost successively until the body of liquid is reduced proportionate to the air pressure required for lifting the same.

With the parts of the relative sizes as shown in Fig. 1, the upper valve is set by its spring to discharge at a pressure of 250 pounds when disposed at a depth of 500′ in the air tubing of the well, and the diaphragm of this valve has an area sixteen times greater than that of the valve face exposed to the liquid pressure. This 500′ column of liquid will produce a back pressure of only $15\frac{1}{2}$ pounds upon a $\frac{1}{4}''$ exposed face of the valve which tends to open or assist the air pressure to that extent, and it would therefore be apparent that a maintained pressure of only $234\frac{1}{2}$ pounds on a 1″ diaphragm added to the back pressure would discharge the valve, but under such conditions when the valve starts to open there would be a slight momentary back flow of liquid through the valve so that to obtain a positive raising of the liquid the pressure of 250 pounds is maintained, and after passing through the valve exerts the same pressure upon the volume of liquid thereby raising the same approximately 100 feet toward the top of the well, by which time the next valve below is opened and operating due to the reduced pressure of the liquid caused by the air space. After this column is raised the escape of air immediately reduces the pressure and the spring by which the tension of the valve is adjusted closes the same and it again requires a pressure of 250 pounds to discharge from the top valve as at this time there is no back pressure of the liquid thereon. The successive valves operate in the same manner, it being understood that at no time is the pressure within the air pipe necessarily increased above that required for the valve to be discharged, and this valve may be used with air, gas, steam or any fluid pressure.

Having now described my invention and set forth its merits, what I claim and desire to secure by Letters Patent is:—

1. In a well blower, the combination with a pressure pipe, of a series of valves each hav-

ing an actuated fluid pressure surface and an actuating fluid pressure surface of greater area, said valves being located at different distances apart throughout the length of the pipe and constructed and arranged to discharge actuating fluid therefrom at successively downwardly decreasing pressures within said pipe.

2. In a well blower, the combination with a pressure pipe comprising sections of downwardly successively decreasing lengths, of an automatically operated valve in each of said lengths having an actuated fluid pressure surface and an actuating fluid pressure surface of greater area, each valve being constructed and arranged to discharge actuating fluid at a different pressure from that of the next successive valve beneath the same.

3. In a well blower, the combination with a pressure pipe provided with a series of discharge openings, of automatically controlled pressure opening valves disposed at different points throughout the length of said pipe and each having an actuated fluid pressure surface and an actuating fluid pressure surface of greater area, said valves being adjusted to discharge at successively downwardly decreasing pressures.

4. In a well blower, the combination with a pressure pipe provided with a series of discharge openings, of automatically controlled valves disposed at said openings and having their seating faces of less area than their surface exposed to an actuating fluid within the pipe, and tension means arranged to control the discharge of actuating fluid from said valves at successively downwardly decreasing pressures.

In testimony whereof, I affix my signature in presence of two witnesses.

JOSEPH H. McEVOY.

Witnesses:

CHAS. B. WOOD,

CHAMP ROSS.