3 Sheets—Sheet 1.

J. L. HASTINGS.

Fire Apparatus.

No. 196,089. **Patented Oct. 16, 1877.**

Fig. 1.

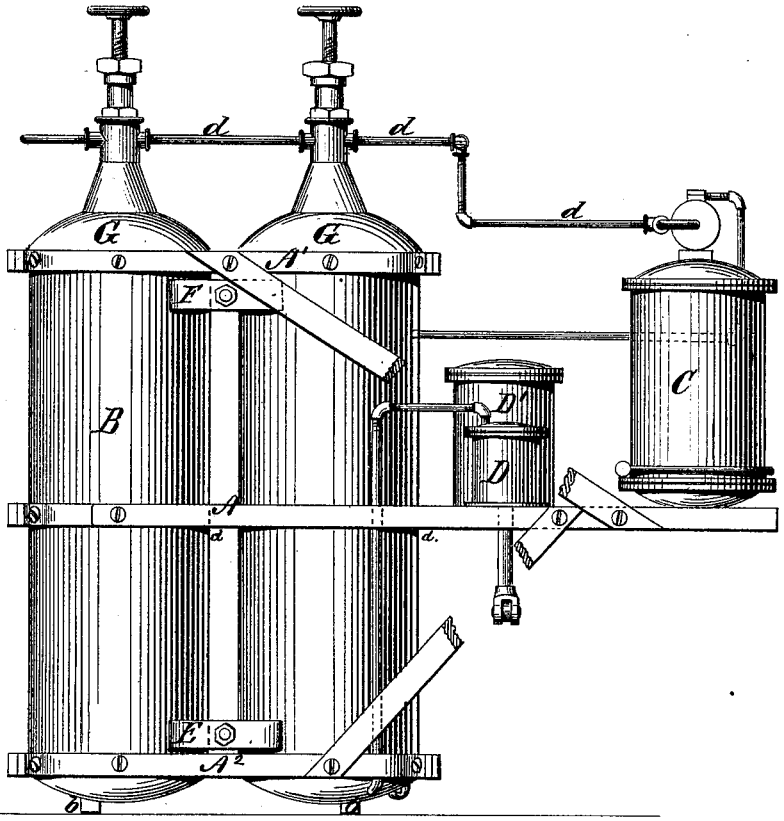
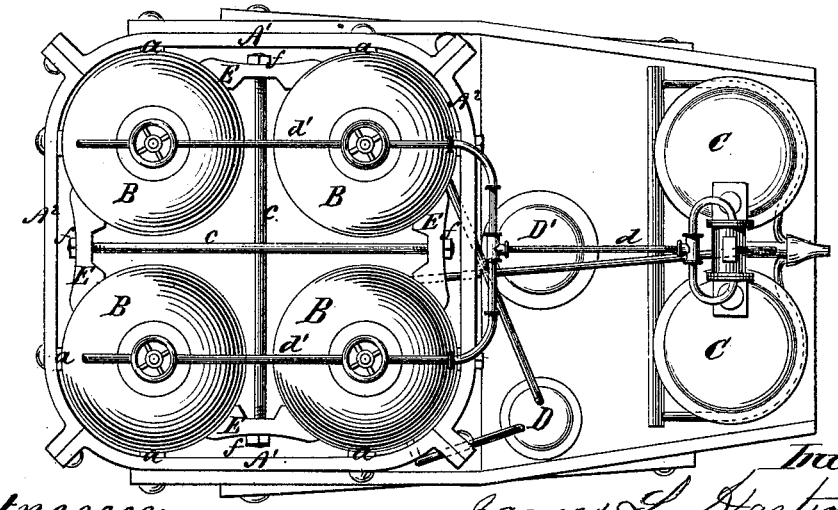


Fig. 2



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Hugh Jones

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by his Attorney
L. D. Lace

3 Sheets—Sheet 2.

J. L. HASTINGS.

Fire Apparatus.

No. 196,089. **Patented Oct. 16, 1877.**

Fig. 3

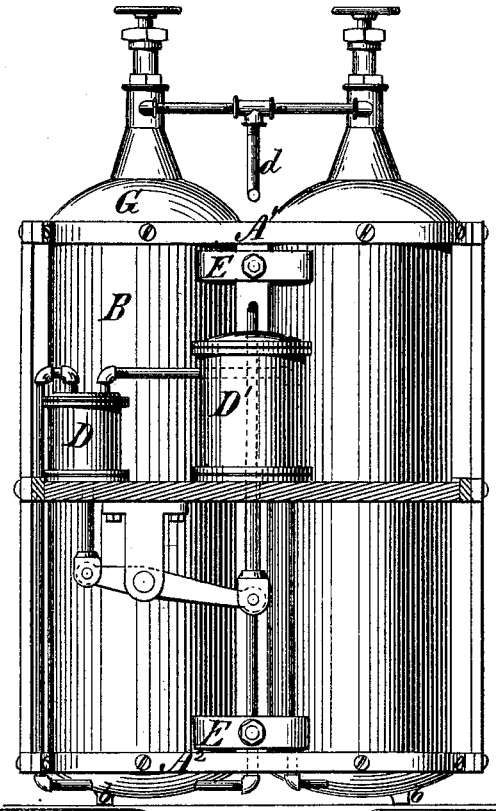


Fig. 4

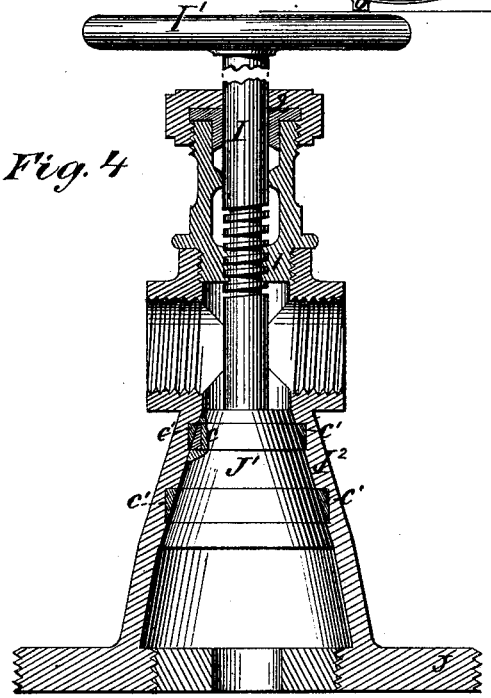
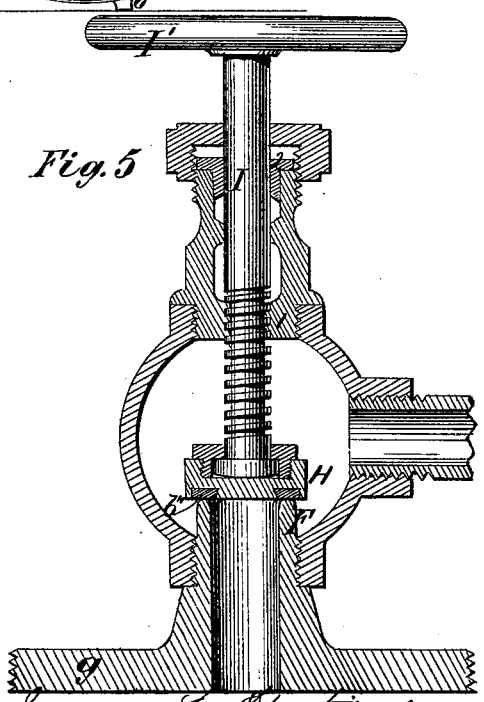


Fig. 5



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3 Sheets—Sheet 3.

J. L. HASTINGS.

Fire Apparatus.

No. 196,089. Patented Oct. 16, 1877.

Fig. 6

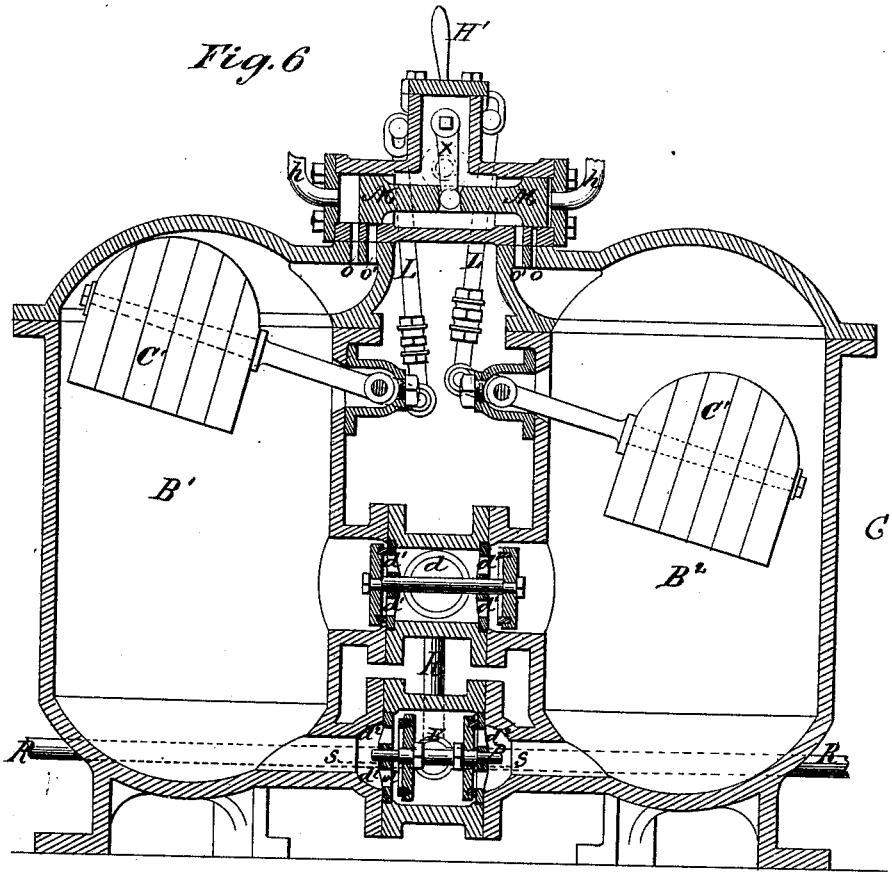
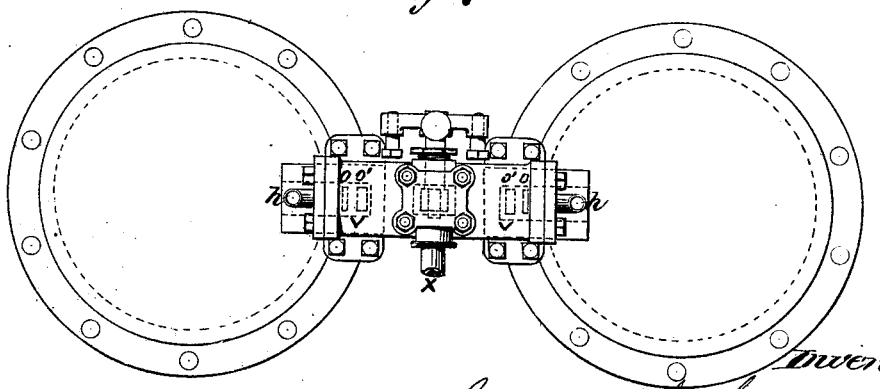


Fig. 7



Witnesses:
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UNITED STATES PATENT OFFICE.

JAMES L. HASTINGS, OF NEW YORK, N. Y.

IMPROVEMENT IN FIRE APPARATUS.

Specification forming part of Letters Patent No. **196,089,** dated October 16, 1877; application filed January 16, 1877.

To all whom it may concern:

Be it known that I, JAMES L. HASTINGS, of the city, county, and State of New York, have invented a new and useful Improvement in Fire Apparatus, which improvement is fully set forth in the following specification, reference being had to the accompanying drawings.

The object of my invention is to construct an apparatus for the utilization of the elastic qualities of compressed carbonic-acid gas or air for the purposes of forcing a continuous stream of water. It differs from all inventions known under the head of fire-extinguishers in this, that the gas or air taken from the generator, storage-tanks, or reservoir, after having exerted its force on the water, is returned to the original pressure in the tanks for further use, losing only the percentage that is absorbed by the water in the automatic pump, (working under ten to twenty-five atmospheres,) and which is carried away with the water.

The advantages secured by such an apparatus are apparent in the reduction of the expenditure for gas, which is usually lost by being dispelled in the atmosphere *in transitu.* and in the amount of water, length of time, and distance a small quantity of compressed carbonic-acid gas or air can be utilized to throw water through a nozzle, by means of a pump that is constructed to work continuously under an even heavy pressure.

The nature of my invention consists in the arrangement and combination of an apparatus for forcing a stream of water by the pressure exerted by compressed carbonic-acid gas or air; in the manner of supporting the gas tanks or tubes; in the mode of compressing such gas or air; in the construction of the valves for holding the gas or air under great pressure in the tanks or tubes; in the construction of an automatically-working pump, whereby the pressure of the gas or air is exerted on the surface of the water to force the stream; and in the arrangement of an air or gas pump or compressor combined with a suitable motor, whereby the exhausted gas from the automatic pump is again compressed to the required degree, and forced back into the tanks or tubes for use again.

Figure 1 is a side view of one form of such apparatus, showing the gas-tanks B, the automatic pump C, the gas or air pump D, and the engine D′ used to work such pump, and the pipes connecting the same. Fig. 2 is a top view of the same, showing the construction and arrangement of the clamps and braces for supporting and bracing the tanks. Fig. 3 is a front view of the gas-tanks, the gas or air pump, and engine working such pump, the automatic pump not being shown. Fig. 4 represents one construction of valve to be used in the head of the tanks for holding the gas or air in such tanks. Fig. 5 represents another construction of valve for the same purpose, and the fitting therefor. Fig. 6 is a sectional view of the automatic pump C. Fig. 7 is a top view of the same and of its chambers.

The whole apparatus is supported on a bed-frame generally made of iron, which may be of any desired thickness and width sufficient to bear the weight and strain put upon it. It may, however, be made of any sufficiently strong material, and is to be mounted on springs and wheels.

The tanks are supported within and by side pieces A A^1 A^2, which are bolted to pieces of metal *a a* brazed or otherwise fixed to the tank. The center and heavier side piece A is connected by bolts to a band, *d*, which is shrunk on the tank, and serves the double purpose of strengthening the tank and supporting it, such band being bolted to the frame. Bands shrunk on the top and bottom of the tank may be used for the same purpose.

The clamp-braces E, which are shown in Fig. 2, are made of brass or other suitable material, and are placed at the top and bottom of the tanks B, and are connected by iron rods *c c*, which can be tightened by nuts *f*. As will be apparent, these clamps and rods will so secure the tanks that they cannot have movement in either direction, or in the frames A A^1 A^2. The gas tanks or tubes are made of any required strength, and are fitted with screw-plugs *b* for the purpose of blowing off or clearing such tanks, when desired or necessary.

In the top of each of such tanks or tubes is a valve for retaining the gas or air in such tanks, or permitting it to pass therefrom into the automatic pump, and is attached to the head of such tank in the following manner:

J is a flange, about four inches in diameter, which is screwed to a piece of iron or brass,

brazed or welded on the inside of the head G, and provided with an opening in its center of one-half or three-fourths of an inch. The purpose of making this fitting of such diameter is to facilitate the putting the heads in the tanks, and to apply, when desired, an acid-proof coating to the inside of the tanks. The valve J^1 is conical shaped, and its seat is formed by the shell J^2, which is or may be a part of the flange J, and is fitted inside to the valve. Such valve and seat have recesses *c c'* filled with soft-metal or other packing, so placed that when the valve is closed the surfaces of the soft-metal or other packing are brought tightly together, making it impossible for the gas or air to escape. To such valve is fixed a stem, I, which works in a thread, and is held in place by the bushing 1, and is packed at the bushing 2 by asbestus, gum, or other packing, and the connections of the valve are also so constructed as to admit of packing. In the use of such valve the pressure of the gas or air in the tanks or tubes is against the bottom of the valve, and tends to tighten it. Such valve may be worked by hand, through the wheel I', or by a lever, or in any other suitable manner.

Fig. 5 shows another construction of valve, which may be used for the same purpose, in which F is a nipple which forms the seat for the valve, and *g* its flange. Such flange is made in one piece, of brass or other suitable material, of any required size; but I prefer it of brass, four inches in diameter at the flange and one-half or three-fourths of an inch at the nipple, and screws into a piece of iron brazed or welded inside the head G, fitted with a thread, into which takes the thread of the flange *g*. These threads should be trimmed before the filling is screwed into the head, and soldered afterward to make the joint perfectly gas or air tight. The end of the nipple F is turned off conical shaped, and forms the seat of the valve H, to which is connected a stem, I, such stem working in and being supported by bushing and packing, as before described. Such valve has also a recess, *b''*, in it, filled with soft metal, which allows the conical seat F to embed itself in such metal, thus making the valve absolutely gas or air tight.

The several tanks B, except one, (or more, according to the size of the apparatus,) which is intended to receive the exhaust from the automatic pump, and which should be but partially charged, if at all, are charged from the generator, or by an air-pump if air is used, and when any required pressure is obtained the valve in the top is closed, and such pressure will be thus available whenever desired; and when the apparatus is required for working, communication is made between the tanks and the automatic pump by means of the pipe *d d*, and opening the valve. One or more tanks can be used, as desired, and communication between such tanks is effected by a pipe, d^1 d^1.

The pump or compressor D is single or double acting, of any desired capacity, of no prescribed form, but, like any efficient gas or air pump, placed in a convenient position to its work, and firmly secured to the frame and tanks.

Fig. 6 is a sectional view of the automatic pump C, in which B^1 B^2 are the chambers, two or more, made of steel or other suitable material, and of any desired dimension. C' C' are floats, made of cork or other suitable material, to work the levers L L, which operate the valves M M. *d* is the inlet for the water which passes into the chambers through the valves d^1 d^1. E is the outlet for the water passing through the valve d^2 d^2. These valves have recesses that are filled with soft metal or other material to make them gas and water tight in their action, and they are arranged on the stem P, one on each end. The stem is held in place and works in the bearings *s s*. *h h* are the inlet-pipes for the gas or air, connecting with the gas tanks or tubes. *o o* are the inlets to the chambers B^1 B^2 for the gas, and *o' o'* the exhaust or outlet; *x*, the exhaust-pipe which conducts the exhaust-gas back into the tanks reserved for such purpose. H' is a handle to levers L.

The exhaust of gas from the automatic pump C is conducted by pipe or hose back to one of the gas-tanks used for such purpose, and which is empty, or is charged with gas or air at about one-third less pressure than are the other tanks, and from such tank the exhaust air or gas is drawn or exhausted by the air pump or compressor D, and by it compressed to the required degree, and then forced into the other tanks or one of them, and the pressure thus kept up, as required, in this continual mechanical way.

The tube conveying the exhaust air or gas from the pump C to the exhaust-tank is fitted with a check-valve to prevent any back pressure from the exhaust-receiving tank. There is no gas thus lost, except that absorbed by the water, as all the gas, with such exception, is conveyed again to the tanks after being recompressed, so as to be again available for use, as before. Any style of generator may be used, and pressure-gages to note the pressure.

The apparatus being charged, its action is as follows: The tanks, except that appropriated to receive the exhaust from the pump C, being filled with compressed gas or air at a pressure of two hundred to four hundred pounds on the inch, and the pump C connected by pipes, it is readily understood that the pressure of gas in the tanks, upon being liberated by opening the valves, rushes into the chambers of the pump until the pressure is equalized. If the chambers are full of water, the pressure of the gas displaces it and forces it out. As soon as this displacement has been effected, and the supply from the tanks is shut off by one of the valves M in the automatic pump, the other valve M is opened, and the liberated gas rushes through pipe or hose back into one of the tanks B, used for that purpose. From such tank the gas or air is exhausted by the pump D and engine D', and compressed to the required pressure, and then forced into the

other tanks to be used again, and so on continuously.

The pump or compressor D, used for compressing again the gas or air returned from the automatic pump and forcing it into the other tanks, may be worked by any suitable power; but I prefer, for working such pump D, an engine working on the principle or plan similar to that used in Brayton's ready motor. Such engine is constructed with an air-pump, which is used to pump air into the working-cylinder to supply combustion. If applied to my apparatus, the size of this pump would be increased, and the whole strength of the engine would be applied to pump air into the tanks to the density required to work the automatic pump C.

By my apparatus I make a fire-engine that will throw as much water as a steam fire-engine, and which will be almost inexpensive in its working compared with the fire-engines now in use, and at a comparatively trifling expense.

Fig. 7 is a top view of the chambers B^1 B^2 of the automatic pump. *v v* are the valve-chambers; *h h*, gas-inlets; and *x*, the exhaust-pipe.

The action is as follows: The pump is attached to the tanks or tubes by pipes or by hose, the suction-hose R having been attached to the water-plug, and also to the pump at *d;* or the pump may be immersed in water, the water rushing through the valve *d* into chamber B^1, raising float C', which operates the levers L, thereby opening the valve M, and letting the gas pass through inlet O from pipe *h* to the chamber B^1. The pressure of the gas on the water in the chamber B^1 closes valve d^1 and opens valve d^2, forcing the water out through valve d^2 into the hose connected at E. The pressure of the gas on the valve d^1 closes it in that chamber and opens it in the other, (both valves being on the same stem,) and the water from *d* passes through the open valve and fills that chamber while the pressure of the gas is forcing the water out of the other. As this operation is going on, the exhaust-port *o* of the chamber, being thus filled with water, is open, so that the gas or air can flow into the tank used to take the exhaust air. As the water rises in such chamber the float therein is raised, which moves the lever connected therewith, thereby opening the valve N and letting the gas into such chamber, the pressure of which closes the valve d^1, opening valve d^2, as before described, in respect to the other chamber. In this manner an automatic action of the pump, produced by the pressure of the gas, causes a continuous stream of water to flow through the hose at E.

If the amount of water from the plug is more than the pump works, the surplus is permitted to pass into the discharge E by pipes and siphon fittings connected therewith, the supply to the chambers being regulated by gate-valve or in any suitable manner.

When there are no water-plugs, the chambers may be filled by the pump D, or the automatic pump may be immersed in a stream or well of water, the gravity of the water filling the chambers. The gas in this case is conducted to and from the pump by hose, the action of the pump being the same in all cases.

Having described the character of my invention, I wish it to be understood that I do not limit myself to any precise arrangement, form, or dimensions of apparatus. They may be made stationary as well as portable, and sulphurous-acid gas may be used, if found convenient, in connection with water, for extinguishing fires.

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

1. In combination with the gas or air tanks or holders B, one or more used for holding the compressed air or gas, and one or more used for receiving the exhaust air or gas, as described, the automatic pump C, or its equivalent, connecting with such pressure and exhaust, substantially as described, and the air pump or compressor D, having suitable connections with the exhaust and pressure tanks for recompressing the exhaust air or gas and forcing the same into the pressure-tanks, substantially as and for the purposes set forth.

2. In combination with the gas tanks or holders B, as described, the conical valve J^1 J^2, constructed and operating substantially as set forth.

3. The combination and arrangement, in the automatic pump C, of the chambers B^1 B^2, floats C^1, and levers L for operating the valves M moving in valve-chambers, and having inlet and outlet passages *o o'*, and the self-acting valves d^1 d^2, moving in chambers provided with inlet and outlet passages, the whole operating substantially as and for the purpose set forth.

4. The combination, with the gas-tanks B, automatic pump C, air pump or engine D, of a motor engine to work the air-pump, substantially as and for the purpose set forth.

5. The combination and arrangement, with the gas-tanks B, of the clamp-braces E and their connecting-rods *c*, substantially as and for the purpose set forth.

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Witnesses:
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