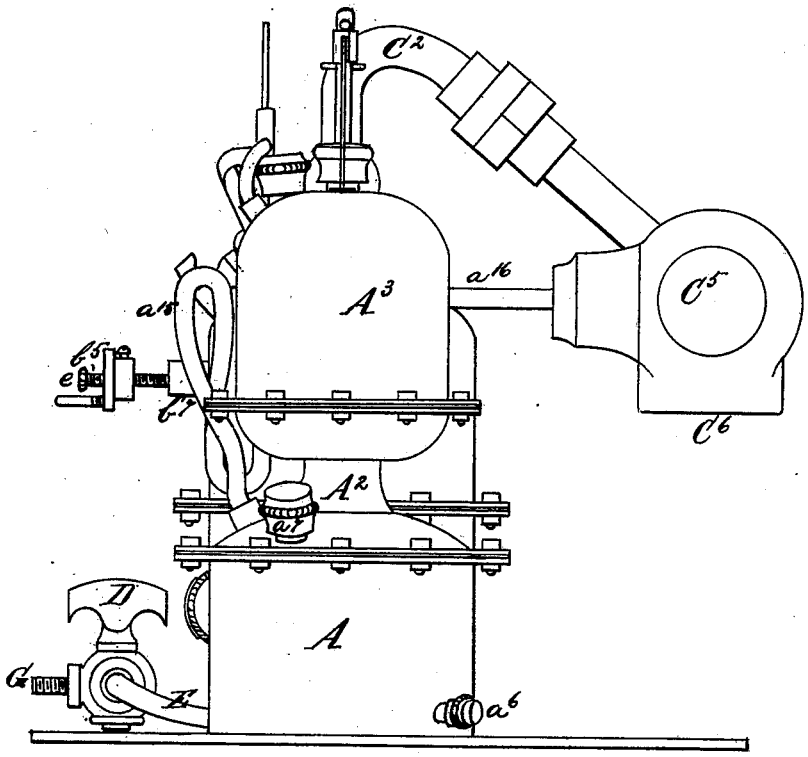
4 Sheets—Sheet 1.

H. B. DUNHAM.

Apparatus for Charging Water with Carbonic Acid Gas.

No. 205,950. **Patented July 16, 1878.**

Fig. 1.



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4 Sheets—Sheet 2.

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Fig. 2.

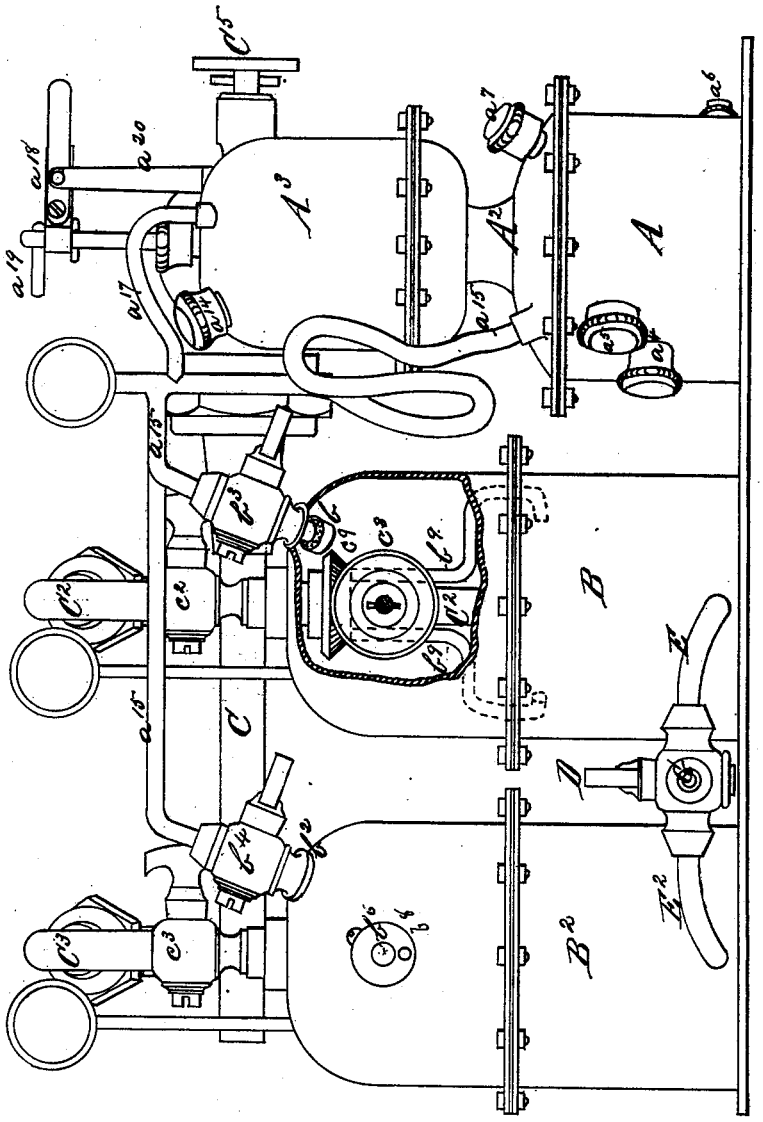

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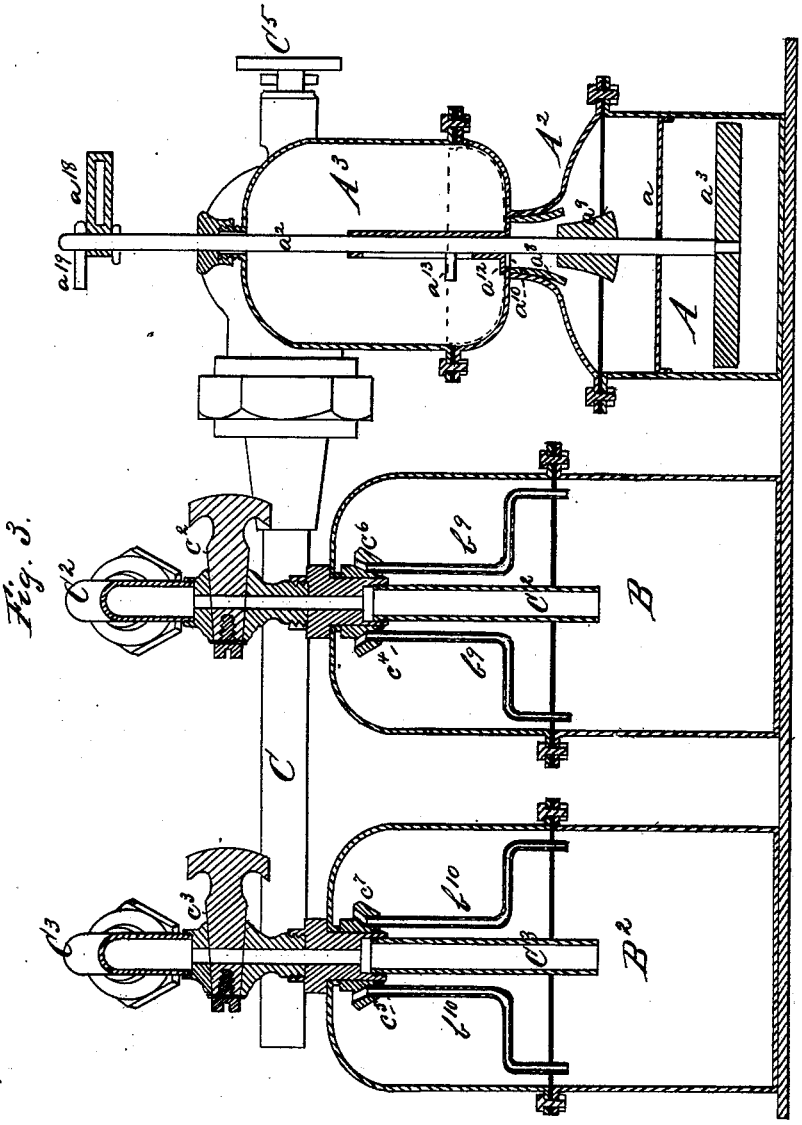
Fig. 3.



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Apparatus for Charging Water with Carbonic Acid Gas.

No. 205,950. **Patented July 16, 1878.**

Fig. 4.

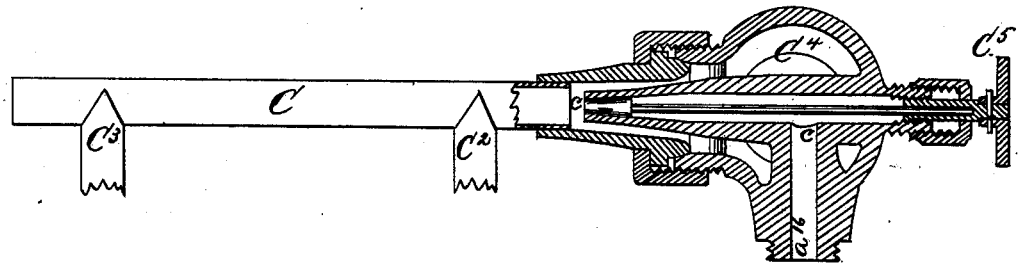
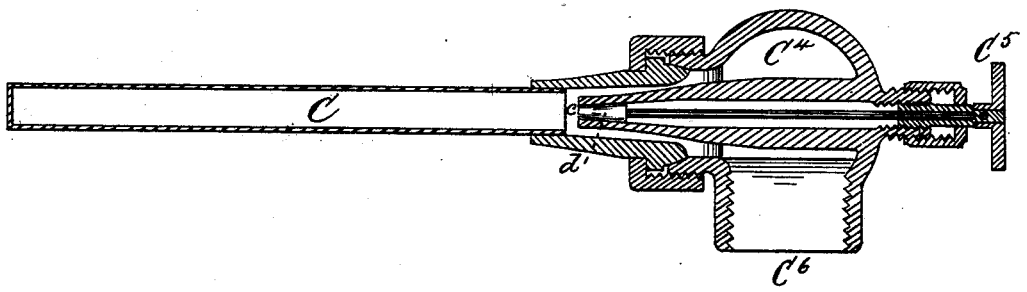


Fig. 5.



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UNITED STATES PATENT OFFICE.

HUMPHREY B. DUNHAM, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN APPARATUS FOR CHARGING WATER WITH CARBONIC-ACID GAS.

Specification forming part of Letters Patent No. **205,950**, dated July 16, 1878; application filed June 8, 1876.

To all whom it may concern:

Be it known that I, HUMPHREY B. DUNHAM, of the city of Newark, county of Essex, and State of New Jersey, have invented a new and useful Apparatus for Charging Water with Carbonic-Acid Gas and throwing it on a fire, of which the following is a full, clear, and exact description, taken in connection with the accompanying drawings.

My invention appertains to mechanism for putting out fires by means of a stream of water charged with carbonic-acid gas; and has for its object to continuously charge said water with gas and discharge it without perceptible intermission.

To effect the above object my invention consists in certain combinations of a carbonic-acid-gas generator and soda-chamber with one or more reservoirs for holding and mixing the water and carbonic-acid gas, provided with suitable pipes and valves for connecting them and for discharging the mixture. These combinations of mechanism are specifically set forth at the end of this specification.

In order that persons skilled in the art may make and use my invention, I will proceed to describe the apparatus as I have constructed it, and the manner in which I have used it.

Referring to the drawings, Figure 1 represents an end elevation of my apparatus, showing the carbonic-acid-gas generator and soda-chamber with the water and gas pipes and the outlet or discharge pipe from the reservoirs, with other parts to be referred to hereinafter. Fig. 2 represents a front elevation of my apparatus, showing the generator, soda-chamber, and two water and gas mixing reservoirs, with the pipes, valves, &c., a portion of one reservoir being broken away to expose the mixing apparatus in one reservoir. Fig. 3 is a vertical longitudinal central section through the centers of the generator, soda-chamber, and reservoirs. Fig. 4 is a horizontal section through the supply-pipe C, showing the injector and its valve. Fig. 5 is a vertical section through said pipe and injector and main connection.

The generator and soda-chamber are composed of three principal parts, marked A A^2 A^3. The lower portion A is a tank to hold water, acid, and soda, or other suitable materials for making carbonic-acid gas, and it is in it that the gas is formed when the proper proportions of the said ingredients are mixed together. A cross-piece, a, is connected to the tank A, through the center of which the shaft a^2 passes and finds a bearing. The shaft extends below the said bearing, and is supplied with a cross-bar or lever, a^3, which, when it is revolved, stirs up the contents of the tank, and properly mixes them to produce rapid and uniform action. The tank A is also provided with nozzles a^4, a^5, and a^6. a^4 is used as a gage to regulate the quantity of water; a^5, to regulate the amount of acid mixed with the water, and a^6 to remove the sediment.

The part A^2 connects the parts A and A^3, and is provided with a nozzle, a^7, through which water and acid are introduced into A. At its neck is a conical valve-seat, a^8, to which a cone-valve, a^9, is fitted, in order that when the shaft a^2 is raised the conical valve a^9, being keyed to it, may fit the seat and close the passage between the tank A and the soda-chamber A^3, so that when the whole apparatus is made portable and is moved from place to place rapidly the acid and water cannot be thrown up into the soda-chamber. A^3 is the soda-chamber, in which a half-barrel of soda or other suitable material may be placed and admitted as needed to the tank A through the valve-opening a^8. At the bottom of the soda-chamber A^3 is a valve-opening, a^{10}, in the form of a half-circle, which is opened and closed by turning the valve a^{12}, which is a little larger than the opening, and also in the form of a part of a circle. It is shown in the sectional drawing in its closed position. To the valve a^{12} is attached a sleeve which covers the shaft to a sufficient height to permit a pin, a^{13}, in the shaft to play up and down in a slot cut in the sleeve vertically, so that the shaft may turn the valve a^{12} around, and yet have enough vertical motion to close the valve a^9 when raised. The soda is supplied to the chamber through the nozzle a^{14}. The shaft a^2 extends up through the top of the soda-chamber a^3, and is kept tight by a packing-box.

To the portion A^2 is connected a pipe, a^{15}, through which the gas when generated is carried to the reservoirs B and B^2, and also through pipes a^{16} to the injector c, and a branch, a^{17}, of the same pipe also enters the

soda-chamber A^3 to equalize the pressure in it with that in A.

On the upper part of the shaft a^2 is a loose slotted arm, a^{18}, which is connected with a lever for raising the shaft. The lever takes a bearing in a stand, a^{20}, shown on the top of the soda-chamber, and is provided with a pin which slides in the slot. A lever-pin, a^{19}, is also attached to the shaft, to enable the operator to revolve the shaft and open and close the valve-opening a^{10}. The position of the lever a^{19} in reference to the standard a^{20} will indicate to the eye whether the said valve is open or closed.

B is one mixing-reservoir, and B^2 is another. They are duplicates, and are connected at b and b^2 to the pipe a^{15}. b^3 and b^4 are cocks for making and breaking the connection with the generator. The reservoirs B and B^2 are also connected with the water-supply pipe C by means of the branches C^2 and C^3, which lead severally from C to the top of the reservoirs at the center of each, and are provided with cocks c^2 and c^3, by which the communication with pipe C is opened or closed. The pipes C^2 and C^3 pass vertically down into the reservoirs about half-way of their height, and are turned off, as at c^4 and c^5, so as to form bearings for the gears c^6 and c^7, which revolve around the pipes when acted on by the gears c^8 and c^9, mounted on shafts b^5 and b^6, fitted to bearings b^7 and b^8, attached to the vertical sides of the reservoirs. These gears, turning at right angles to the gears c^6 and c^7, revolve the latter on the pipes.

Pipes b^9 and b^{10} are attached to the gears c^6 and c^7, as shown, and are open at the top, and also at the bottom, where they are curved to lie in the circumference of a circle. When the gears c^6 and c^7 are revolved the open ends of these pipes come in contact with the water, and cause it to flow up through the pipes above the gears c^6 and c^7, and then, by its own gravity, it falls again. Thus a circulation of water in the reservoir is insured.

By the above-described means I am able to secure a more rapid combination of the gas with the water than is practicable by depending upon its own pressure, or by shaking the entire vessel, as is practiced by others; and I obviate the tendency of the water to spray while being projected on a fire, which is a serious difficulty in apparatus designed to throw large quantities of water and gas, on account of the imperfect combination of water and the gas, whether it be chemical or mechanical.

I am not aware that any attempt has ever been made before my invention to stir up and mix the water and gas by mechanism inside the reservoir itself.

The shafts are made hollow to give vent to the air or gas in the top of the reservoir, and caps are screwed over their ends to close the openings in them when the reservoirs have been filled. These shafts may be revolved by hand or by power otherwise applied.

Near the bottom of the reservoirs B and B^2 are the discharge-pipes E and E^2, leading one from each reservoir to a three-way cock, D, from which one discharge-pipe, G, leads to a suitable hose when connected.

The water-supply pipe C is connected either with a pump or street-main or tank. In said pipe at C^4 will be seen an injector, c, placed in the center of said pipe, and lying so as to inject a stream of gas from the generator into the water flowing toward the reservoirs.

The operation is as follows: The water-supply pipe, being connected to the main at C^6, and the injector-valve d being closed, admits water, through cocks c^2 and c^3, into the mixing-reservoirs B and B^2, until the pressure in the reservoirs is equal to that of the main, the small caps on the ends of the horizontal shafts e and e having been turned to allow the air above the water to escape through the shafts b^5 and b^6. When the water has reached the level of the outlets in the shafts, turn the caps again, and close the air-vents and shut off the water from the main. Now, admit water into the bottom of the generator through the inlet a^7 until it flows from nozzle a^4, and then, having put the cap on the said nozzle, admit sulphuric acid by the same inlet until the mixed water and acid flow from the nozzle a^5; shut off the acid, and put the caps on a^5 and a^7. Next, fill the soda-chamber with bicarbonate of soda, or other suitable material, the valve a^{12} being closed, and then put the cap on inlet a^{14}. Now, open the soda-valve a^{12} and admit soda into the generator, the conical valve a^9 and shaft being lowered. When the pressure begins to rise in the generator the gas will fill the soda-chamber through branch a^{17} of the pipe a^{15}. Next, open the injector-valve by turning the hand-wheel C^5, and allow the gas to flow into the reservoirs through pipe C until the water in them becomes thoroughly charged at the pressure of the generator. To do this thoroughly, revolve the gears by the shafts b^5 and b^6, which will carry the water up to the top of the reservoirs and create a circulation, and mix the water with the air and gas in the space over the surface of the water. If, now, a hose for throwing the charged water on the fire be attached to the outlet-pipe G, and the cock D be opened, and the pipe C be connected with the force-pump or with the street-main, and if the pressure of water in it is equal to the pressure in the generator, a stream of water mixed with carbonic-acid gas may be thrown on a fire continuously, the water thrown out being supplied by the pump or main through pipe C, and the gas entering the stream from the injector partially charging it, the rapid revolution of the shafts b^5 and b^6, and the fountain-pipes b^9 and b^{10}, completing the operation.

It is not necessary to use two reservoirs to effect the result of the operation thus far described, as one reservoir will be sufficient; but my apparatus is chiefly for use where the water-pressure from the main is light, and my apparatus is designed and arranged to use

the force of the pressure of the carbonic-acid gas from the generator to discharge the charged water on the fire in substantially a continuous stream for a great length of time, if desirable. For the latter purpose two or more reservoirs are necessary, so that they may be used alternately. Beginning with the generator charged and in operation, the reservoir being filled, as above, with water, the cocks b^3, c^2, and c^3 are closed, and b^3 and b^4 are opened, allowing the carbonic-acid gas to pass direct from the generator above the water in the reservoirs. The shafts b^5 and b^6 being revolved by hand or other power, the water is impregnated with the gas, as in the first method. As soon as the water becomes fully charged the three-way cock D may be opened so as to open communication with one reservoir only, when the pressure of the gas above the water forces the mixture on the fire until that reservoir is emptied. Then by turning the cock D in the opposite direction communication is established with the second reservoir, and the stream of charged water from it is thrown on the fire.

To charge the exhausted reservoir, the water from the main is again let into it, going through the same process for mixing the water and gas as before. While the second reservoir is discharging, when the latter is emptied, it may be again charged, and the first one again used to play on the fire, the second in the mean time being recharged as above.

I have thus provided for a continuous supply of water mixed with the gas and a continuous means of discharging it on the fire by the pressure of the gas-generator until the supply of materials in the generator is exhausted.

The soda is to be supplied to the water and acid, as required, by turning the soda-valve a^{12} away from the opening in the bottom of the soda-chamber, and allowing a sufficient quantity of soda to feed by gravity.

By revolving the shaft the lever a^3 mixes the soda and acid water, and produces rapid and thorough action.

When the apparatus is to be transported from place to place, the conical valve must be closed by raising the shaft a^2, to prevent the acid-water from being thrown up into the soda-chamber or against the bottom of valve a^{12}.

When the conical valve a^9 is lowered into the acid-water it is washed clean and free from soda which may have fallen on it.

The inside of the generator and the conical valve a^9 are to be made of a material which will not corrode, or the parts may be covered or lined with lead, or such like substance.

Having now fully described the apparatus as I have made it, what I claim, and desire to secure by Letters Patent, is—

1. The combination of the generator A A^2, soda-chamber A^3, and the vertical shaft a^2 with the valves a^9 and a^{12} and the stirring cross-bar a^3, all constructed and arranged to operate substantially in the manner and for the purposes set forth.

2. The combination of the reservoir B with the fountain-pipes and apparatus for operating them inside the reservoir, arranged substantially as described, to throw a stream of water vertically into the top of said reservoir to mix it with the carbonic-acid gas held above the water, all constructed and arranged to operate substantially in the manner and for the purposes set forth.

3. The combination of the generator A A^2, soda-chamber A^3, with their shaft and valves, and two or more reservoirs, B and B^2, with connecting pipes and valves, arranged substantially as described, to alternately charge and discharge said reservoirs, for the purposes set forth.

4. The combination of the generator A A^2, soda-chamber A^3, shaft and valves, the water-pipes and injector, with reservoir B, all constructed and arranged to operate substantially in the manner and for the purposes set forth.

5. The combination of a gas and water reservoir, with vertical fountain-pipes constructed substantially as described, and arranged inside of the reservoir, to mix and circulate the water in connection with the carbonic-acid gas, substantially as set forth.

Witness my hand this 3d day of June, A. D. 1876.

HUMPHREY B. DUNHAM.

Witnesses:
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BERN. T. VETTERLEIN.