2 Sheets—Sheet 1.

J. M. POLLARD.

FIRE-EXTINGUISHER.

No. 192,005. Patented June 12, 1877.

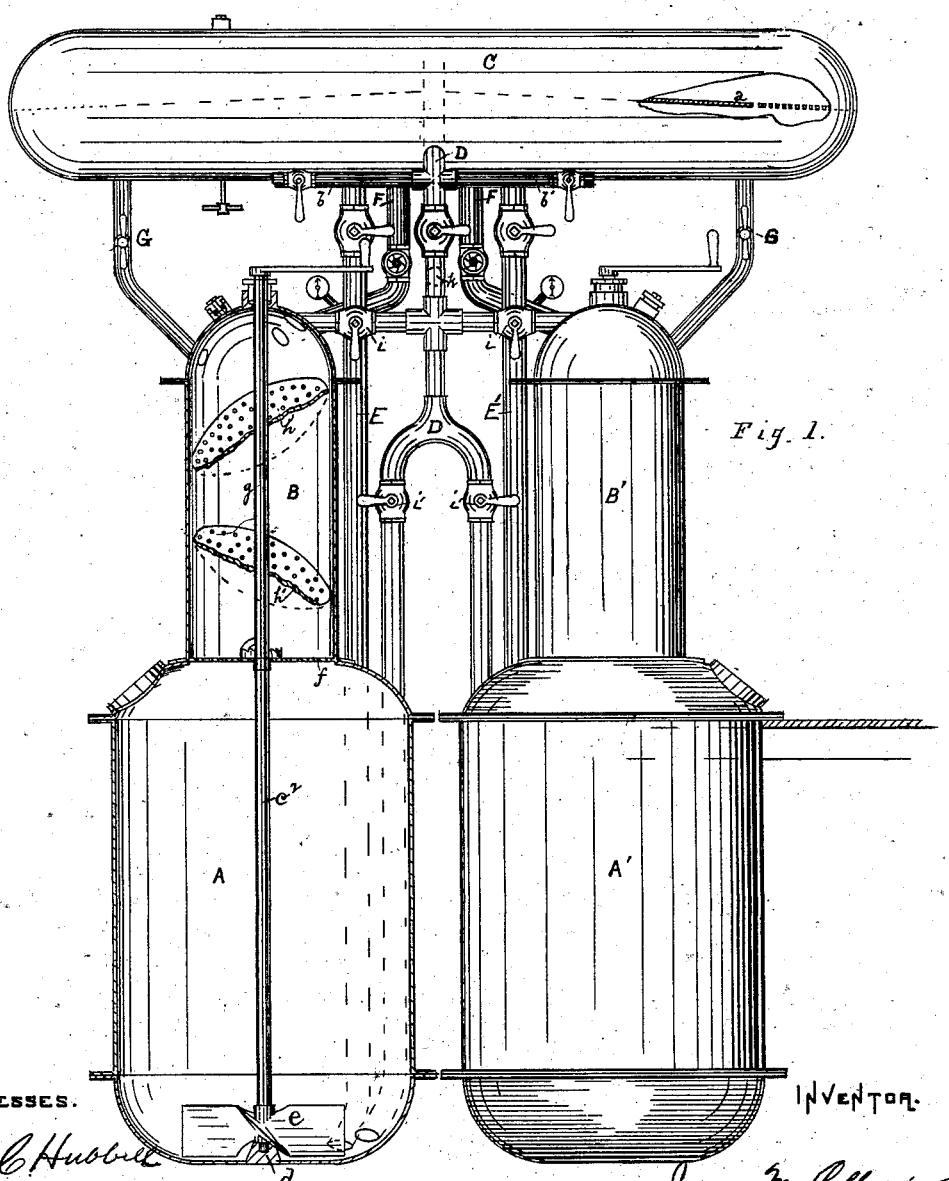

Fig. 1.

WITNESSES.

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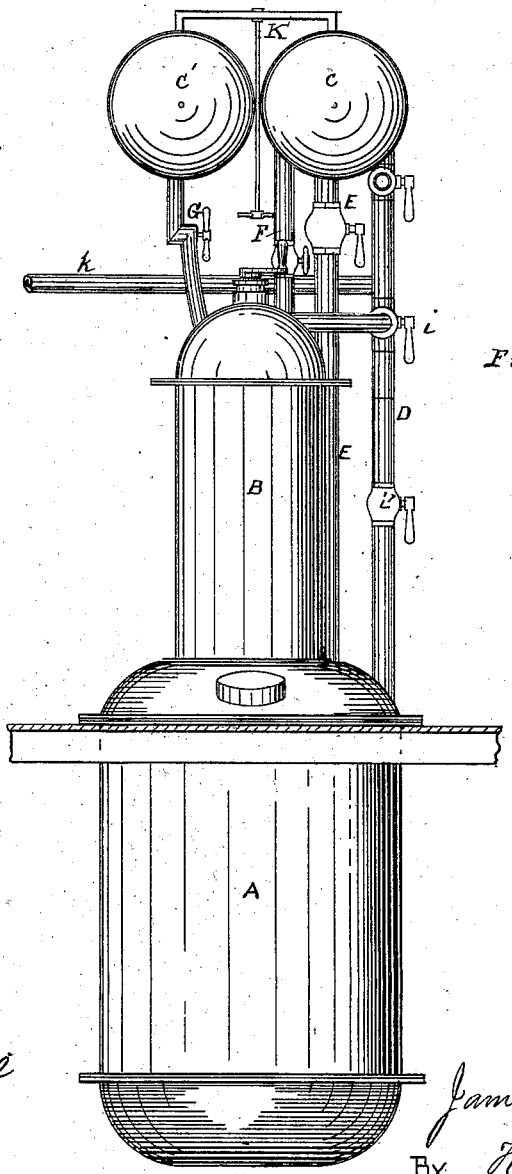

Fig. 2.

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IMPROVEMENT IN FIRE-EXTINGUISHERS.

Specification forming part of Letters Patent No. **192,005**, dated June 12, 1877; application filed May 8, 1877.

To all whom it may concern:

Be it known that I, JAMES M. POLLARD, a resident of the city of New Orleans, parish of Orleans and State of Louisiana, have invented a certain new and useful Improvement in Fire-Extinguishers; and I do hereby declare the following to be a full, clear, and correct description of the same, reference being had to the annexed drawing, making a part of this specification.

This invention relates to that class of apparatus in which a volume of dry carbonic-acid gas is evolved for the purpose of extinguishing fires. It consists in two (though any number may be used) vertical generators, surmounted by domes, above which are supported, in any suitable manner, two horizontal drums or cylinders, the whole connected by a system of pipes, the functions and purposes of which will be hereinafter described.

The nature of my invention will be readily understood by referring to the accompanying drawing, wherein Figure 1 represents a front and Fig. 2 a side, view of my improved apparatus.

A A′ are vertical cylinders, each having a capacity of say thirty cubic feet. They are charged with the bicarbonate of soda in dry finely-powdered form, each generator to contain say nine to twelve hundred pounds, or fifteen to twenty cubic feet by measure, though any less quantity may be used.

These generators are surmounted by domes of a less diameter, B B′, in which the gas is made to separate from the foam or bubbles caused by the action of the chemicals, and from which it is conveyed through the pipes F F to the drum C, impinging against the interior partition *a*, passing to the ends or perforated portions of the same, and thence back to the center of the drum, and out of the exit-pipe D, through its lateral branches *b b*, which are furnished with screw-butts or couplings for flexible hose, and with suitable stop-cocks for determining the direction and intensity of flow of the gas.

The cylinder marked C′, Fig. 2, is provided with a leaden lining, and is designed for containing sulphuric acid, sufficiently diluted to prevent its active corrosion of the same. It may be filled through a suitable opening from above, or the acid may be forced into it from a second and larger reservoir located below, and for this purpose an air-pump or its equivalent may be used.

Each generator is provided with a vertical central shaft, c^2, having its foot operating in a step, *d*, immediately above which it is furnished with an agitator, somewhat similar to a three or four blade screw propeller. The upper bearing of this shaft is in the perforated diaphragm *f*, which is interposed between the generator and its dome. Just above this bearing it is connected with an upper shaft, *g*, by means of a ratchet-wheel and pawl, so constructed as to revolve the lower shaft and agitator in but one direction, that inducing an upward central current in the chemicals, and a counter downward current at the circumference; while, by turning in a reverse direction, the upper shaft only may be rapidly rotated, carrying with it the angularly-set beaters or perforated plates *h h′*, and thus liberating the gas from the foam carried into the dome by its expansion.

The process of charging and operating my extinguisher is as follows: The bicarbonate of soda is placed in the generators, and the manholes securely fastened, when a current of steam or hot water, or either, is introduced, either at the top or bottom of the generators, by means of the pipe D, with branches and stock-cocks, *i i′*. A branch of this pipe, *k*, connects with a suitable steam-boiler, (not shown in the drawing,) but which will be the steam-boilers of vessels, or the boiler of a steam fire-engine when used as an auxiliary to a fire-department.

By this process the soda is reduced to a sesqui-carbonate, parting with one-fourth its carbonic-acid gas while being thoroughly agitated and moistened preparatory to the introduction of the acid.

A very important point is also gained by expelling and excluding the air from all parts of the apparatus before mingling the chemicals, and maintaining a high temperature during the process, as it prevents the crystallization or solidification of the sulphate of soda, resulting from their union.

When the soda or carbonate has become sufficiently moistened, the sulphuric acid is

introduced in a small and, as nearly as possible, continuous stream from the drum or cylinder C′, through the pipe and cock G, the process being regulated by an indicator, care being taken to keep the pressure of the generated gas just below that indicated by the steam pressure, by which means a small though constant current of steam is admitted to the bottom of the generators, and the mass of soda agitated thereby. The liquid is also kept at a temperature so high that the water does not absorb the gas, and an injurious waste is thus prevented or avoided. Again, the steam and gas escape together, the steam condensing and imparting its heat to the gas, which is thus made to occupy a larger space and produce a greater effect.

The above process is continued until the addition of acid fails to evolve the gas, when the cocks *i′ i′* are closed, those marked *i i* opened, and an outlet cock and pipe at the bottom of the generators (not shown in drawing) being opened, the pressure of steam rapidly expels the residuum or sulphate of soda. The interior of the apparatus may then be rinsed by a dash of hot water, the connections closed, and the apparatus recharged.

The pipes E E′ are designed to return to the generators any liquids that may be carried to the drum C by the action of the escaping gas.

It will be observed that all cocks, &c., are so arranged as to be within easy reach of the operator without his having to change place, and that by obvious manipulation of the same the hot water or steam may be forced in either direction through all the pipes, domes, generators, &c.

Suitable gages and safety-valves are provided separately for each generator, and an equalizing pipe, K, with lengthened handle and stop-cock, connects the drum and acid-holder, as shown.

In the process, as hereinbefore described, water is only necessary in that it facilitates the action of the chemicals. This it does by its very great affinity for sulphuric acid, the two becoming intimately mingled by mere contact, thus carrying or diffusing the particles of acid through all parts of the soda, and as the soda neutralizes these particles fresh ones are supplied.

The bicarbonate of soda is but little more soluble in hot than cold water, and requires several volumes of either to assume a liquid form; but the sulphate, which is instantly formed by the introduction of the acid, is extremely soluble, remaining liquid while excluded from the air and heated to 180° Fahrenheit, with less than its weight of water. By utilizing this property I am enabled to rapidly neutralize large bodies of carbonates within a small space, and without the use of water other than that condensed from the steam, and at the same time reduce the bulk and weight of the apparatus to a degree that would otherwise be impossible.

If the apparatus is applied to sailing-vessels, or if in cases of emergency steam cannot be had, I may employ a smaller quantity of the carbonate—say one-third to one-half that used by the steam process—and introduce the acid diluted with two volumes of water into the pipe D, and in the same manner as described in using steam or hot water. For this purpose a force-pump may be used as the equivalent of the steam-pressure, and a separate cylinder may be added for mingling the acid and water before admitting to the generators, or a pump may be so constructed as to force at each stroke two volumes of water and one of acid into the pipe D, and effect their mingling at that point.

In this process the greater portion of the diluted acid will be introduced into the generators through the pipe *i;* but to agitate it I will also introduce the acid as often and in such quantities as may be necessary to the bottom of the cylinders or generators, and thus utilize the gas for the purpose. In doing this the cocks *i i* are closed, and those marked *i′ i′* opened. To this end the pipes D D and also E E′ are provided with upward-closing check-valves to avoid the escape of any gas backward or upward through them.

Where the conformation of vessels or buildings require it, the generators may be placed horizontally, and the connections made to conform to the changes in structure while retaining the same features and principles.

The drawings are intended to represent the proper arrangement of apparatus for a vessel, or for mounting on a truck for use as part of a fire-department outfit Its capacity will be eight thousand to ten thousand five hundred cubic feet of carbonic-acid gas at atmospheric pressure and temperature at each charge, and by working the generators alternately this quantity of gas can be evolved every ten minutes.

A careful estimate of the maximum space in which fires originate shows that for large stores, vessels, &c., (the same being partially filled,) ninety-five per cent. of all fires occur in a closed space of thirty thousand cubic feet or less, and that this space is usually so divided that the air can be partially excluded, especially before the fire has reached the exterior. Supposing the ingress of air to be so checked that it is only renewed once in five minutes throughout such space, which will be a liberal estimate, if we consider the carbonic-acid gas as supplying in a great measure the volume required to replace the air consumed by the fire, then as ten per cent. of carbonic-acid gas extinguishes flame, or rather renders the air unfit to support active combusition, and as eight thousand cubic feet of carbonic-acid gas can be introduced in five minutes by using both the generators at once, it follows that under the conditions named the air in such space would, at the end of five minutes, contain at least fifteen per cent. of carbonic-

acid gas, and consequently that there could be no fire present, though a second charge might be used as a precaution against fire smoldering in bales of goods, &c.

Unless the gas can be generated in volumes sufficient to supply the vacuum (in the atmosphere) that is created by the fire, the air will force its way in and reach the fire, the gas will be expanded by the heat till its specific gravity becomes lighter than air, at which point it will be carried upward and lost, passing off with the smoke and other products of combustion, instead of remaining nearest the fire and excluding the air. It is thus carried off nearly as fast as supplied, producing little effect upon the fire, when the addition of twice the quantity in the same time would almost instantly cut off the supply of air, and extinguish the fire.

These remarks are intended to illustrate the necessity that exists for a very rapid evolution of the gas in very large quantity or volume, and to convey an approximate idea as to the volume that will ordinarily be required.

It is a very easy matter to determine the capacity of any chemical apparatus, and a very exact calculation will be an allowance of four cubic feet of gas for each pound of the bicarbonate of soda neutralized.

Upon this basis it will be seen that to hold the soda in cold aqueous solution requires an apparatus too heavy to be practically available, yet lacking the required capacity to hold the acid in a sufficiently dilute form is but reversing the same conditions.

All attempts to liquefy this gas, and thus store it ready for use, have hitherto failed, on account of its enormous expansive force, which renders its containing-vessels equivalent to so many bomb-shells, and no method yet devised will retain it without serious and constant loss through the pores of the metal or other substance in which it is kept.

These objections apply in great part to the storing of this gas in tanks or cylinders under pressures of two to five hundred pounds. The loss is constant, and the cylinders must be very heavy to withstand the great and continued tension to which they are subjected. Under the most favorable conditions attainable it will require a weight of four pounds of metal to retain one cubic foot of this gas in a sufficiently compressed form.

Having thus fully described my invention, and by means of the foregoing remarks and comparisons pointed out its advantages and superiority, what I claim is—

1. The process, herein described, of expelling the air from the generators of chemical fire-extinguishers, and preventing the crystallization of the sulphate of soda, the said process consisting in the introduction into the generators of currents of steam or hot water, substantially as described.

2. The process herein described for expelling the air, along with a portion of the gas contained in the carbonate, by means of a current of steam, a portion of the steam escaping with the gas, and expanding or increasing its volume by imparting its heat to the gas as the steam is condensed, and a portion of the steam condensing in and moistening the carbonate preparatory to the introduction of the acid, so that the direct use of a volume of water is avoided, and the carbonate converted to the sulphate with the use of but one equivalent of water.

3. The method of agitating and mingling the chemicals previous to and during the admission of the acid, the same consisting in the admission into the generator of a current of steam, substantially as described.

4. The process of agitating and mingling the chemicals in a fire-extinguisher, the same consisting in admitting a portion of the diluted acid to the bottom of the generator, whereby the gases thus liberated produce the desired effect, substantially as described.

5. In a fire-extinguisher, a generator, A, provided with dome B, in which is operated an independent set of beaters, *h*, for the purposes set forth.

6. In combination with the generators of a fire-extinguisher, an agitating-screw, *e*, arranged to operate in but one direction, as described, and for the purpose set forth.

7. The combination of the vertical generators A A′, with domes B B′ surmounted with cylinders C C′, the whole connected by the system of pipes D, E, F, G, *k*, and K′, as shown and described, and for the purposes set forth.

In testimony whereof I have hereunto set my hand.

J. M. POLLARD.

In presence of—
L. D. ELLIOT,
J. C. HUBBELL.