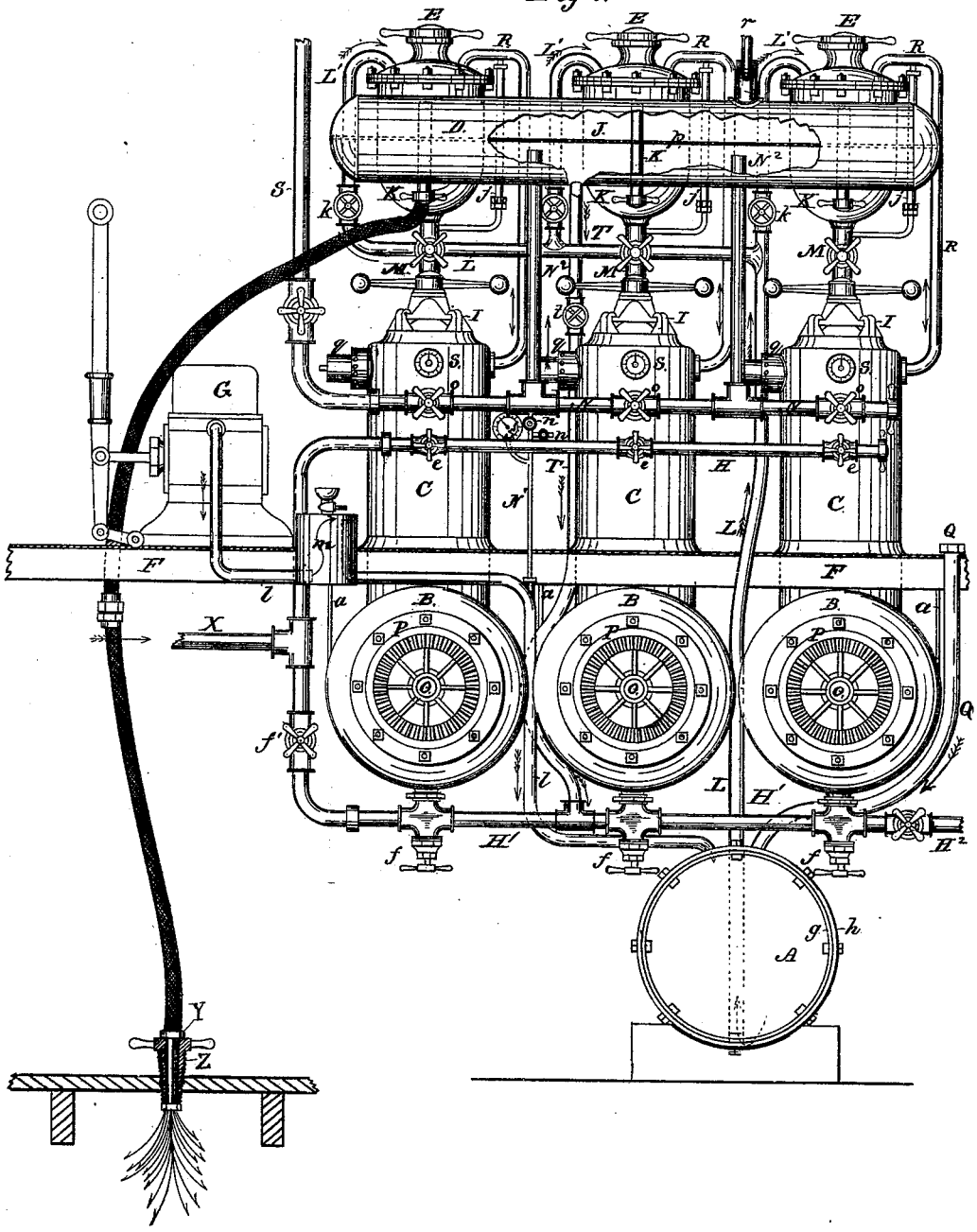
2 Sheets—Sheet 1.

A. M. GRANGER.

CHEMICAL FIRE-EXTINGUISHER FOR VESSELS, &c.

No. 185,913. Patented Jan. 2, 1877.

Fig. 1.



WITNESSES:

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BY

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2 Sheets—Sheet 2.

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Fig. 2.

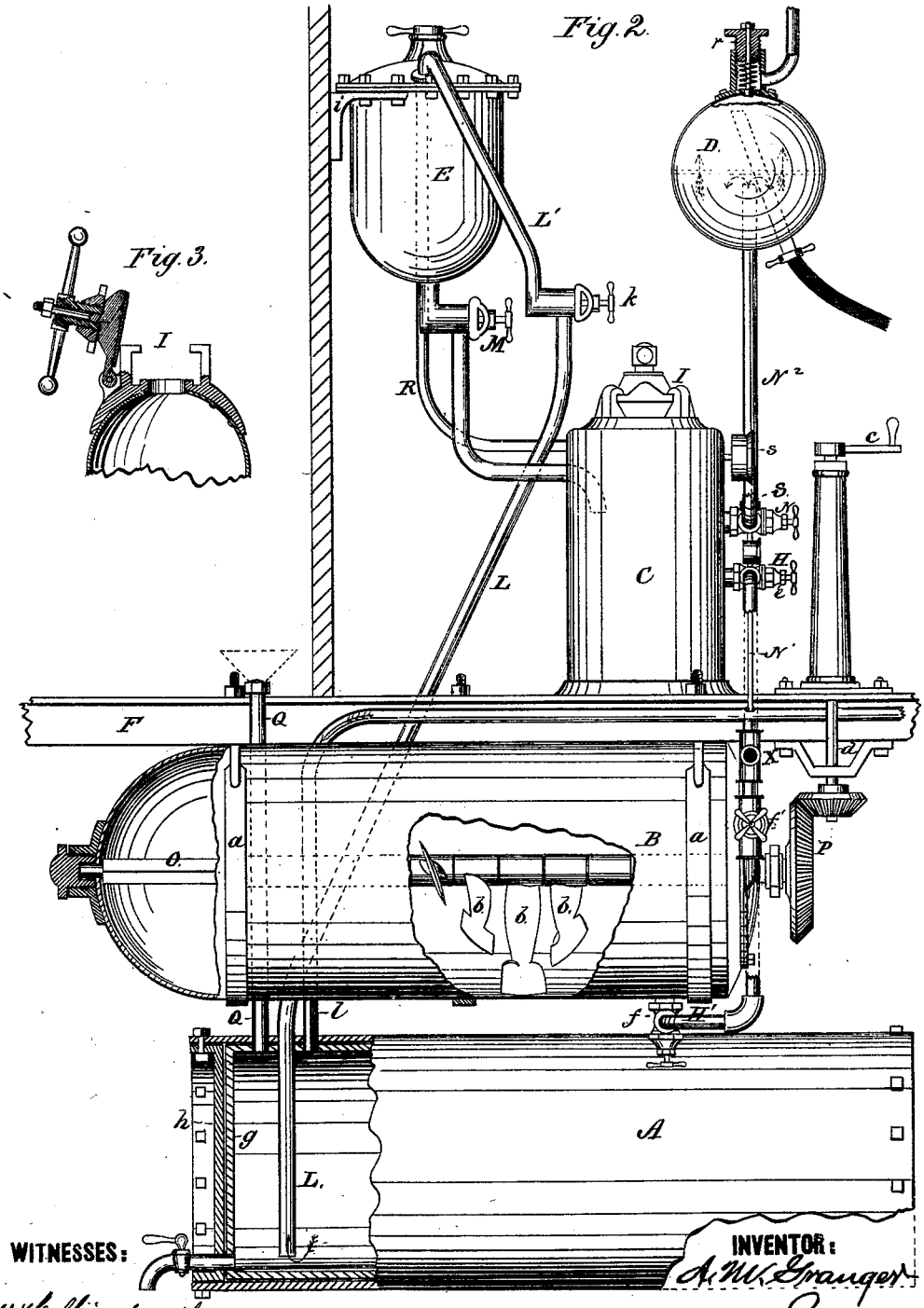

Fig. 3.

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UNITED STATES PATENT OFFICE.

ALMON M. GRANGER, OF NEW ORLEANS, LOUISIANA.

IMPROVEMENT IN CHEMICAL FIRE-EXTINGUISHERS FOR VESSELS, &c.

Specification forming part of Letters Patent No. **185,913**, dated January 2, 1877; application filed December 19, 1876.

To all whom it may concern:

Be it known that I, ALMON M. GRANGER, of New Orleans, in the parish of Orleans and State of Louisiana, have invented a new and Improved Chemical Fire-Extinguisher for Vessels, &c.; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a front elevation, partly in section. Fig. 2 is a side elevation, partly in section. Fig. 3 is a detail, showing in vertical section the cover for the domes.

My invention relates to certain improvements in chemical fire-extinguishers, designed more particularly for harbor fire-protection boats and sea-going vessels, but applicable also, in most of its features, to general use.

The general principle of the improvement rests in the direct use of the dry gaseous carbonic acid in smothering volume, in contradistinction to the common use of a limited quantity of the same dissolved in water under pressure.

The means for carrying out the invention consist, generally, in the combination of a set of capacious generators for containing bicarbonate of soda, a set of superposed acid-vessels, a subjacent acid-reservoir, and an air-pump, or equivalent forcing apparatus for charging the acid-vessels from the reservoir, the whole being combined by means of communicating pipes, controlled by valves or cocks, so that the acid may be forced from the reservoir in the hold of the boat only when the effective power of the gas is required, and whereby accidental admixture of the chemicals is, from the motion of the vessel or from other causes, completely avoided.

The invention also consists in other details of construction and arrangement for the best and most convenient use of the apparatus in charging or cleaning out, as well as the most effective manipulation of the gas, which details will be hereinafter more fully described.

Before proceeding to a description of the accompanying drawings, I would state, in relation to the merit of the dry gas, that the great loss of life and property at sea, extended through a period of many centuries, has proven the entire insufficiency of water for the purpose of extinguishing fires of this class. This is so by reason of the fact that a quantity of water sufficient to completely extinguish the fire when under full headway would help to sink the vessel, while the means for throwing a sufficient quantity of water are necessarily limited. Moreover, if water were found sufficient for the purpose, its application would not, beyond the saving of life, be desirable, by reason of the damage to cargo; hence I have resorted to a use of the carbonic-acid gas, dry, and under pressure, which, although not being capable of being projected a sufficient height to render it particularly desirable on land, is, nevertheless, specially applicable on the sea, by reason of the confined character of the vessel's compartments, and for the reason, also, that its own gravity effects its distribution and its consequent passage to the parts needed, while its inert chemical character is such as to completely smother the fire, and yet produce no deleterious effect upon the cargo.

In the drawings is shown my apparatus applied to a vessel, of which only the deck F F is shown. B B B are the generators, which are in the nature of copper cylinders, tested to a pressure of about three hundred pounds, tinned upon the inside to render them less susceptible to the action of the acid, and arranged longitudinally in horizontal position below the deck, being suspended either from the deck by means of straps *a*, as shown, or supported upon stanchions. These generators are in number according to the efficiency of the apparatus required, and in dimension preferably about twenty-six inches diameter, by nine feet length, giving to each of them a capacity adapted to receive about four hundred and forty-eight pounds of the bicarbonate of soda, which is mixed with water to the consistency of a paste, and from which, by the admixture of sulphuric or other equivalent acid, the carbonic-acid gas is evolved.

With three of the generators having the capacity indicated, the apparatus is made sufficiently effective for the complete extinguishment of ordinary ships' fires, the size and number permitting the renewal of the charge of one while the others are operating, and

without materially impairing the effective power of the same.

These generators are each extended upwardly through the deck at one end about thirty-six inches, to form the domes C C C, through which the chemicals are admitted to the generators, and are also provided each with a longitudinal shaft, O, carrying detachable spirally-arranged agitators *b*, about four inches in width, and arranged at an angle of about forty-five degrees to each other. These agitators *b* correspond in form to a section of a propeller-blade, and when the shaft O is revolved serve to produce a slowly-moving current of the acid throughout the length of the generators, to secure the better mixture of the acid with the bicarbonate of soda, which materials, it will be seen, are admitted through the dome at one end of the generator. This revolution of the shaft O and agitation of the chemicals is effected through the instrumentality of a set of bevel-gear wheels, P, operated by a crank, *c*, upon a vertical shaft, *d*, extending above the deck. In the place of these devices, however, an endless chain with rag-wheels may be used. The domes of the generators have each a removable cover, I, of a well-known pattern, (shown in Fig. 3,) through which the bicarbonate of soda is charged to the generators. These covers are hinged to the dome, and when they are to be shut down and closed they are folded over, turned beneath lugs upon the dome, and the cap proper is then tightly adjusted to the orifice by the lever and screw. The domes are connected by, and provided with, a horizontal supply-pipe, H, above the deck, for the admission of water to the generators, while the generators themselves are connected by and provided with a horizontal discharge or waste pipe, H^1, located immediately beneath the same. Both these pipes H H^1 are provided with separate sets of valves *e* and *f*, respectively, for each of the generators, whereby the admission of water to or the discharge from the same may be together or separately controlled. Both these pipes H H^1, furthermore, communicate with a common and general inlet water-supply pipe, X, which admits the water either to the domes through pipe H, for reduction of the bicarbonate of soda to the proper pasty consistency in charging the generators, or which, through a valve, *f'*, admits water to the generators from the bottom, for the purpose of breaking up and dissolving the caked residuum of sulphate of soda and bicarbonate of soda before discharging the same overboard through the pipe H^2.

A is the acid-reservoir, which is located in the hold of the vessel beneath the generators, upon any suitable support, and rigidly held in place by stays. This reservoir is of a capacity of about two hundred and thirteen gallons, or sufficient to serve the repeated chargings of the apparatus which an emergency may render necessary. This reservoir is constructed in the form of a cylinder of lead, *g*, about one-fourth inch in thickness, surrounded by an incasing and re-enforcing shell, *h*, of iron, the lead being used by reason of its immunity from the action of the sulphuric acid, while the shell of iron is to re-enforce the feeble tensile strength of the lead and prevent rupture to the same, which might otherwise result from the pressure which, in the operation of my apparatus, is applied to this receptacle.

In constructing this acid-reservoir, the closed leaden cylindrical case *g* is first formed, after which the iron shell is constructed of a little greater diameter and length than said case, with open ends, and is slid longitudinally over the leaden case, after which flanged end caps are fitted into the open ends of the iron shell, in contact with the ends of the leaden case, and are bolted to the projecting edges of the iron shell. This arrangement permits the ready removal of the iron shell and the repair of the leaden case when necessary, and is of simple and easy construction.

In charging the reservoir, this is effected through a pipe, Q, leading to the deck, the reservoir being preferably filled to its utmost capacity to prevent splashing from the motion of the boat, in which condition it is permanently kept until the apparatus is to be used. By running the pipe Q to the deck it will be seen that I am enabled to transfer large quantities of acid to the reservoir in an expeditious manner, and without the danger attending the lowering of the same into the hold.

E E E are the acid vessels or chargers, which are arranged above the domes of the generators, and bolted to, and supported upon, angle-irons *i*, affixed to a wall or partition of the boat. These acid-vessels are arranged above their respective generators, and correspond in number to the same. They are constructed of copper, with an interior lead lining, and have at their tops removable covers to give access to the interior, either for inspecting the same or charging with acid, which latter, however, is ordinarily effected in a different way, as hereinafter described. These acid-vessels are provided with glass level-gages *j*, to indicate the height of the acid in the vessels, and have also pendent pipes M, with valve-connections, which pipes enter the domes, and, when the valves are turned, open a communication between the acid-vessels and the generators for the admixture of the chemicals.

For the filling of the acid-vessel I have devised a special apparatus. It will be remembered that the acid is permanently carried in a reservoir in the hold of the ship out of the way, and where it will do but little harm in the event of its leakage, which contingency of leakage is made remote by the structure of the reservoir.

Thus locating the bulk of the acid has also for its object, in addition to that just described, the avoidance of the corrosive action of the acid upon the acid-vessels, and the con-

sequent prolongation of the life of the same, and, furthermore, the prevention of the accidental or premature mixture of the chemicals, which, where so large quantities are used as in my system, might result in disastrous explosion, to say nothing of the waste of the chemicals. The said vessels E, therefore, are only used as intermediate and distributing receptacles or charges for the acid to hold the latter until the right time, and apportion the acid to their respective generators. To fill these charges E a pipe, L, has its lower end open and located near the bottom of the acid-reservoir A. This pipe extends upwardly, and communicates, through valves *k k k*, with branch pipes L′ L′ L′, which open at their tops into their respective acid-vessels. An air-pump, G, is located in convenient position upon deck, and is made to communicate, through a pipe, *l*, with the acid-reservoir A, which arrangement, it will be seen, permits me to apply a sufficient pressure upon the surface of the acid to force the same up the pipes L L′, to fill the vessels E, the valves *k* permitting the latter to be separately or collectively filled, as may be desired. Thus it will be seen that I am enabled to manipulate a large body of acid without exposure to the air, and without the awkward and dangerous handling of the same.

As a modification of this feature of filling the acid-vessels I may employ, when using the apparatus, the effective power of the carbonic-acid gas for the purpose of forcing up the acid; and to do this I disconnect as many of the members B C E of the apparatus as are to be filled from the rest, and all the valves *k* being closed I then open the valve *k* of the disconnected member or members, and open a valve, *n*, in a pipe, N¹, when the gas-pressure in the other operating members will operate, through pipes N, N¹, and *l*, to force the acid in the reservoir up to the acid-vessel of the disconnected member or members of the apparatus to be filled. After the vessel is thus filled with acid the valve *n* is closed and *n′* opened, which latter allows the pressure upon the reservoir to be relieved, and permits the column of acid in pipe L to pass down into the reservoir and regain its equilibrium.

As a further modification of the mode of filling the acid chargers from the reservoir, I may, in the place of the pump or carbonic acid, employ steam.

In the communication *l* between the pump G and the acid-vessel A I arrange a water trap or seal, *m*, which prevents the fumes from the acid-reservoir from injuriously affecting the working parts of the pump.

R are pipes connecting the dome with the top of the acid-vessels, which pipes serve to equalize the pressure in the two, and permit the free passage of the acid down to the generator when the chemicals are to be mixed by preventing a vacuum above the acid.

N is a horizontal distributing-pipe, with which each one of the domes communicates through a separate valve, *o*. This pipe is provided with vertical branches N², which conduct the generated carbonic-acid gas to a gas holder or purifier, D. This purifier or holder is a horizontal continuous cylindrical vessel, provided with a partition or diaphragm, *p*, which is imperforate at the points where the entering gas strikes it in issuing from the pipes N², and between these points is perforated to permit the gas to pass through. The object of this partition is to eliminate the solid and liquid particles, which are mechanically carried up by the gas in the form of spray, by causing them to impinge against the imperforate portion of the diaphragms. As the gas passes through the diaphragm it passes into the pipes K, which open at the top, and form connections for the various flexible service-pipes which may be employed in the utilization of the gas.

As the gas holder or purifier D, in the course of time, accumulates a quantity of the collected impurities, it will be necessary, at times, to clean the same out; and for this purpose a pipe, T, provided with valve *t*, leads from the bottom of the same to the discharge-pipe H¹, which permits the introduction of water to the holder D from the main water-supply X, and also permits the water and impurities to be discharged, through the same pipe, down to H¹, and from thence to H², overboard. This pipe T also serves as a drain-pipe for any portion of the liquid contents of the generator which might surge up into the holder D from the evolution of gas, and thus operates as an equalizing-pipe to restore the said liquid to the generators.

In introducing the gas into the burning vessel I have provided a special means for doing the same without carrying a body of air therewith. It consists in constructing the nozzle Y with a tapered externally screw-threaded swiveling sleeve, Z, provided with handles, which is adapted to be screwed directly into a hole of any size bored in the deck of the vessel, thus not only preventing an ingress of air with the gas, and a consequent feeding of the flames, but dispensing, also, with the service of a constant attendant for the nozzle.

To provide for the escape of superfluous gas an extra pipe, S, with valve, is connected with pipe N, and is carried out to the air, to prevent the escape of the gas into the room through the safety-valves.

The apparatus, as thus described, is provided with a separate safety-valve, *q*, upon the domes of each one of the generators, and also a safety-valve, *r*, upon the purifying gas-holder D, which is arranged to blow off into the atmosphere at a lower pressure than those on the domes, in order to prevent the escape of gas into the room, separate safety-valves being located upon each generator, in order to provide a separate and individual protection for each generator, for its separate and individual use.

Pressure-gages *s* are also arranged upon each

of the generators, to indicate the pounds pressure per square inch; and a pressure-gage, s', is also connected with pipe N^1, in order to indicate the pressure applied upon the acid in the reservoir.

The apparatus, as thus described, it will be seen from the above description, is, with the greatest economy of structure, made capable of a varied and extensive method of manipulation, which renders it a perfect and effective apparatus in function, with such attention to its details of construction as to render it a permanent and durable apparatus, fully capable of fulfilling the purpose for which it is intended. The efficiency of the apparatus, moreover, has been practically tested, upon a large scale, upon the harbor-protection boat at New Orleans, and the practical value of the same attested in the clear saving of no less than three hundred and seventy-five thousand dollars worth of cotton and other insured cargo on shipboard within a period of about two months.

Having thus described my invention, what I claim as new is—

1. An apparatus for generating dry carbonic-acid gas for the extinguishment of fires on shipboard, consisting of a set of generators and acid-chargers having intermediate communication, controlled by cocks or valves, and combined with an acid-reservoir having communication with both the chargers and the generators, whereby a part of the series may be employed to charge the rest, substantially as described.

2. An apparatus for generating and utilizing dry carbonic-acid gas for the extinguishment of fire, consisting of the combination of a series of generators for containing the bicarbonate of soda, a set of superposed acid-chargers connected with the generators by pipes and valves, and a subjacent acid-reservoir connected with the acid-chargers by means of a pipe opening in the bottom of the reservoir, and having an independent pipe for the application of pressure, either through a pump or its equivalent, substantially as described.

3. The horizontal generator B, having at one end an upright dome, through which the chemicals are delivered to the said generator, in combination with a revolving shaft in the generator, carrying spirally-arranged agitators, substantially as and for the purpose described.

4. The combination, with the acid-reservoir and the pressure-pump G, connected therewith by pipe l, of an intermediate liquid seal, m, to prevent the corrosive action of the acid fumes upon the pump, as described.

5. The combination, with the generators B, having domes C, of the pipe H, connected with each of the domes through separate valves, and the pipe H^1, located below the generators, having valve f', and connected with each of the same through separate valves, and both communicating with the single supply-pipe X, for the purpose of admitting water to the top of the generator, for the preparation of the bicarbonate of soda, or for the admission of water to the bottom of the same, to cleanse the generators and wash out their contents, substantially as described.

6. The combination, with the generators and their conducting-pipes for the gas, of a purifying gas-holder, D, having a perforated partition, J, with a plain or imperforate surface at the points upon which the gas impinges in issuing from the pipes, substantially as and for the purpose described.

7. The acid-reservoir made of a closed case of lead, and combined with an outer re-enforcing shell of iron, made in the form of a cylinder open at the ends, to adapt it to be slid longitudinally over the lead case, and fastened with flanged end cap, as described.

8. The acid-chargers E, provided each with a glass level-gage, and combined, through branch pipes L', with the single pipe L and acid-reservoir, for the purpose of indicating the quantity of acid for each generator.

9. The pipe T, having valve t, in combination with the purifying-holder D and discharge-pipe H^1, for the purpose described.

10. The combination, with the pipe l, communicating with the acid-reservoir, and the pipe N, communicating with the generators, and having separate valves for each, of the pipe N^1, having valve n, substantially as described, and for the application of the gas-pressure for filling the acid-chargers.

11. The combination, with the pipe L and acid-reservoir A, of the pipe N^1, communicating with the acid-reservoir, and provided with valve n and escape-valve n', for the restoration of the acid-level in pipe L, substantially as described.

12. The combination of the generators B, having domes C, the superposed acid chargers E, the subjacent acid-reservoir A, and the purifying gas-holder D, substantially as and for the purpose set forth.

13. The purifying-holder D, having a safety-valve, r, arranged to blow off at a lower pressure than the safety-valves of the generators, and discharge its gas into the atmosphere through a pipe, substantially as described.

14. A pipe-nozzle for the discharge of carbonic-acid gas into a confined compartment, having a tapering external screw-thread, for the purpose described.

15. A pipe-nozzle for the discharge of carbonic-acid gas into a confined compartment, having a tapering externally-threaded sleeve provided with handles, substantially as and for the purpose described.

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Witnesses:
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EDWD. W. BYRN.