No. 776,932. PATENTED DEC. 6, 1904.

F. PAUL, JR.

AIR FORCING MECHANISM.

APPLICATION FILED DEC. 28, 1903.

NO MODEL. 6 SHEETS—SHEET 1.

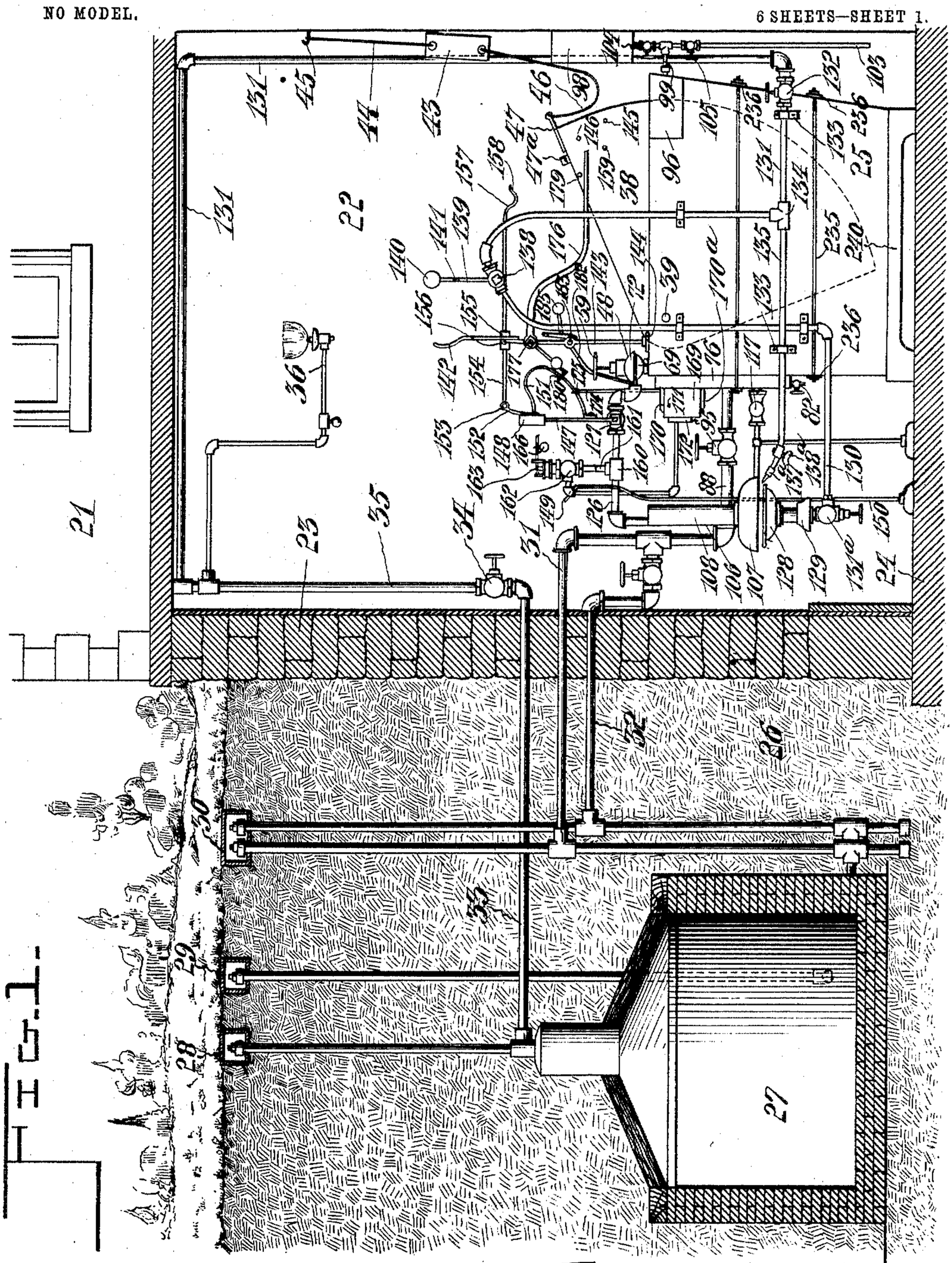

FIG. 1.

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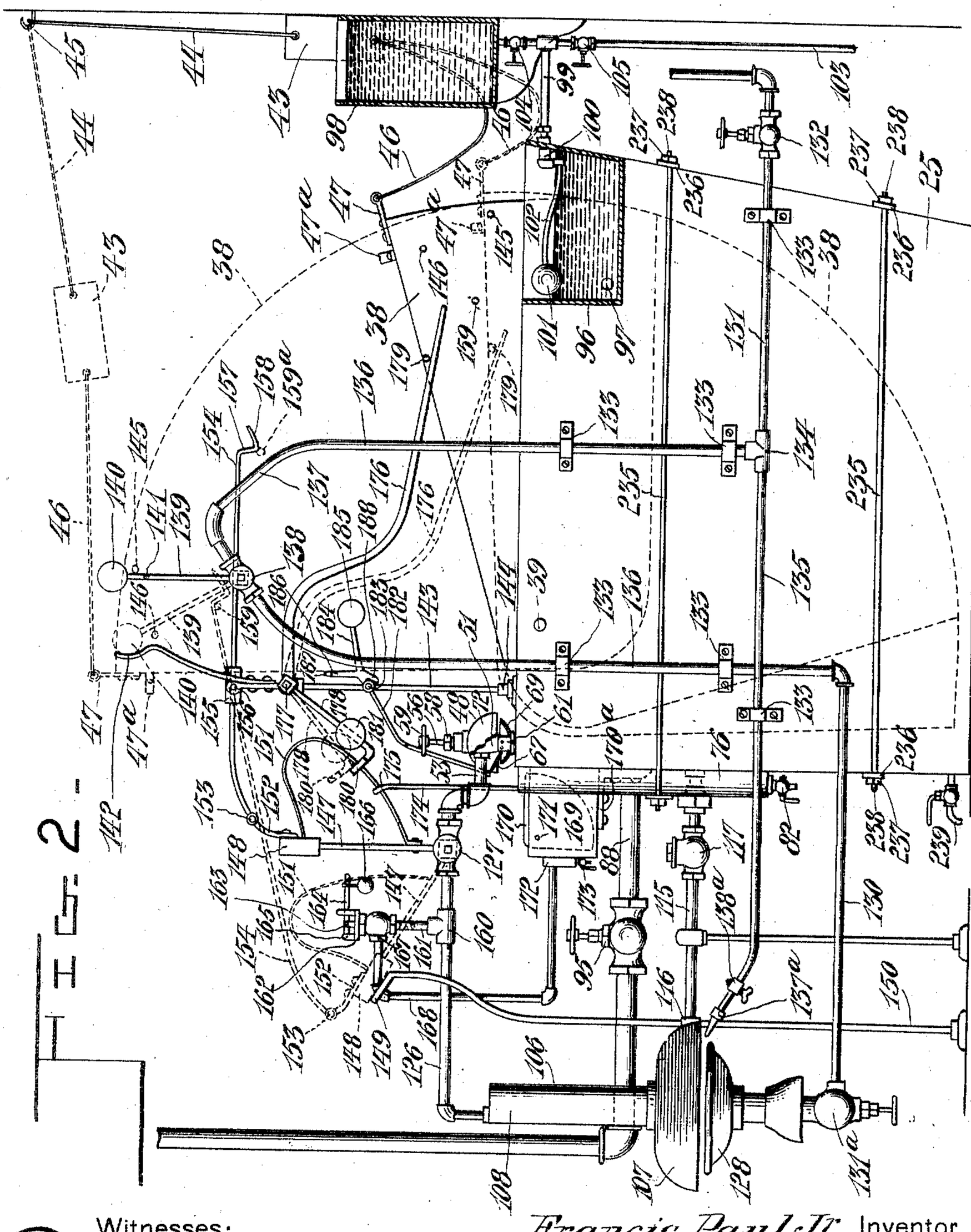
NO MODEL. 6 SHEETS—SHEET 2.

FIG. 2.



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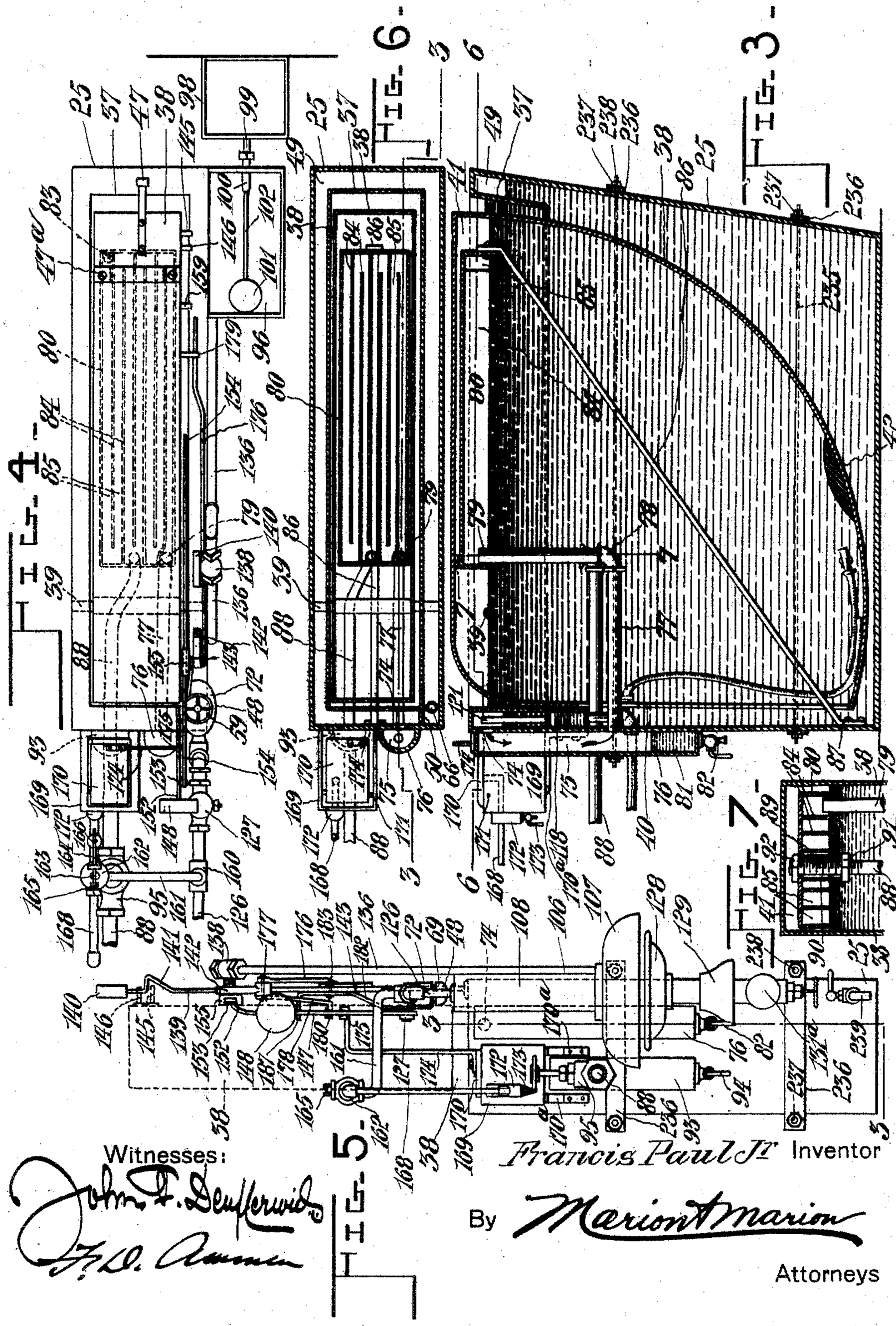
NO MODEL. 6 SHEETS—SHEET 3.



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NO MODEL. 6 SHEETS—SHEET 4.

FIG. 8.

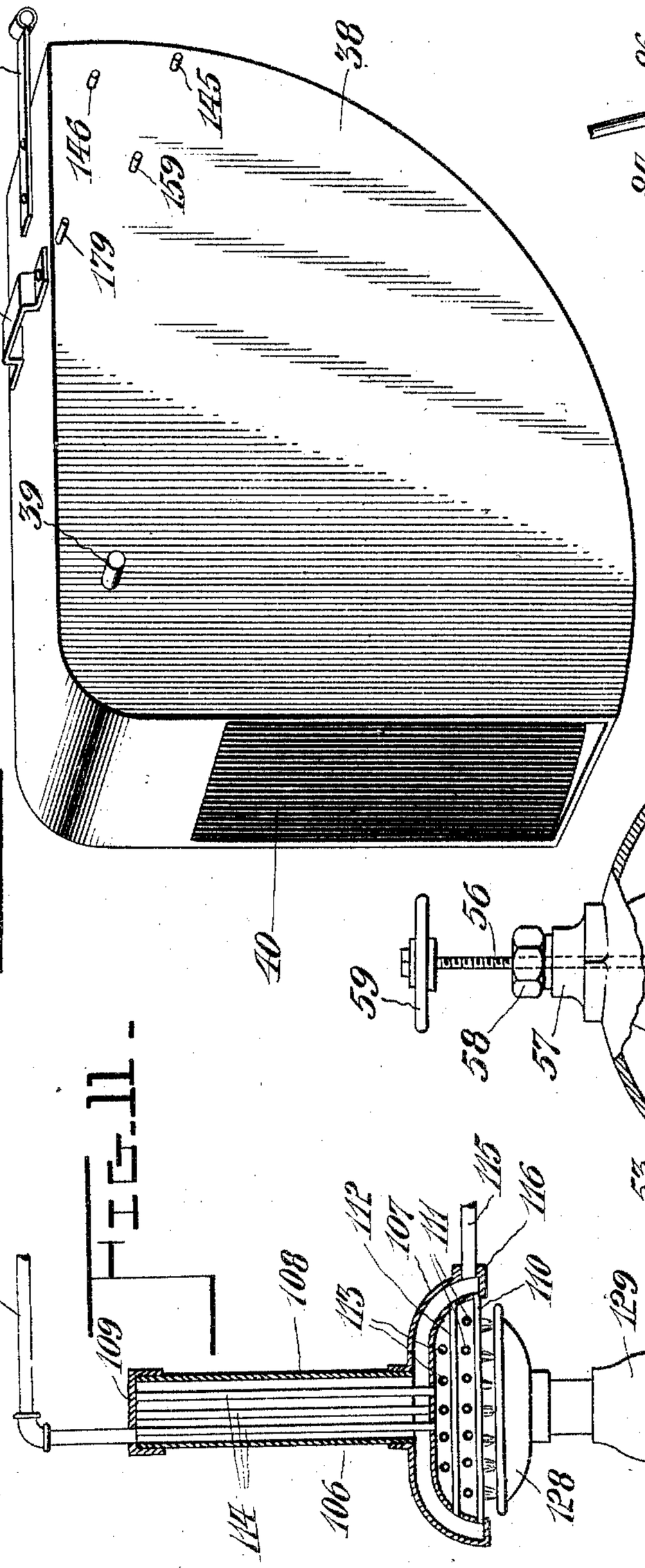

FIG. 9.

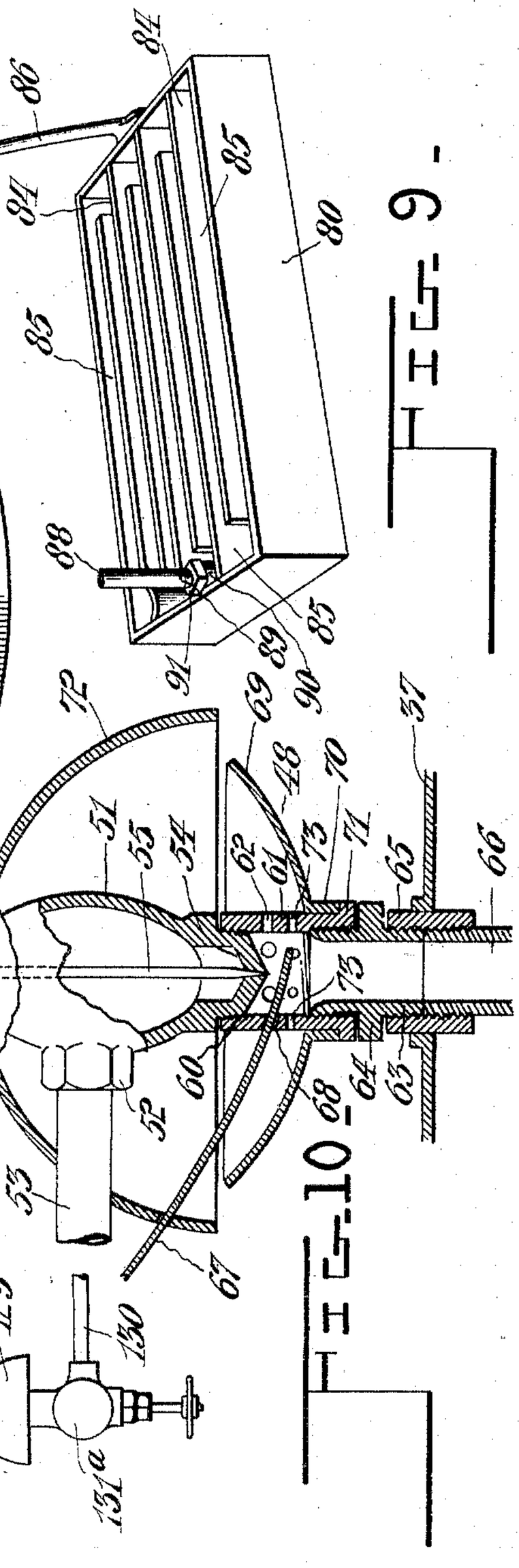

FIG. 10.

FIG. 11.

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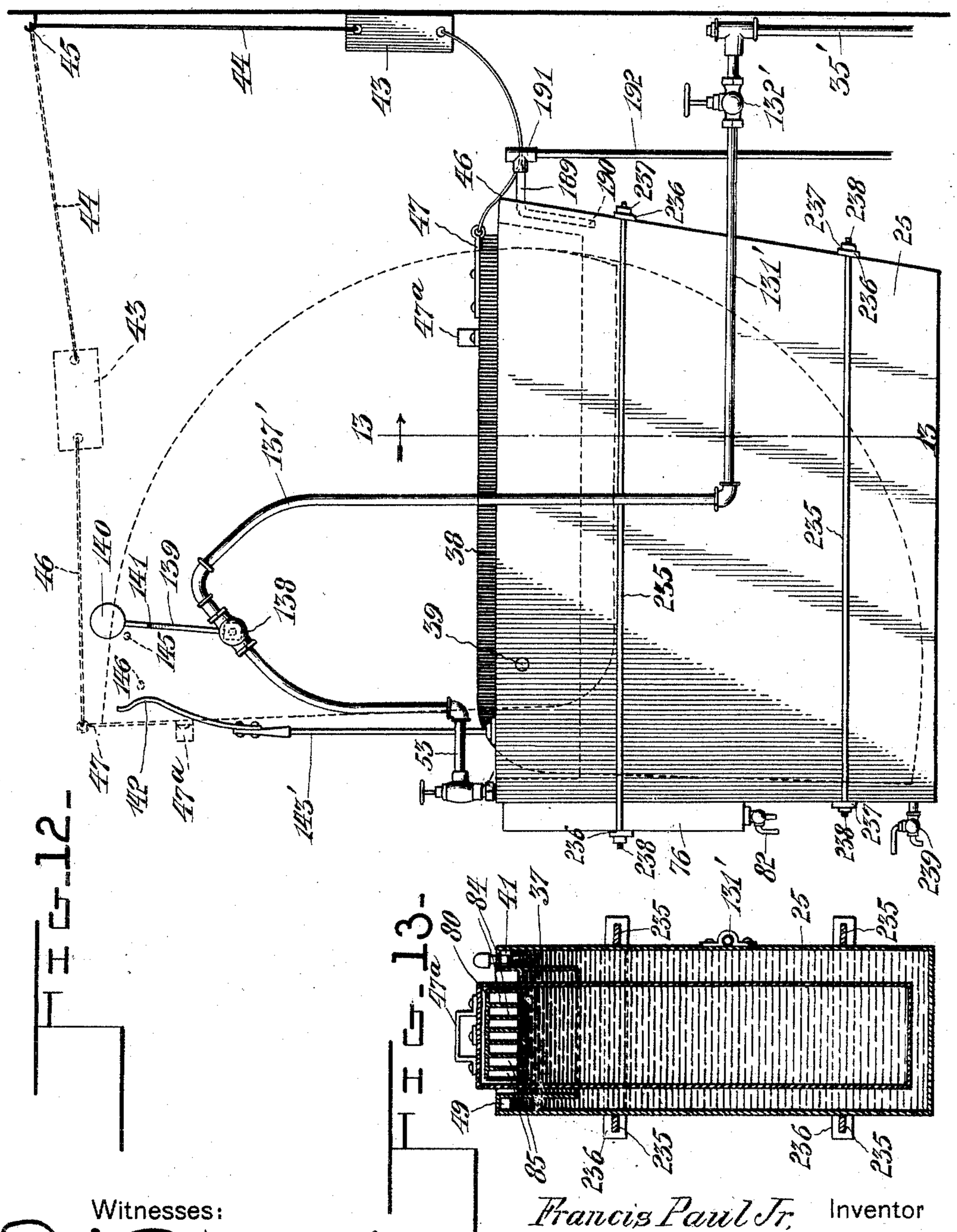
NO MODEL. 6 SHEETS—SHEET 5.



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NO MODEL. 6 SHEETS—SHEET 6.

FIG. 14.

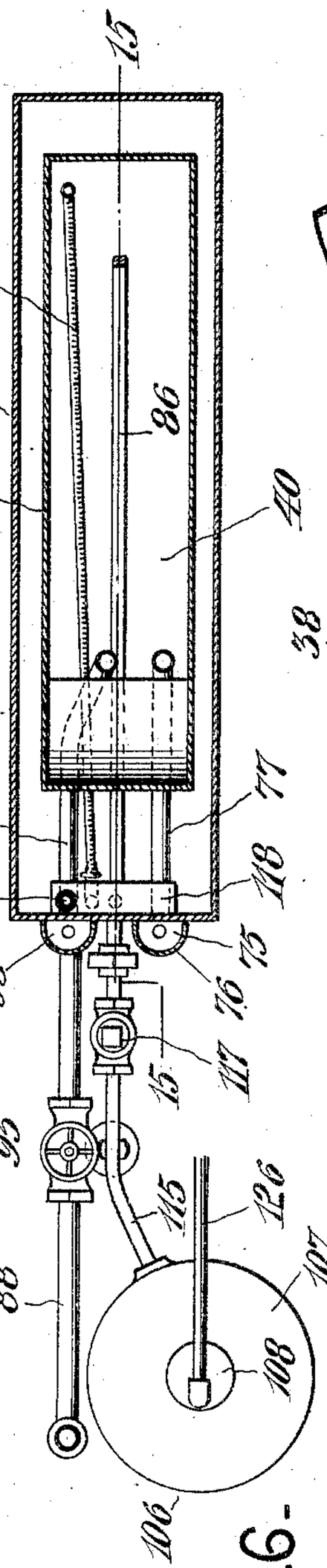

FIG. 15.

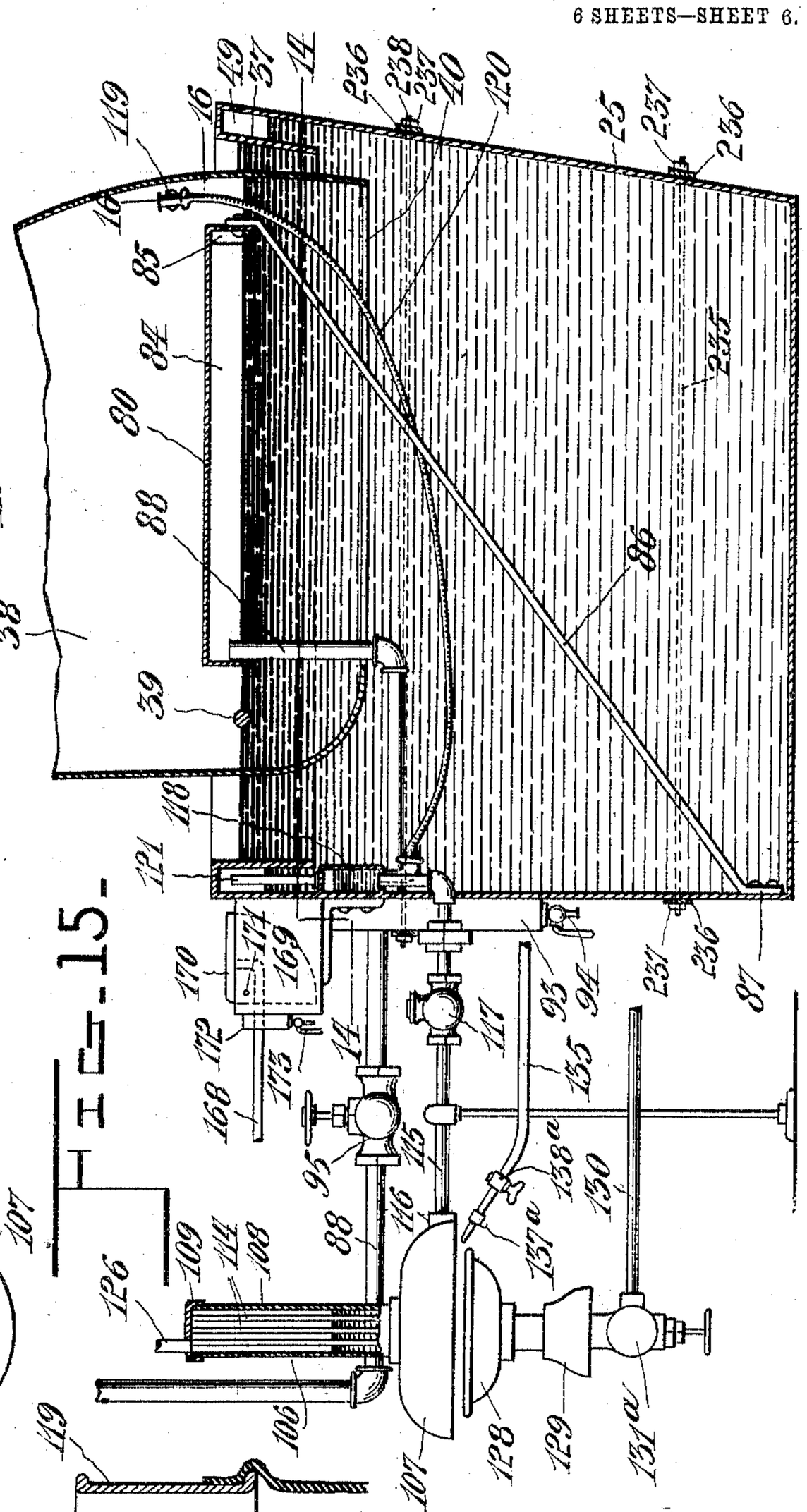

FIG. 16.

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No. 776,932. Patented December 6, 1904.

UNITED STATES PATENT OFFICE.

FRANCIS PAUL, JR., OF SOREL, CANADA.

AIR-FORCING MECHANISM.

SPECIFICATION forming part of Letters Patent No 776,932, dated December 6, 1904.

Original application filed August 7, 1903, Serial No. 168,686. Divided and this application filed December 28, 1903. Serial No. 186,930. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS PAUL, Jr., a subject of the King of Great Britain, residing at Sorel, county of Richelieu, Province of Quebec, Canada, have invented certain new and useful Improvements in Air-Forcing Mechanism; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This application is a division of an application for improvements in gasolene-gas machines filed August 7, 1903, Serial No. 168,686.

My invention relates to apparatus to be used in connection with gas plants where gas for fuel or light is formed from gasolene.

The invention concerns itself especially with the construction of air-forcing mechanism, which mechanism affords means for carbureting or impregnating the air with gasolene or similar hydrocarbon fluid.

The object of the invention is to provide simple mechanism for the purpose mentioned which may be safe, reliable in operation, and substantially automatic in its operation.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a general elevation of the apparatus as a whole, showing the buildings and the subterranean structures in section. Fig. 2 is a side elevation, on a larger scale, of that part of the mechanism located within the building, certain parts being shown in section. Fig. 3 is a longitudinal vertical section of the air-tank. Fig. 4 is a plan view thereof. Fig. 5 is an end elevation of the apparatus shown in Fig. 2. Fig. 6 is a plan section on the line 6 6 of Fig. 3. Fig. 7 is a transverse section on the line 7 7 of Fig. 3. Fig. 8 is a perspective view of the air-bell. Fig. 9 is a perspective view of the condenser in inverted position. Fig. 10 is a longitudinal vertical section of the air-injector. Fig. 11 is a longitudinal vertical section of the steaming apparatus for supplying the air-injector. Fig. 12 is a side elevation of a simpler form of air-supply apparatus applicable to plants where a constant water-supply is available. Fig. 13 is a transverse section through the same on the line 13 13. Fig. 14 is a horizontal section very similar to Fig. 6 and taken substantially on the line 14 14 of Fig. 15. This figure is intended to illustrate certain mechanism used in controlling the water-level of the steam-generator. Fig. 15 is a vertical section taken substantially on the line 15 15 of Fig. 14. Fig. 16 is a section taken substantially on the line 16 16 of Fig. 15, this view being upon an enlarged scale, as will appear.

The same numerals of reference denote like parts in all the figures of the drawings.

The invention employs the principle of forming a combustible gaseous mixture by impregnating air with light hydrocarbids, such as gasolene, and its manner of operation consists, briefly speaking, in first collecting a suitable air-supply under pressure and subsequently passing this air on its way to the burners through the gasolene-impregnator, which is outside the building and preferably buried in the earth, so that there is no possible way for the explosive gas or vapor of gasolene to accumulate in the building or, in fact, anywhere, it being strictly confined to the impregnating-tank, which is, as stated, completely isolated and buried in the earth. In this invention there is no independent reservoir for gas with a gasometer-bell; but instead the air supply and pressure is regulated before passing to the burners, and simple mechanism is provided for replenishing this supply as fast as it is exhausted and for keeping the pressure as well as the quality of the mixture constant in the pipes.

In Fig. 1 on the right is shown a portion of a house 21 the cellar or basement portion of which is shown in section, exhibiting a chamber 22, in which the air-regulating apparatus, as above mentioned, is stored. 23 is the outer wall, and 24 the floor of the cellar. On this floor is placed the air-tank 25, with regulating mechanism to be presently described, while buried in the earth 26 on the other side of this wall is the gas-impregnating tank 27, access to which is had from the surface of the ground above by covered boxes 28 29 30. The air from the tank 25 is delivered through

pipes 31 32 to the impregnating-tank 27, where it takes up the proper quantity of gasolene-vapor, and from thence is returned through the delivery-pipe 33, which connects through a main valve 34 with the house-main 35, from whence it is tapped off at burners 36.

Referring now more specificially to the mechanism of the air-supply, (shown particularly in Figs. 2 to 11, inclusive,) the tank 25 is, as shown, of generally square form in side elevation and deep and narrow in end elevation, Figs. 4 and 5. The upper margin of the tank on all four sides is provided with an inwardly and downwardly turned flange 37, depending about ten inches below the level of water in the tank and forming an air conduit or duct 49. Within the tank and fitting the opening in the upper side thereof left by this flange is a quadrantal air-bell 38, which is pivoted on a cross-pin 39 near its left-hand upper corner, which is the geometrical center of the quadrant, and is closed on all sides except for the longitudinal opening 40 on the lowermost straight side of the bell. This bell is destined to hold the air-supply within the air-space 41 above the water-line of the tank and may be provided on its arcuate side with one or more weights 42, which permit of maintaining the necessary air-pressure when the bell is raised. I may also provide additional means to this end in the form of a weight-block 43, which is swung from a cord 44, attached to a hook or peg 45 in an adjacent wall or post of the building, and the weight 43 is also attached by a cord 46 to a bracket 47, secured to the upper right-hand corner of the bell for this purpose. When the bell rises into its highest position, as shown by the dotted lines in Fig. 2, it will be obvious that a large part of its weight will rest directly upon the pivot-pin 39, and hence means must be provided for replacing this weight by other means of keeping the confined air compressed within the bell, which means is provided by the weight 43, which assumes the position likewise shown in dotted lines when the bell is raised. A handle-strap 47[a] is likewise attached to the bell for manually raising the same. The means for automatically keeping this tank supplied with air comprises, essentially, an air-injector 48, which is located, as shown, at the left-hand front corner of the apparatus and whose educt-pipe 66 depends into the water of the tank and directly within the duct 49, formed by the depending flange 37, there being a partition 50 in said duct at this point—that is to say, across the duct just behind the injector 48, as shown in Fig. 6. Either water or steam may be employed as means for injecting the air, the former being the simpler in cases where a constant water-supply can be had; but as this plant is intended for country houses and like places not provided with a water-supply it will often be desirable to have self-contained means for injecting the air. Such means, both for steam and water, will be presently described. Any suitable form of injector may be used, that shown in Fig. 10 being a simple form shown by way of illustration. It comprises a hollow cast-iron body 51, at one side of which is a threaded opening 52, to which is attached the steam-supply pipe 53. The body 51 is vertically elongated and has at its lower end a pointed nozzle 54, with a small aperture in the point thereof, and into this aperture projects a needle-valve 55, mounted on a stem 56, threaded at its upper end into a socket 57, provided with a packing-gland 58, the stem 56 having at its upper end a handle 59 for regulating the flow of steam through the nozzle. The nozzle 54 is threaded exteriorly, as at 60, and surrounded by a short threaded sleeve 61, which has a plurality of lateral apertures 62, through which air is drawn by the water or steam which rushes through the nozzle. The sleeve 61 is connected at its lower end by a short nipple 63, having a polygonal collar 64, with a threaded socket-piece 65 secured fast in the horizontal part of the flange 37, and with the lower end of this threaded socket is connected a short pipe 66, which depends into the water and nearly to the bottom of the flange 37. There is also shown in Fig. 10 a part of the automatic valve 67, which is destined to automatically intercept the action of the injector without cutting off the steam and whose mode of action will be hereinafter described, this valve projecting through a lateral aperture 68 in front of and distant by about one-sixteenth of an inch from the opening in the nozzle. I also prefer to surround this injector with a cup 69, which has a sleeve 70 fitting over the sleeve 61 and resting on the terminal flange 71 thereof and by a dome-shaped shield 72, which depends from the upper margin of the body 51 of the injector and surrounds the latter, being slightly larger than the cup 69, so as to completely surround and inclose the latter. The cup and shield are necessarily formed with vertical sides on the side next to the bell in order not to interfere with the latter, or they may be of generally oval form, as shown in Fig. 4. This spherical cup and shield serve a double purpose, first, to prevent the leakage or splattering of water or condensed steam from the injector around the chamber in which the apparatus is located, and, secondly, to deaden the noise produced by the action of the injector. The cup 69 catches all the moisture which leaks through the apertures 62 or otherwise around the injector and which is returned to the tank either through the air-apertures 62 or preferably through another set of small apertures 73, which permit the water to drain through independently without choking up the air-inlet orifices.

The air interjected through the pipe 66 is driven down through the water in the tank,

and the steam or water used for injection here mingles with the water of the tank, the air rising into the duct 49 and thence traveling completely around the tank through this duct to the opposite side of the partition 50, at which point there is an aperture 74 opening into a vertical passage-way 75, formed by a semicylindrical piece 76, secured to the outer side of the tank, this piece depending to a point rather more than half-way down the side of the tank, as may be found most suitable, and being closed at both ends. From an intermediate point in this passage-way leads an air-pipe 77, which is elbowed at 78 and whose end 79 extends vertically upward to a point above the surface of the water and just inside one corner of the condenser 80. The lower end of the passage-way 75 serves as a receptacle for condensation 81, which is drawn off at intervals by a drip-cock 82.

The condenser 80 is, as shown in Figs. 3, 4, 6, 7, and 9, substantially in the form of a rectangular box open at the bottom and closed on all four sides and over the top with the exception of an aperture 83 at the diagonally opposite corner from that at which the pipe 79 enters. In its interior it is provided with a series of longitudinal partitions 84, each of which extends from one end of the box to a point near the other and forming a labyrinthian passage-way 85 for the air, which enters it through the pipe 79 and passes back and forth between the partitions until it finally passes out through the hole 83 in the upper side of the condenser. This condenser depends into the water of the tank to a sufficient distance to prevent the air from getting under its walls and might be made to float therein; but I prefer to support the same in fixed position, the level of the water in the tank being also regulated automatically at a fixed point by means to be presently described. The means for supporting the condenser in fixed position comprise at the outer end a bracket-arm 86, whose lower end 87 is secured to one end of the tank near the bottom, passing through the aperture 40 in the bell, and the condenser is supported at its other end by the elbowed delivery-pipe 88, (shown behind the pipe 77 in Fig. 3,) and which is fixed at one end of the wall of the tank, as shown, and at the other is threaded, as shown at 89, Fig. 7, and projects through an aperture in the end of the condenser, which is surrounded by a sleeve 90, fixed thereto, whereby the air is prevented from issuing through the top of the condenser at this point. Suitable means, such as nuts 91 92, are also provided on the threaded end 89, locking the condenser in position thereon. It will be understood that the air which is injected into the duct 49 carries a certain quantity of moisture which it is the aim of the apparatus just described to eliminate. A certain portion of the moisture becomes eliminated in passing around the duct 49, another portion in the vertical passage-way 75, which acts as a separator, and a third portion in the condenser, after which the air issues into the reservoir 41 of the bell, and from thence it is drawn off through the delivery-pipe 88. At the wall of the tank the delivery-pipe meets a vertical semicylindrical chamber similar to the passage-way 75 and formed by a semicylindrical piece 93, closed at both ends, which forms a pocket for any moisture condensing in the pipe, which condensation water is drawn off by the drip-cock 94. From thence the delivery-pipe 88 leads to the gasolene-impregnator to be described hereinafter, there being preferably a regulating-valve 95 interposed in this pipe.

The means above referred to for maintaining the water-level in the tank at a uniform height may comprise an auxiliary or annex tank 96, mounted at the side of the larger tank and communicating therewith through an aperture 97 below the water-level. This tank is kept supplied from any suitable source, as from a cistern 98, to which it is connected by a pipe 99, having at the end opening within the tank 96 an automatic ball-cock 100, operated by the float 101, connected with the lever 102 of the cock in the usual manner of flush-tanks, acting to maintain the water at a fixed level. The cistern 98 is provided ordinarily only where no regular water-supply is accessible; but where such is provided the tank 96 may be filled directly from the water-main 103, or both means of supply may be provided, as shown in Fig. 2, and suitable valves 104 105 being provided in the pipes, whereby either source may be used to the exclusion of the other. This means of maintaining a fixed water-level in the tank is only necessary for the steam-injection system, because the water-injection system to be described hereinafter maintains itself the water-level without any necessity of a special water-supply for that purpose.

I will now describe the steam-operated means for automatically injecting air, which forms an important part of this invention. It comprises four principal elements, to wit: the steamer or boiler, the gas-burner, the automatic means for lighting and extinguishing the burner, and the automatic means for admitting and shutting off the steam-supply to the injector.

The steamer (designated as a whole 106) is shown in enlarged sectional view in Fig. 11. It comprises four parts, to wit: a spherical or dome-shaped double-walled cap or hood 107, adapted to contain water and closed on all sides with the exception of a flanged central opening in the upper side; a vertical cylinder 108, which fits within said flanged opening, thus communicating with the interior of the hood 107, and is closed at its upper end by a cap 109; a plurality of water-tubes arranged, as shown in Fig. 11, in four series of

parallel tubes 110 111 112 113, whose ends terminate in the inner wall of the hood, the tubes of the different series making various angles with the tubes of the adjacent series, as desired, whereby to take up the heat from the burner as fully as possible, and, finally, a plurality of fire-tubes 114, which connect the lower face of the hood 107 with the cap 109 and are open at both ends, forming means for the passage of the gases of combustion therethrough. This steamer forms at once a compact and exceedingly efficient apparatus capable of raising steam in an extremely short space of time after the burner has been turned on. It is connected with the tank at its lower end by a water-supply 115, which enters at the base of the hood 107 through the boss 116, and through which water is adapted to flow at all times, whereby the level of water in the boiler is maintained constant by an arrangement presently to be described. A check-valve 117 is inserted in the pipe 115, which prevents any backflow of water which would otherwise take place while steam is being generated under pressure. In order to maintain a constant water-level in the steam-generator 106, the supply-pipe 115 is connected with a water-pocket 118, attached to the inner side of the wall of the tank 25, but not communicating with the interior thereof. This pocket is supplied through the medium of a cup or fitting 119, (shown in detail in Fig. 16,) which is carried by the side of the bell 38 and which is connected with the pocket by means of a small hose 120. From this arrangement when the bell descends sufficiently from exhaustion of the air the fitting 119 becomes immersed and water flows through to the pocket. In order to permit the free ingress and egress of the water from the pocket 118, the air-space above the water in the pocket communicates through a pipe 121 with the air-duct 49 aforesaid. From the upper end of the steamer leads the steam-delivery pipe 126, which is connected with the inlet-pipe 53 of the injector, not directly, however, but with the interposition of the automatic cut-off valve 127 and other means for operating this valve to be described hereinafter.

The burner for my improved steam-generating means is shown at 128, this, however, not being itself a part of my invention, as any suitable stove or cooking burner may be used, that shown being intended to designate a burner of any ordinary type, having a hood 129, through which air is admitted for mixing with the gas which enters through the pipe 130 and is regulated by the valve 131[a]. The gas burned in this burner is that produced by the apparatus itself and is led to the burner by a branch pipe 131 led from the main 35 and having a main valve 132 therein adjacent to the tank. This pipe 131 is secured, together with its branches, to the side of the tank 25 by suitable straps 133 or otherwise.

At 134 the pipe 131 is divided into two branches 135 and 136, the former of which is carried to a point close to the upper end of the burner, where it is provided with a small burner-tip 137[a], and the flow of gas through which is regulated by a cock 138[a]. This branch is intended to serve as an igniter or pilot-burner, a minute flame being kept constantly burning at the tip 137[a] in proximity to the burner, whereby the latter is automatically ignited as soon as the gas is turned on. The branch 136 has a vertical loop 137, which rises at the side of the tank to a point adjacent to the position occupied by the air-bell in its uppermost position, and thence the pipe 136 descends again, as shown, and terminates in the regulating-valve 131[a]. In this branch at the upper end of the loop 137 is an automatically-operated gas-cock 138, on the stem of which is mounted a lever 139, carrying at its upper end a weight 140, and having at an intermediate point thereof an outward bend 141. (Best exhibited in the end view, Fig. 5.) This lever is so arranged with respect to the cock that the latter is open when the lever is vertical, as shown in full lines in Fig. 2, and is closed when thrown over by the rise of the bell into the position shown in dotted lines in Fig. 2, in which position it is supported by a rest 142, which is secured to and rises from the upper end of a vertical post 143, whose base 144 is secured to and rests on the flange 37 of the tank. The cock-lever 139 is operated by two pins or short posts 145 146, which are fixed to and project horizontally from the side of the bell near the corner thereof, as shown, the pin 145 being located at a point above the bend 141, so that when the bell approaches its uppermost limit of movement the pin 145 strikes the lever 139 and throws it over into the position shown in dotted lines, thus shutting off the gas from the burner 128, and thereby causing the generation of steam in the steamer 106 to cease. When the bell starts on its downward movement, the pin 146 strikes the lever 139 on the other side and raises it into vertical position, passing under the bend 141 as soon as it is thus raised, and thus leaving it in raised position as the bell descends, and thereby again admitting gas to the burner 128, which is automatically ignited by the tip 137[a].

The fourth part of my automatic steaming means comprises means for regulating the flow of steam to the injector. If such means were not provided, no sufficient pressure could be generated in the steamer, because the steam would flow off continually as fast as generated through the injector, thus becoming wasted, as such initial pressure would be insufficient to carry air with it. Hence I provide the automatic cock 127, which has fixed to the stem thereof the lever 147, carrying the weight 148 at its upper end and which though otherwise similar in arrangement to the lever

139 of the cock 138 is the opposite thereof in being so connected with the cock 127 that the latter is closed when the lever 147 is in vertical position (shown in full lines in Fig. 2) and open when it is thrown over into the dotted-line position in Fig. 2, in which latter position it is supported by a rest 149 on the upper end of the standard 150, which rises from the floor. The lever 147 has further a bowed metal strip 151 secured to and projecting laterally from the side thereof and which may be of spring metal, if desired, though this is unimportant, and, furthermore, it has a bracket 152, to which is pivoted at 153 a rod 154, which is guided in a block 155, pivoted to the upper end of the post 143, as shown at 156. The rod 154 has at its free end a downward rectangular offset 157, which is continued in an oblique offset 158, this portion of the rod being arranged to coöperate with a pin 159 on the side of the bell, it being understood that the rod 154 is arranged close to the side of the bell, so that the pin 159 engages it laterally. The rod 154 is somewhat flexible or resilient, so that when the bell rises the pin 159 strikes the under side of the oblique offset 158 (the rod 154 being at this time in the position shown in dotted lines, Fig. 2) and bends it upwardly until it snaps around the elbow of the offset and engages at the back of the offset 157. At this point, the gas being shut off in the manner before described by the operation of the lever 139 in the manner above described and the generation of steam ceasing, whereby air is no longer injected into the tank, the bell next begins to descend by the continuous withdrawal of air for the burners, and in so doing the pin 159 will draw the rod 154 with it, and thus by the time gas is turned on again will have raised the lever 147 into vertical position, at which time the pin 159 reaches the position 159[a], (shown in dotted lines in Fig. 2,) disengaging the offset 157, thus leaving the lever 147 vertical, while the bell proceeds on its downward motion. The lever 147 remains vertical and the valve 127 closed until sufficient pressure is generated in the steamer to operate the injector, when it is automatically opened by the following arrangement of parts: Between the steamer and the valve 127 in the pipe 126 is located a T 160, from which leads a branch 161 to a fluid-pressure-operated valve 162 of the ordinary safety-valve type, having a stem 163 attached to an intermediate point of a lever 164, pivoted at 165, and having a suitable weight 166 on its end so adjusted that the stem 163 is raised at a fixed pressure, ordinarily about twenty pounds in the present case. The raising of the valve-stem 163 admits steam to the side outlet 167, to which is connected a pipe 168, whose other end is led into and above the water-line of a small secondary tank 169, attached to the side of the main tank and supported by a bracket 170[a], this tank having therein a quadrantal bell 170, similar to the bell 38, and pivoted at 171. In the pipe 168 may be located a water-pocket 172, similar in arrangement to the pocket 93, and having a drip-cock 173. To the bell 170 is fixed an upright rod 174, which has at its upper end a fork 175 taking under the bowed strip 151. The valve 127 then remains closed until the pressure within the steamer reaches that to which the fluid-pressure valve 162 is adjusted, at which point steam is admitted under the bell 170 and the latter raised by the pressure, which causes the fork 175 to thrust laterally upon the strip 151 and throw the lever 147 over, thus opening the steam-pipe and admitting steam to the injector, which thereby forces air into the tank and under the bell, and when the latter is again raised to its former position the burner 128 is again shut off, thus keeping the bell automatically supplied with air to the requisite extent.

Ordinarily steam is generated so quickly in the steamer that the bell has not time to sink more than a few inches after closing the valve 127 and opening the valve 138 until steam rises to the requisite pressure to throw over the lever 147; but to provide for the possibility that steam should not be generated with sufficient rapidity I provide further means for opening the lever 127 before the bell has got too low. This means comprises an automatically-operated lever 176, which is fixed to a short shaft or stud 177, journaled on the post 143, and having secured to its opposite end a weighted lever-arm 178. The lever 176 projects to a point near the circular periphery of the bell; but it lies in a plane outside of the rod 154, so that it is not influenced by the pin 159; but it is struck by a longer pin 179, fixed on the side of the bell near its upper corner, in case the bell descends too low, and thus tilted into the position shown in dotted lines in Fig. 2. This causes the lever 178, which is provided with a fork 180, taking under the bowed strip 151, to strike the latter and throw the lever 147 over, opening the steam-pipe 126 again to the injector and admitting a replenishing supply of air before the air-bell has reached the bottom. This inflow restores it to its former position. The lever-arm 178 may be supplied with a weight 181 or any other suitable means for overbalancing the arm 176 and causing it to normally assume the position shown in full lines in Fig. 2.

Inasmuch as the steam generated in the steamer 106 will not ordinarily cease to be generated and to pass through the injector at the moment the burner 128 is extinguished, I provide special means for nullifying the action of the injector—that is to say, for acting directly thereon to prevent it from drawing in air after the bell 38 has reached its highest position, this means being the automatic valve 67 heretofore described, which is mounted on the bent lever 182, which is pivoted at 183 at an intermediate point thereof

on the post 143, so that a slight rocking movement of the lever causes the valve 67 to enter or be withdrawn from the aperture 68. The opposite end of the lever 182 is branched as shown, a horizontally-projecting portion 184, carrying the weight 185, by which the center of gravity of the lever is thrown to the right of its pivot, and hence the valve 67 is caused to assume a position normally withdrawn from the injector. The other branch, 186, of the lever carries a rectangularly-bent finger 187, which projects into position to be struck by the upper side of the bell just as it reaches its highest position, thus tilting the lever 182 and causing the valve 67 to be projected in front of the nozzle of the injector, which action by spreading the steam nullifies its injecting action while at the same time permitting the steam to escape and condense in the tank, so that there is no danger of the steam becoming confined to an explosive pressure in the steamer 106. A small heel 188 or its equivalent may be provided on the lever 184, which by abutting against the post 143 prevents it from falling over when the bell is lowered.

When a constant water-supply is at hand in the building in which the apparatus is located, it may be conveniently drawn upon to take the place of steam, and the apparatus is then much simplified, as exhibited in Figs. 12 and 13. In this case no steam-generator or burner and but one automatic valve is necessary. I replace the gas-pipe 131 by a water-pipe 131′, which is connected directly with a water-main 35′ and in which is located a valve 132′, and I replace the gas-loop 137 by a water-loop 137′, forming a continuation of the pipe 131′, the pipe 135 being abolished and the other end of the loop 137′ being connected directly to the inlet-pipe 53 of the injector. In this loop 137′ is located the cock 138, having the lever 139, weight 140, and bend 141, all arranged exactly as previously described and operated by the pins 145 and 146. A post 143′ is provided for carrying the rest 142, all the other apparatus carried by the post 143 in the steam-operated device being dispensed with and the bell operating the injector directly by means of the cock 138. It will be obvious that when the lever 139 is in the position shown in full lines, the valve 138 being open, the water will flow through the pipe 131′ and enter the injector, drawing air with it and supplying the air-space 41 within the bell, thus raising the latter, and when it has reached a position near the top the lever 139 will be thrown over, shutting off the water-supply and immediately cutting off the feed of air. In this case no auxiliary water-supply tank 96 or cistern 98 are necessary, the injection water keeping the tank 25 continually full, and it is desirable to provide a fixed overflow 189, which has a downwardly-projecting end 190 within the tank and which keeps the water-level constant, its other end being connected with an open-ended T 191, from which an offtake-pipe 192 leads to the sewer or otherwise outside the building. In order to maintain the rectangular tank 25 in shape against the pressure of the water, iron straps or bands 235 236 may be used, the bands 235 being set edgewise against the sides of the tank and interlocking with the bands 236 and secured therein by nuts 237, engaging with their threaded ends 238. At the bottom of the tank is provided a suitable draw-off cock 239 for discharging the water in the tank. The tank may be placed on a suitable base 240, if desired, to raise it off the floor.

While I have shown in the accompanying drawings the preferred form of my invention, it will be understood that I do not limit myself to the precise form shown, for many of the details may be changed in form or position without affecting the operativeness or utility of my invention, and I therefore reserve the right to make all such modifications as are included within the scope of the following claims or of mechanical equivalents to the structures set forth.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an air-forcing mechanism, the combination of a water-tank having an internal marginal air-conduit at its upper edge communicating with the interior of the gas-bell, and a pivoted gas-bell pivoted to rise and fall in said tank.

2. In an air-forcing mechanism, the combination of a water-tank having an internal marginal air-conduit at its upper edge communicating with the gas-bell, and a quadrantal gas-bell pivotally mounted in said tank.

3. In an air-forcing mechanism, the combination of a water-tank having an inwardly and downwardly inclined flange at its upper margin to form a marginal air-conduit communicating with the gas-bell, and a sector-shaped gas-bell pivoted within said tank at its geometrical center and adapted to rise and fall in said tank.

4. In a gas-generating system, the combination of a water-tank, having inwardly and downwardly turned flange at its upper margin, forming an internal air-conduit, a sector-shaped bell pivotally mounted therein at its geometric center and having approximately parallel lateral sides and generally closed except for an opening in its lower straight side, means for introducing a gaseous body into said bell, and one or more weights applied to the lower portion of the circular periphery of the bell.

5. In a gas-generating system, the combination of a water-tank having a marginal downward and inwardly turned flange at its upper edge forming an internal air-conduit, a sec-

tor-shaped bell pivotally mounted therein at its geometrical center and having approximately parallel lateral sides and generally closed except for an opening in its lower straight side, means for introducing a gaseous body into said bell, and one or more weights secured to said bell at the lower part thereof.

6. In a gas-generating system, the combination of a water-tank having an upper internal marginal depending flange forming an air-conduit, a rising-and-falling air-bell, means for injecting air into said bell with its educt-pipe depending into said air-conduit, automatic means operated by the bell for setting said injecting means in operation when the bell reaches a point on its downward movement, and means operated by the bell for throwing said injecting means out of operation at a point of its upward movement.

7. In a gas-generating system, the combination of a water-tank having at its upper end an inner marginal air-conduit, a pivoted quadrantal air-bell rising and falling therein, an air-injector, means connecting said air-injector with the interior of said bell directly into said air-conduit and means operated by said bell for throwing said injecting means into operation at a point of its downward movement and out of operation at a point of its upward movement.

8. In a gas-generating system, a water-tank having at its upper end an inner marginal air-conduit, a sector-shaped bell pivoted therein, an injector adapted to deliver a gaseous fluid beneath said bell directly into said air-conduit, means operated by said bell for setting said injector in operation at a point of its downward movement, and means operated by said bell for throwing said injector out of operation at a point of its upward movement.

9. In a gas-generating system, the combination, of a water-tank having at its upper end an inner marginal air-conduit, a bell rising and falling therein, an injector adapted to force a gaseous material into said bell directly into said air-conduit, a pipe carrying fluid adapted to operate said injector, an automatic valve in said pipe, and means carried by said bell for closing said valve on its upward movement and opening said valve on its downward movement.

10. In a gas-generating system, the combination of a water-tank having at its upper end an inner marginal air-conduit, a bell rising and falling therein, an injector adapted to force a gaseous material into said bell directly into said air-conduit, a pipe carrying fluid adapted to operate said injector, an automatic valve in said pipe, a lever mounted on the stem of said valve, and one or more projections on the side of said bell adapted to throw said lever alternately in opposite directions, whereby to alternately open and close said valve.

11. In a gas-generating system, the combination of a water-tank having at its upper end an inner marginal air-conduit, a sector-shaped bell rising and falling therein and pivoted thereto, an injector adapted to force a gaseous material into said bell directly into said air-conduit, a pipe carrying fluid adapted to operate said injector, an automatic valve in said pipe, and means carried by said bell for closing said valve on its upward movement and opening said valve on its downward movement.

12. In a gas-generating system, the combination of a tank having at its upper end an inner marginal air-conduit, a bell rising and falling therein and adapted to hold a supply of gaseous material, a fluid-operated injector adapted to deliver said gaseous material to said bell directly into said air-conduit, a supply-duct for operating fluid for said injector, and means operated by said bell for opening and closing said supply-duct according to the position of said bell.

13. In a gas-generating system, the combination of a water-tank having at its upper end an inner marginal air-conduit, a rising-and-falling bell therein adapted to hold a supply of gaseous material, a fluid-operated injector adapted to deliver said gaseous material under said bell directly into said air-conduit, a pipe supplying said injector with operating-fluid, a valve in said pipe, and means carried by said bell for opening and closing said valve according to the position of said bell.

14. In a gas-generating system, the combination of a water-tank having at its upper end an inner marginal air-conduit, a bell adapted to contain a supply of gaseous material therein and rising and falling in said tank, an injector adapted to deliver gaseous material to said tank with its educt-pipe extending into said air-conduit, a valve adapted to throw said injector out of operation, the said valve being normally in open position, and means carried by said bell for temporarily closing said valve when near the limit of its upward movement.

15. In a gas-generating system, the combination of a water-tank having a tits upper end an inner marginal air-conduit, a bell adapted to contain a supply of gaseous material therein and rising and falling in said tank, an injector adapted to deliver gaseous material to said tank, a valve adapted to throw said injector out of operation, the educt-pipe of said injector depending directly within said air-conduit, the said valve being normally in open position, and a lever pivoted adjacent to said bell and operating said valve and positioned to be struck by said bell or a projecting part thereof when near the limit of its upward movement, whereby said valve is moved to throw said injecting means out of operation.

16. In a gas-generating system, the combination of a tank having at its upper end an inner marginal air-conduit, a sector-shaped bell pivoted thereto and rising and falling therein

and adapted to hold a supply of gaseous material, a fluid-operated injector adapted to deliver said gaseous material to said bell directly into said air-conduit, a supply-duct for operating fluid for said injector, and means operated by said bell for opening and closing said supply-duct according to the position of said bell.

17. In a gas-generating system, the combination of a water-tank having at its upper end an inner marginal air-conduit, a sector-shaped bell pivoted thereto and adapted to contain a supply of gaseous material therein and rising and falling in said tank, an injector adapted to deliver gaseous material to said tank with its educt-pipe depending directly within said air-conduit, a valve adapted to throw said injector out of operation, the said valve being normally in open position, and means carried by said bell for temporarily closing said valve when near the limit of its upward movement.

18. In a gas-generating system, the combination of a water-tank, a rising-and-falling bell therein, a steam-operated injector, a steam-supply for said injector, and means operated by said bell for admitting and shutting off said steam-supply to said injector.

19. In a gas-generating system, the combination of a water-tank, a rising-and-falling bell therein, a steam-operated injector adapted to supply a gaseous fluid to the space within said bell, a steam-generator for supplying steam to said injector, a cut-off valve between said injector and steam-generator, a lever attached to the stem of said cut-off valve, and means operated by said bell for throwing said lever.

20. In a gas-generating system, the combination of a water-tank, a rising-and-falling bell therein, a steam-operated injector adapted to supply a gaseous fluid to the space beneath said bell, a steam-generator supplying steam to said injector, a gas-burner generating steam in said generator, means for turning on and off the gas-supply to said burner, and means operated by the movements of the gas-bell for operating said turning on and off means.

21. In a gas-generating system, the combination of a water-tank, a rising-and-falling bell therein, a steam-operated injector adapted to supply a gaseous fluid to the space beneath said bell, a steam-generator supplying steam to said injector, a gas-burner generating steam in said generator, a gas-pipe supplying said burner, a valve located in said gas-pipe, and means operated by said bell for opening and closing said valve.

22. In a gas-generating system, the combination of a water-tank, a rising-and-falling bell therein, a steam-operated injector adapted to supply a gaseous fluid to the space beneath said bell, a steam-generator supplying steam to said injector, a gas-burner generating steam in said generator, a gas-pipe supplying said burner, a valve located in said gas-pipe, a tumble-bob lever fixed to the stem of said valve adjacent to said bell, and means carried by said gas-bell for throwing said tumble-bob lever alternately in opposite directions, whereby said gas is turned on and off.

23. In a gas-generating system, the combination of a water-tank, a rising-and-falling bell therein, a steam-operated injector adapted to supply a gaseous fluid to the space beneath said bell, a steam-generator supplying steam to said injector, a gas-burner generating steam in said generator, a gas-pipe supplying said burner, a valve located in said gas-pipe, means operated by said bell for opening and closing said valve, and means for automatically igniting said gas when turned on.

24. In a gas-generating system, the combination of a water-tank, a rising-and-falling bell therein, a steam-operated injector adapted to supply a gaseous fluid to the space beneath said bell, a steam-generator supplying steam to said injector, a gas-burner generating steam in said generator, a gas-pipe supplying said burner, a valve located in said gas-pipe, a tumble-bob lever fixed to the stem of said valve adjacent to said bell, means carried by said gas-bell for throwing said tumble-bob lever alternately in opposite directions, whereby said gas is turned on and off, and a small independent gas-jet adapted to burn continuously and to ignite said burner when turned on.

25. In a gas-generating system, the combination of a water-tank, a bell rising and falling therein, steam-operated injecting means for supplying a gaseous fluid beneath said bell, a steam-generator supplying steam to said injecting means, a gas-burner coacting with said generator to generate steam, means for turning on and off said burner according to the movements of the bell, a cut-off valve located in the supply-duct between said generator and injecting means, and means for automatically opening said valve at a predetermined pressure.

26. In a gas-generating system, the combination of a water-tank, a bell rising and falling therein, steam-operated injecting means for supplying a gaseous fluid beneath said bell, a steam-generator supplying steam to said injecting means, a gas-burner coacting with said generator to generate steam, means for turning on and off said burner according to the movements of the bell, a cut-off valve located in the supply-duct between said generator and injecting means, and fluid-pressure-regulated means for throwing said valve open at a predetermined pressure.

27. In a gas-generating system, the combination of a water-tank, a gas-bell rising and falling therein, steam-operated means for conveying a gaseous fluid beneath said gas-bell, a steam-generator supplying said steam-operated means, a cut-off valve in the supply-pipe between said steam-generator and steam-op-

erated means, and means for automatically throwing open said valve when the steam in said generator reaches a fixed pressure.

28. In a gas-generating system, the combination of a water-tank, a gas-bell rising and falling therein, steam-operated means for conveying a gaseous fluid beneath said gas-bell, a steam-generator supplying said steam-operated means, a cut-off valve in the supply-pipe between said steam-generator and steam-operated means, means for automatically throwing open said valve when the steam in said generator reaches a fixed pressure, and means operated by said bell for subsequently restoring said valve to its original or closed position.

29. In a gas-generating system, the combination of a water-tank, a gas-bell rising and falling therein, steam-operated means for conveying a gaseous material under said bell, a steam-generator connected with said steam-operated means, a cut-off valve between said steam-generator and steam-operated means, a burner adapted to generate steam in said generator, means for opening said cut-off valve operated by the downward movement of said bell, and means operated by the movement of said bell for closing said cut-off valve.

30. In a gas-generating system, the combination of a water-tank, a gas-bell rising and falling therein, steam-operated means for conveying a gaseous material under said bell, a steam-generator connected with said steam-operated means, a cut-off valve between said steam-generator and steam-operated means, a burner adapted to generate steam in said generator, a tumble-bob lever mounted on the stem of said cut-off valve, and means carried by said bell for throwing said tumble-bob lever in alternately opposite directions.

31. In a gas-generating system, the combination of a water-tank, a gas-bell rising and falling therein, vapor-operated means for forcing a gaseous material under said bell, a cut-off valve in the vapor-pipe supplying said vapor-operated means, a tumble-bob lever mounted on the stem of said valve, and means operated by said bell for throwing said lever to alternately open and close said valve.

32. In a gas-generating system, the combination of a water-tank, a gas-bell rising and falling therein, vapor-operated means for forcing a gaseous material under said bell, a cut-off valve in the vapor-pipe supplying said vapor-operated means, a tumble-bob lever mounted on the stem of said valve, a rod sliding in a stationary guide and pivoted to said tumble-bob lever, said rod having an offset, a projection on said bell adapted to engage said offset to raise said lever into vertical position on its downward movement and subsequently release the same, a lever oscillating on a stationary pivot and having an arm adapted to strike and throw said tumble-bob lever in the opposite direction, and a projection on said bell adapted to strike and oscillate said last-described lever.

33. In a gas-generating system, the combination of a water-tank, a gas-bell rising and falling therein, vapor-operated means for forcing a gaseous material under said bell, a cut-off valve in the vapor-pipe supplying said vapor-operated means, a tumble-bob lever mounted on the stem of said valve, a rod sliding in a stationary guide and pivoted to said tumble-bob lever, said rod having an offset, a projection on said bell adapted to engage said offset to raise said lever into vertical position on its downward movement and subsequently release the same, a lever oscillating on a stationary pivot and having an arm adapted to strike and throw said tumble-bob lever in the opposite direction, and a projection on said bell adapted to strike and oscillate said last-described lever, in combination with means for raising the pressure in said vapor-supply pipe and fluid-pressure-regulated means for automatically throwing said tumble-bob lever when the pressure reaches a predetermined amount.

34. In a gas-generating system, the combination of a water-tank, a bell rising and falling therein, steam-operated means for forcing a gaseous material under said bell, a steam-generator, a gas-burner adapted to generate steam in said generator, a pipe connecting said generator with said steam-operated means, a cut-off valve in said pipe, a gas-pipe supplying said burner, a cut-off valve in said gas-pipe, means operated by said bell when near the limit of its upward movement for closing said gas-valve, means operated by said bell on its downward movement for closing said steam-valve, and fluid-pressure-operated means for reopening said steam-valve when the steam has reached a certain pressure.

35. In a gas-generating system, the combination of a water-tank, a bell rising and falling therein, steam-operated means for forcing a gaseous material under said bell, a steam-generator, a gas-burner adapted to generate steam in said generator, a pipe connecting said generator with said steam-operated means, a cut-off valve in said pipe, a gas-pipe supplying said burner, a cut-off valve in said gas-pipe, means operated by said bell when near the limit of its upward movement for closing said gas-valve, means operated by said bell on its downward movement for closing said steam-valve, fluid-pressure-operated means for reopening said steam-valve when the steam has reached a certain pressure, and independent means operated by the bell for opening said steam-valve when it has reached a certain point in its descent.

36. In a gas-generating system, the combination of a water-tank, a bell rising and falling therein, steam-operated means for conveying a gaseous material under said bell, a steam-

generator, a steam-pipe connecting said steam-generator with said steam-operated means, a cut-off valve located in said steam-pipe, a tumble-bob lever mounted on the stem of said cut-off valve, an auxiliary water-tank, an auxiliary bell located in said auxiliary tank, a projection carried by said auxiliary bell adapted to strike and throw over said tumble-bob lever and thereby open said cut-off valve, a pipe connecting the steam-space in said generator with the gas-space in said auxiliary bell, and a fluid-pressure-operated valve located in said last-named connection adapted to open the same when the steam in said generator has acquired a predetermined pressure.

37. In a gas-generating system, the combination of a water-tank, a bell rising and falling therein, steam-operated means for conveying a gaseous material under said bell, a steam-generator, a steam-pipe connecting said steam-generator with said steam-operated means, a cut-off valve located in said steam-pipe, a tumble-bob lever mounted on the stem of said cut-off valve, an auxiliary water-tank, an auxiliary bell located in said auxiliary tank, a projection carried by said auxiliary bell adapted to strike and throw over said tumble-bob lever and thereby open said cut-off valve, a pipe connecting the steam-space in said generator with the gas-space in said auxiliary bell, a fluid-pressure-operated valve located in said last-named connection and adapted to open the same when the steam in said generator has acquired a predetermined pressure, a rod 154 pivoted to said tumble-bob lever and sliding in a stationary guide, said rod having an offset adjacent to said bell and a projection carried by said bell and adapted to engage said offset on its upward movement and to draw said rod back with it in its downward movement, whereby said tumble-bob lever is raised into vertical position.

38. In a gas-generating system, the combination of a water-tank, a bell rising and falling therein, steam-operated means for conveying a gaseous material under said bell, a steam-generator, a steam-pipe connecting said steam-generator with said steam-operated means, a cut-off valve located in said steam-pipe, a tumble-bob lever mounted on the stem of said cut-off valve, an auxiliary water-tank, an auxiliary bell located in said auxiliary tank, a projection carried by said auxiliary bell adapted to strike and throw over said tumble-bob lever and thereby open said cut-off valve, a pipe connecting the steam-space in said generator with the gas-space in said auxiliary bell, a fluid-pressure-operated valve located in said last-named connection and adapted to open the same when the steam in said generator has acquired a predetermined pressure, a rod 154 pivoted to said tumble-bob lever and sliding in a stationary guide, said rod having an offset adjacent to said bell, and a projection carried by said bell and adapted to engage said offset on its upward movement and to draw said rod back with it in its downward movement, whereby said tumble-bob lever is raised into vertical position, in combination with a gas-burner supplying said steam-generator, a gas-pipe supplying said burner, an automatic igniter for said burner, a cut-off valve in said gas-pipe, a tumble-bob lever mounted on the stem of said gas-valve, and projections mounted on said bell adapted to throw over said tumble-bob lever to close said valve during the upward movement of the bell, and to open it on its downward movement at the same time that said first-mentioned tumble-bob lever is raised to vertical position.

39. In a gas-generating system, a condenser comprising a box closed on its lateral sides and on the top and open at the bottom floating on the surface of a water-tank and having a plurality of parallel partitions each fixed to the side of the box at one end and having an aperture for the passage of gas at the other.

40. In a gas-generating system, a condenser comprising a box closed on its lateral sides and on the top and open at the bottom floating on the surface of a water-tank and having a plurality of parallel partitions each fixed to the side of the box at one end and having an aperture for the passage of gas at the other, an open-ended pipe leading upward into and adapted to deliver a moisture-laden gas into one corner of said box, and an exit-orifice in said box at the diagonally opposite corner.

41. In a gas-generating system, the combination of a water-tank, a condenser comprising a rectangular box closed on its four sides and on the top and open at the bottom and supported on a level with the water-surface of said tank and partially submerged therein, said condenser containing a plurality of parallel partitions connecting with the side of the box at one end and having each an aperture at the other for the passage of gas, whereby a labyrinthian passage-way is afforded, an open-ended pipe adapted to deliver gas under one corner of the condenser, an exit for the gas at the diagonally opposite corner, and a pair of supports holding said condenser in fixed position.

42. In a gas-generating system, the combination of a water-tank, a condenser comprising a rectangular box closed on its four sides and on the top and open at the bottom and supported on a level with the water-surface of said tank and partially submerged therein, said condenser containing a plurality of parallel partitions connecting with the side of the box at one end and having each an aperture at the other for the passage of gas, whereby a labyrinthian passage-way is afforded, an open-ended pipe adapted to deliver gas under one corner of the condenser, an exit for the gas at the diagonally opposite corner, a sector-shaped bell pivotally mounted in said tank over said condenser, said bell having an open-

ing in the lower straight side thereof, and a pair of lateral brackets secured to the end wall of said tank and passing through said opening and holding said condenser in fixed position.

43. In a gas-generating system, the combination of a water-tank, a condenser comprising a rectangular box closed on its four sides and on the top and open at the bottom and supported on a level with the water-surface of said tank and partially submerged therein, said condenser containing a plurality of parallel partitions connecting with the side of the box at one end and having each an aperture at the other for the passage of gas, whereby a labyrinthian passage-way is afforded, an open-ended pipe adapted to deliver gas under one corner of the condenser, an exit for the gas at the diagonally opposite corner, a standard 86 fixed to the tank and supporting one end of said condenser, and a delivery-pipe for gas passing through and secured to the other end of said condenser, whereby to hold it in fixed position.

44. In a gas-generating system, the combination of a water-tank, a condenser comprising a rectangular box closed on its four sides and on the top and open at the bottom and supported on a level with the water-surface of said tank and partially submerged therein, said condenser containing a plurality of parallel partitions connecting with the side of the box at one end and having each an aperture at the other for the passage of gas, whereby a labyrinthian passage-way is afforded, an open-ended pipe adapted to deliver gas under one corner of the condenser, an exit for the gas at the diagonally opposite corner, a short sleeve depending through said condenser at the center of one side thereof and open at both ends, a sector-shaped bell pivotally mounted in said tank and having an opening in its lower straight side, a bracket 86 secured to the end wall of said tank and to said condenser and passing through said opening, and a gas-delivery pipe also secured to the end wall of said tank and passing through said opening and extending upwardly through said open-ended sleeve in the condenser, the end of said pipe being provided with means for securing the condenser solidly thereto.

45. In a gas-generating system, the combination of a water-tank, a floatable bell therein, a gas-conduit extending in contact with the water around all four sides of said bell, means for conveying gaseous material into one end of said conduit, and means for conveying said material from the other end of said conduit under said bell.

46. In a gas-generating system, the combination of a water-tank, a floatable bell therein, a gas-conduit extending in contact with the water around all four sides of said bell, means for conveying gaseous material into one end of said conduit, a vertically downwardly extending passage-way leading from the other end of said conduit and having a water-pocket therein, means for withdrawing condensation-water from said water-pocket, and a duct leading from an intermediate point of said passage-way under said bell.

47. In a gas-generating system, the combination of a water-tank, a floatable bell therein, a gas-conduit extending in contact with the water around all four sides of said bell, means for conveying gaseous material into one end of said conduit, a vertically downwardly extending passage-way leading from the other end of said conduit and having a water-pocket therein, means for withdrawing condensation-water from said water-pocket, an open-bottomed condenser having a labyrinthian passage-way for the gas sustained on the surface of the water of the tank and beneath said bell and partially submerged therein, said condenser opening at one end into the gas-space in said bell, and a duct leading from said vertical passage-way through the water of the tank to the other end of said condenser.

48. In a gas-generating system, the combination of a water-tank, a floatable bell therein, an inwardly and downwardly turned flange extending around the four sides of the upper margin of said tank, said flange depending a certain distance within the water of said tank and forming a water-sealed gas-conduit thereunder, a partition across said gas-conduit at one point thereof, means for leading a gaseous material into said conduit at one side of said partition, and means for carrying away the gaseous material from the other side of said partition and leading it under said bell.

49. In a gas-generating system, the combination of a water-tank, a floatable bell therein, an inwardly and downwardly turned flange extending around the four sides of the upper margin of said tank, said flange depending a certain distance within the water of said tank and forming a water-sealed gas-conduit thereunder, a partition across said gas-conduit at one point thereof, means for leading a gaseous material into said conduit at one side of said partition, a vertical passage-way formed on the side of said tank and opening into said gas-conduit on the other side of said partition, said passage-way forming a water-pocket at its lower end, means for abstracting the water of condensation from said conduit, and a pipe leading from an intermediate point of said vertical passage-way to the gas-space within the bell.

50. In a gas-generating system, the combination of a water-tank, a floatable bell therein, an inwardly and downwardly turned flange extending around the four sides of the upper margin of said tank, said flange depending a certain distance within the water of said tank and forming a water-sealed gas-conduit thereunder, a partition across said gas-conduit at one point thereof, means for leading

a gaseous material into said conduit at one side of said partition, a vertical passage-way formed on the side of said tank and opening into said gas-conduit on the other side of said partition, said passage-way forming a water-pocket at its lower end, means for abstracting the water of condensation from said conduit, a condenser mounted in the water of said tank beneath said bell, and a pipe leading from said passage-way to said condenser at one end thereof, the other end opening into the gas-space of the tank.

51. In a gas-generating system, the combination of a water-tank, a floatable bell therein, an inwardly and downwardly turned flange extending around the four sides of the upper margin of said tank, said flange depending a certain distance within the water of said tank and forming a water-sealed gas-conduit thereunder, a partition across said gas-conduit at one point thereof, means for leading a gaseous material into said conduit at one side of said partition, a vertical passage-way formed on the side of said tank and opening into said gas-conduit on the other side of said partition, said passage-way forming a water-pocket at its lower end, means for abstracting the water of condensation from said conduit, a condenser mounted in the water of said tank beneath said bell, a pipe leading from said passage-way to said condenser at one end thereof, the other end opening into the gas-space of the tank, a fixed support for one end of said condenser, and a tubular support for the other end of said condenser and forming a delivery-pipe through which gaseous material is abstracted from the gas-space of said bell.

52. In a gas-generating system, in combination with a gas-holder comprising a water-tank and a floatable bell therein, a longitudinally-arched strip secured in vertical position to the side of the tank and forming a vertical passage-way and water-pocket, means for abstracting water from the lower end of said pocket, and pipes leading into and from said pocket to or from the interior of said bell.

53. In a gas-generating system, a water-tank, a substantially semicylindrical vertical strap secured to the side thereof and closed at both ends forming a gas-space and water-pocket, a drip-cock at the lower end of said water-pocket, and a pipe leading from said tank and another pipe both opening into the said gas-space.

54. In a gas-generating system, the combination of a rectangular water-tank having an inwardly and downwardly extending flange depending beneath the water-surface in said tank and extending around all four sides of the upper margin thereof and forming a gas-duct, a floatable gas-bell mounted in said tank, a partition across said gas-duct, means for conveying a gaseous material into said gas-duct at one side of said partition, a substantially semicylindrical vertical strip secured to the outer side of said tank and closed at both ends and opening at its upper end into said gas-duct at the other side of said partition and forming a vertical downwardly-leading passage-way for the gaseous material, a drip-cock at the lower end of said vertical passage-way, and a pipe leading from an intermediate point of said passage-way within the tank and opening into the gas-space of said bell.

55. In a gas-generating system, the combination of a water-tank having a floatable bell therein, a delivery-pipe leading from the gas-space beneath said bell downwardly through the water of said tank and leading out through the side of said tank, a vertical water-pocket formed on the outer side of said tank and through which said pipe leads, and a drip-cock at the lower end of said pocket.

56. In a gas-generating system, the combination of a substantially rectangular water-tank, a sector-shaped gas-bell pivotally mounted therein and having an opening at its lower straight side, an elbowed delivery-pipe leading from the gas-space within said bell downwardly and then horizontally through the side of said tank and through the opening in said gas-bell, and a water-pocket formed on the outer side of said tank through which said delivery-pipe passes, and having a drip-cock at the lower end thereof.

57. In a gas-generating system, the combination of a substantially rectangular water-tank, a sector-shaped gas-bell pivotally mounted therein and having an opening at its lower straight side, an elbowed delivery-pipe leading from the gas-space within said bell downwardly and then horizontally through the side of said tank and through the opening in said gas-bell, an inwardly and downwardly extending flange surrounding the four sides of the upper margin of said tank and forming a water-sealed gas-conduit, a partition across said water-conduit at one point thereof, an injector adapted to force a gaseous material into said gas-conduit at one side of said partition, a vertical substantially semicylindrical strip secured to the outer side of said tank and opening at its upper end on the other side of said partition into said gas-conduit, means for abstracting water from the lower end of said passage-way, and an elbowed pipe leading from an intermediate point of said passage-way through the opening in said bell and upwardly to the surface of the water within said tank.

58. In a gas-generating system, the combination of a substantially rectangular water-tank, a sector-shaped gas-bell pivotally mounted therein and having an opening at its lower straight side, an elbowed delivery-pipe leading from the gas-space within said bell downwardly and then horizontally through the side of said tank and through the opening in said gas-bell, an inwardly and downwardly extend-

ing flange surrounding the four sides of the upper margin of said tank and forming a water-sealed gas-conduit, a partition across said gas-conduit at one point thereof, an injector adapted to force a gaseous material into said gas-conduit at one side of said partition, a vertical substantially semicylindrical strip secured to the outer side of said tank and opening at its upper end on the other side of said partition into said gas-conduit and forming a passage-way, means for abstracting water from the lower end of said passage-way, an elbowed pipe leading from an intermediate point of said passage-way, through the opening in said bell and upwardly to the surface of the water within said tank, a condenser comprising an open-bottomed rectangular box having a plurality of longitudinal partitions leading alternately from opposite ends of said box to near the other end, said condenser being partially submerged within the water of said tank, and said last-named pipe opening under one corner of said condenser, an exit-passage from the other end of said condenser to the gas-space under said bell, a bracket fixed to the side of said tank and to one end of said condenser, means for securing the other end of said condenser to said delivery-pipe whereby the condenser is held in fixed position in the tank, an auxiliary tank on the side of said main tank and communicating with the latter beneath the water-level thereof, a float-valve adapted to maintain the water in said auxiliary tank at a fixed level, and a water-supply connected with said float-valve.

59. In a gas-generating system, in combination with a water-tank and a floatable bell therein, a steamer supported at the side of said water-tank and partially above the water-line therein, a horizontal water-supply pipe leading from said tank to the lower end of said steamer, a check-valve interposed in said pipe to prevent the flow of water from said steamer to said tank, a steam-pipe leading from the upper end of said steamer back to said tank, an injector mounted on the end of said steam-pipe and adapted to inject gaseous material forcibly into the water-space of said tank, and means for carrying said gaseous material under said bell.

60. In a gas-generating system, in combination with a water-tank and a floatable bell therein, a steamer supported at the side of said water-tank and partially above the water-line therein, a horizontal water-supply pipe leading from said tank to the lower end of said steamer, a check-valve interposed in said pipe to prevent the flow of water from said steamer to said tank, a steam-pipe leading from the upper end of said steamer back to said tank, an injector mounted on the end of said steam-pipe and adapted to inject gaseous material forcibly into the water-space of said tank, means for carrying said gaseous material under said bell, a cut-off valve in said steam-pipe between said steamer and injector, a fluid-pressure-operated valve between said steamer and said cut-off valve, and steam-operated means for throwing open said cut-off valve, said fluid-pressure-regulated valve being arranged to admit steam to said steam-operated means at a predetermined pressure.

61. In a gas-generating system, the combination of a water-tank, a floatable bell therein, a vertical cylinder supported at the side of said bell and partially above the water-level thereof, a substantially dome-shaped double-walled hood connected with the lower end of said cylinder, a plurality of open-ended tubes leading from the lower side of said hood to the upper closed end of said cylinder, a burner under said hood, a horizontal water-supply pipe leading from the side of said tank to the periphery of said hood, a check-valve in said pipe, a steam-pipe leading from the upper end of said cylinder back to said tank, a gas-injector in said pipe adapted to carry gas beneath the water in said tank, and means for conveying the injected gas beneath the bell.

62. In a gas-generating system, the combination of a water-tank, a floatable bell therein, a vertical cylinder supported at the side of said bell and partially above the water-level thereof, a substantially dome-shaped double-walled hood connected with the lower end of said cylinder, a plurality of open-ended tubes leading from the lower side of said hood to the upper closed end of said cylinder, a burner under said hood, a horizontal water-supply pipe leading from the side of said tank to the periphery of said hood, a check-valve in said pipe, a steam-pipe leading from the upper end of said cylinder back to said tank, a gas-injector in said pipe adapted to carry gas beneath the water in said tank, means for conveying the injected gas beneath the bell, a cut-off valve in said pipe, and means operated by a predetermined pressure of steam for opening said cut-off valve.

63. In a gas-generating system, the combination of a water-tank, a floatable bell therein, a vertical cylinder supported at the side of said bell and partially above the water-level thereof, a substantially dome-shaped double-walled hood connected with the lower end of said cylinder, a plurality of open-ended tubes leading from the lower side of said hood to the upper closed end of said cylinder, a burner under said hood, a horizontal water-supply pipe leading from the side of said tank to the periphery of said hood, a check-valve in said pipe, a steam-pipe leading from the upper end of said cylinder back to said tank, a gas-injector in said pipe adapted to carry gas beneath the water in said tank, means for conveying the injected gas beneath the bell, a cut-off valve in said pipe, means operated by a predetermined pressure of steam for opening said cut-off valve, and means operated by the bell at the upper limit of its motion for nulli-

fying the action of said injector without interfering with the passage of steam therethrough.

64. In a gas-generating system, an injector for gaseous material comprising a hollow chamber having an inlet, means for injecting fluid therethrough, a nozzle leading from said chamber, a sleeve surrounding said nozzle and having a plurality of apertures therein, and means for regulating the action of said injector comprising a slide adapted to be interposed in front of said nozzle.

65. In a gas-generating system, an injector for gaseous material comprising a hollow chamber having an inlet, means for injecting fluid therethrough, a nozzle leading from said chamber, a sleeve surrounding said nozzle and having a plurality of apertures therein, and an annular cup adapted to receive drippings mounted on and surrounding said sleeve.

66. In a gas-generating system, an injector for gaseous material, comprising a hollow chamber having an inlet, means for injecting fluid therethrough, a nozzle leading from said chamber, a sleeve surrounding said nozzle and having a plurality of apertures therein, and an annular cup adapted to receive drippings mounted on and surrounding said sleeve, said sleeve having a plurality of apertures therein adapted to drain said cup.

67. In a gas-generating system, an injector for gaseous material comprising a hollow chamber having an inlet, means for injecting fluid therethrough, a nozzle leading from said chamber, a sleeve surrounding said nozzle and having a plurality of apertures therein, an annular cup adapted to receive drippings mounted on and surrounding said sleeve, and a dome-shaped shield surrounding the injector and cooperating with said cup to deaden the noise of said injector.

68. In air-forcing mechanism, a tank containing water, a floatable bell mounted therein, a steam-generator, an injector receiving steam from said generator and adapted to introduce the same to said bell, a receptacle constituting a feeder for said steam-generator, and automatic means for delivering water to said receptacle when said bell becomes depressed.

69. In air-forcing mechanism, in combination, a tank containing water, a bell mounted therein, a steam-generator, a receptacle constituting a feeder for said generator, an injector adapted to introduce air from the said bell, a cup carried by said bell and adapted to dip in the water in said tank, and a pipe connection between said cup and said receptacle.

70. In air-forcing mechanism, in combination, a tank containing water, a bell dipping in said water, a steam-generator, a water-pocket formed at the side of said tank, a pipe connecting said water-pocket with said generator whereby said water-pocket constitutes a feeder therefor, a steam-injector adapted to introduce air to said bell, a cup carried by said bell and adapted to dip in the water of said tank, and a flexible hose connecting said cup with said water-pocket.

71. In air-forcing mechanism, in combination, a tank containing water and having an upper opening with a depending flange thereabove dipping in said water whereby a duct is formed between said flange and wall of said tank, a floatable bell mounted in said opening, a steam-generator, a receptacle attached to said tank and constituting a feeder for said generator, a pipe leading from the upper portion of said receptacle to said duct, a cup carried by said bell and adapted to drip into said water, and a flexible hose connecting said cup with said receptacle.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

FRANCIS PAUL, JR.

Witnesses:
T. MYNARD,
P. MENARD.