No. 704,764. Patented July 15, 1902.

J. SEYMOUR.

AIR AND GAS MIXER.

(Application filed Apr. 19, 1902.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 2.

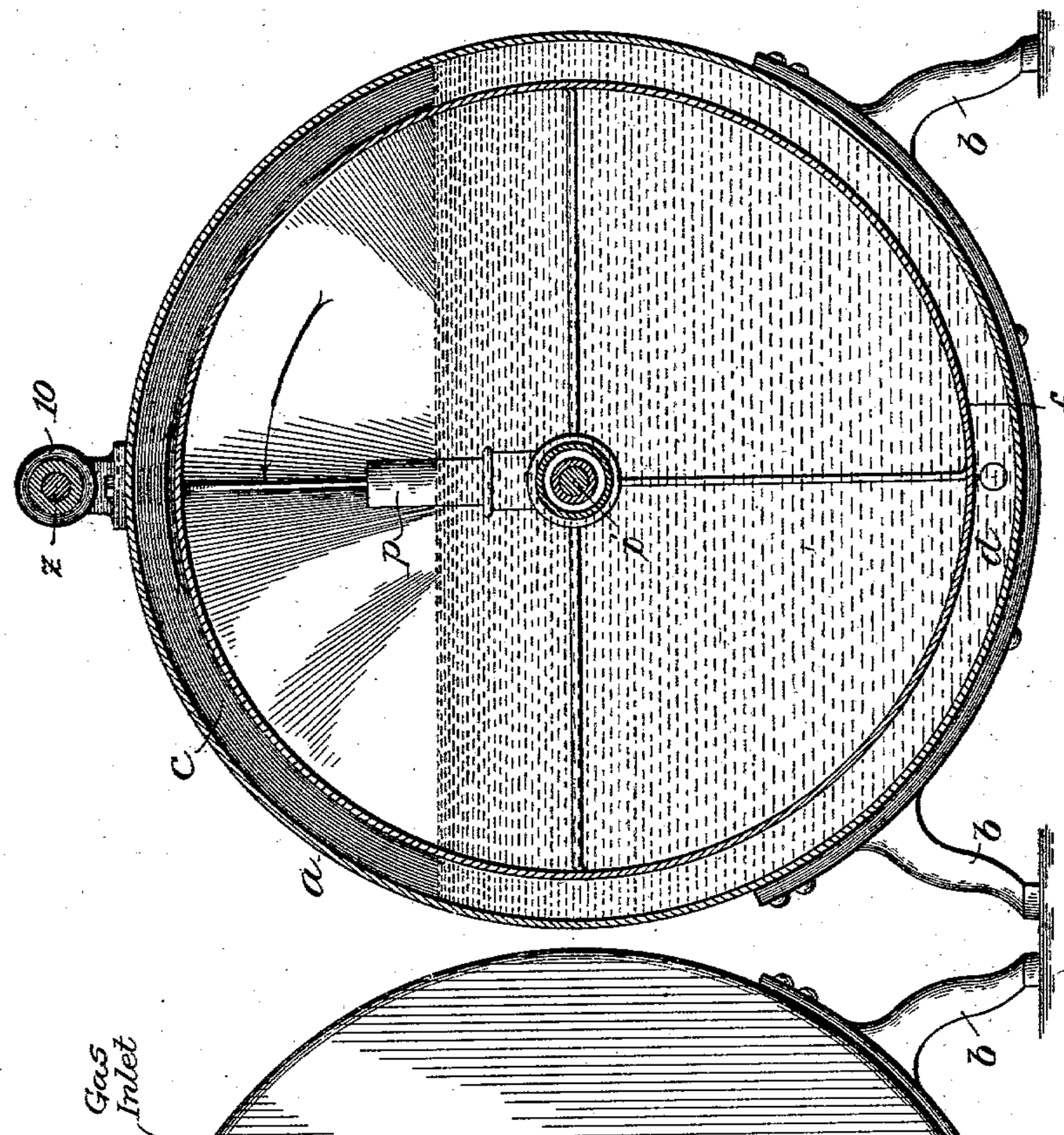

Fig. 1.

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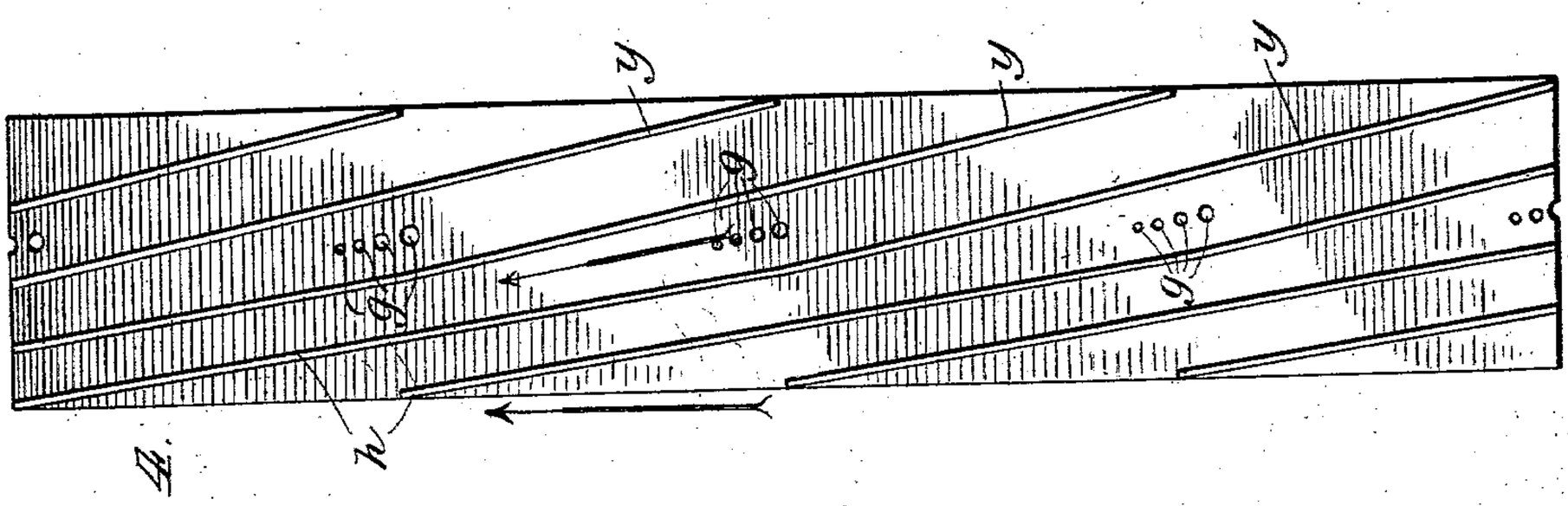

Fig. 4.

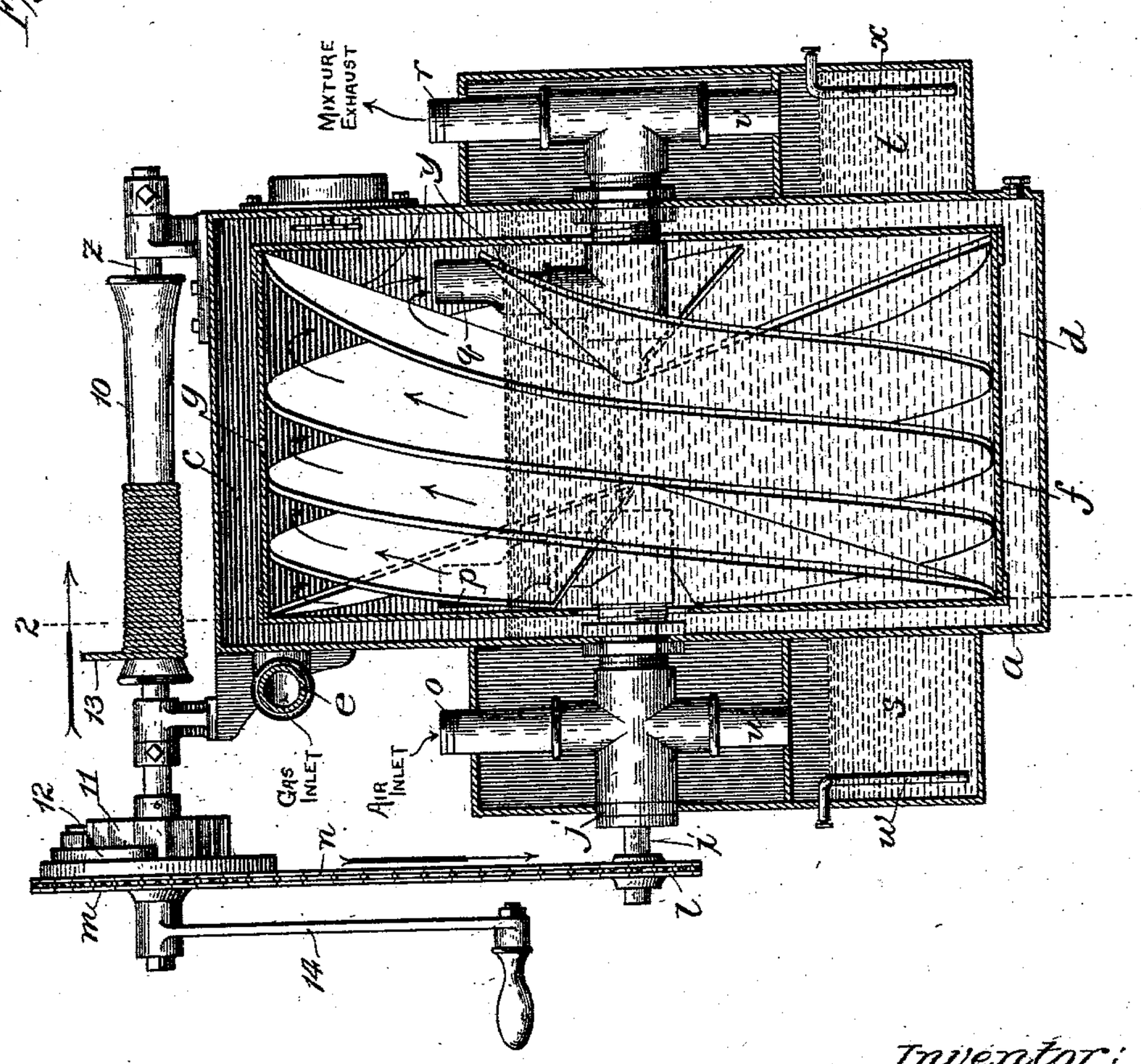

Fig. 3.

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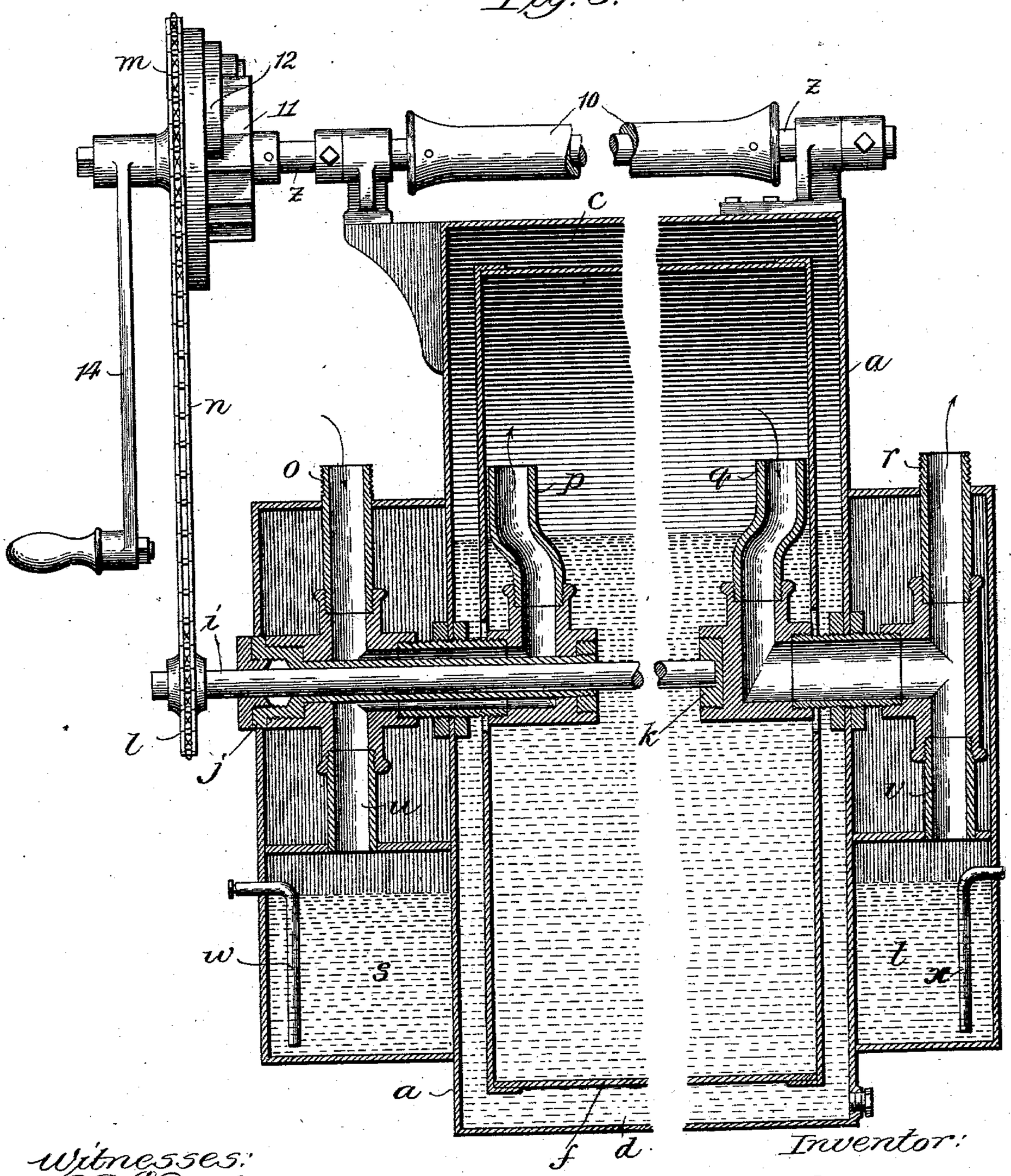
(No Model.) 3 Sheets—Sheet 3.

Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN SEYMOUR, OF TORONTO, CANADA.

AIR AND GAS MIXER.

SPECIFICATION forming part of Letters Patent No. 704,764, dated July 15, 1902.

Application filed April 19, 1902. Serial No. 103,706. (No model.)

To all whom it may concern:

Be it known that I, JOHN SEYMOUR, a subject of the King of Great Britain, residing at 443 Manning avenue, Toronto, in the Province of Ontario and Dominion of Canada, have invented certain new and useful Improvements in Machines for Mixing Gases and Air, of which the following is a specification.

This invention relates particularly to apparatus adapted to mix gas and air in desired proportions, rates, and amounts, and especially to the arrangement and construction of the measuring devices, as will more fully hereinafter appear.

The principal object of the invention is to provide a simple, economical, and efficient apparatus for mixing gas and air.

Further objects of the invention will appear from an examination of the drawings and the following description and claims.

The invention consists principally in the combination of an exterior casing forming a liquid-sealing chamber, a rotatable drum therein provided with a plurality of helical supply and mixing chambers arranged within the same, a supply-pipe for such rotatable drum, and a mixture-exhaust pipe for such inner drum.

The invention consists, further, in the combination of an exterior receptacle providing a gas-supply and liquid-sealing chamber, a closed cylindrical drum rotatably mounted therein and provided with a plurality of atmospheric supply and mixing chambers connected with the gas-supply chamber of the exterior receptacle, an axial air-supply pipe at one end of such chamber, and an axial mixture-exhaust pipe at the other end of such chamber.

The invention consists, further, in the combination of an exterior receptacle providing a gas-supply and liquid-sealing chamber, a closed cylinder rotatably mounted therein and provided with a plurality of perforations and a plurality of helical air supply and mixing chambers connected by means of the perforations in the walls of the cylinder with the gas-supply chamber of the exterior receptacle, an axial air-supply pipe at one end of such rotatable cylinder communicating with the helical chambers therein, and an axial exhaust-pipe at the other end of such rotatable cylinder communicating with the discharge end of the chambers.

The invention consists, further and finally, in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is an end elevation of a machine constructed in accordance with these improvements; Fig. 2, a cross-sectional elevation taken on line 2 of Fig. 3 looking in the direction of the arrow; Fig. 3, a longitudinal sectional elevation taken on line 3 of Fig. 1 looking in the direction of the arrow; Fig. 4, a "developed" plan view of the rotatable cylinder with its helical blades looking at it from the inside, and Fig. 5 an enlarged broken longitudinal sectional elevation similar to that shown in Fig. 3 with the helical blades left out.

In constructing a machine in accordance with these improvements I make an exterior casing *a*, which is practically cylindrical in contour when viewed in end elevation or cross-section, as shown in Figs. 1 and 2, and which, as shown in such figures, is provided with supporting-legs *b*, though any desired supporting base or mechanism may be used in place thereof. This receptacle provides what I prefer to term a "gas-supply" chamber *c*, as shown in Fig. 3, at the upper part and a "liquid-sealing" chamber *d* at the lower part, the liquid being provided to form a hermetical seal therein and above the center line, so as to prevent leakage of the gas or air mixture, as will more fully hereinafter appear. The gas-chamber in the upper part of this receptacle is provided with a gas-supply pipe *e* to furnish the desired supply of gas.

It is desirable to provide means by which the desired amount of gas may be taken from the gas-supply chamber and mixed with the correct proportion of air to form a burning mixture or compound. In order to accomplish this, I provide a closed rotatable cylinder *f*, provided with substantially imperforate end portions, but with its cylindrical wall provided with a plurality of perforations *g* of different sizes, so as to permit the gas under pressure to enter the mixing-chambers in the interior of the cylinder, as hereinafter

set forth. This rotatable cylinder is provided with a plurality of helical blades *h*, secured thereto and arranged substantially parallel to each other, so as to provide a plurality of helical air supply and mixing chambers, each communicating by means of its particular set of perforations *g* with the gas-supply chamber in the exterior receptacle. These helical blades are mounted on a rotatable shaft *i*, one end of which is passed through a stuffing-box bearing or bushing *j* and the other end journaled in a threaded bushing *k*. The rotatable shaft is operated or rotated from the outside by means of a driven sprocket-wheel *l*, secured thereto, which is geared to a driving sprocket-wheel *m* by means of a sprocket-chain *n*, which in turn derives its power through means of other mechanisms hereinafter more fully set forth.

To furnish air to the air supplying and mixing chambers, an air-supply pipe *o* is provided, having one portion thereof axially arranged around the rotatable shaft and with its outlet portion *p* communicating with one end (the sealed end) of each of the helical chambers as they are rotated above the liquid seal. A mixture-exhaust pipe *q* is arranged at the other end of the rotatable cylinder with its opening arranged above the water seal to communicate with the discharge end of each of the mixing-chambers as they are rotated. One portion of this mixture-exhaust pipe is preferably axially arranged and on the outside preferably extends upward, as shown at *r*. Portions of the supply and exhaust pipes are, as above suggested, arranged below the water seal in order to make the proper connections, and consequently there is more or less liability of leakage of water or liquid therefrom. In order to take care of this without in any way losing any of the gas or mixture, I arrange drip-boxes *s* and *t* directly under each of such pipes communicating with a portion of their respective passages by means of the drip-passages *u* and *v*. An inspection of Fig. 5 will show that if any liquid escapes into the air-supply pipe it will pass down the passage *u* into its drip-box *s*, and if any liquid escapes over the mixture-exhaust pipe it will pass down the passage *v* into its drip-box *t*. Each of these drip-boxes is provided with a siphon overflow-pipe *w* and *x*, so arranged that the water or liquid therein forms a seal to prevent the escape of the gaseous body, while at the same time preventing the liquid from rising therein above a desired point. As these helical chambers are used for the purpose of supplying the required amount of air, as well as for the mixture thereof with the desired amount of gas, they are preferably arranged for a portion of their length in a parallel manner--that is, the helical blades, as shown in Fig. 4, are arranged substantially parallel for a portion of their length, providing a chamber of uniform cross-section. It will be understood, however, that when the gas is supplied the chamber ought to be increased in size, so as to permit the gas to more readily enter and mix with the air. To accomplish this, the blades are bent at or near the perforations in a flaring manner, as shown at *y* in Figs. 3 and 4, so that the chambers become increased in size in cross-section and provide for slightly-larger chambers up to the discharge ends to take care of the entrance of the fluid gas. Another distinct advantage derived from this construction is that by raising or lowering the water-level the richness of the mixture can be regulated. As the water-level is raised the air-inlet to each helical chamber is thereby by means of the angle of the inlet end of the blade made smaller in proportion to the size of the chamber with which it communicates and the mixture becomes richer in gas. As the water-level is lowered the air-inlet to each chamber is increased in size by reason of the angle of the inlet end of the blade until it is larger in proportion to the size of the chamber with which it communicates and the mixture becomes poorer in gas, all of which will be understood and appreciated by those skilled in the art. Any desired mechanism can be used for rotating this rotatable cylinder with its helical chambers. I prefer, however, to use the mechanism heretofore described, in which the sprocket-wheel *m* is loosely mounted upon the driving-shaft *z*, which carries a drum 10. Adjacent to the sprocket-wheel *m* is arranged a ratchet-wheel 11, which by means of a spring-pressed pawl 12 rotates the sprocket-wheel with it when moving in one direction, but permits the driving-shaft to be rotated in the other direction without communicating any power or motion to the sprocket-wheel *m*. The winding-drum is connected with a weight (not shown) by means of a cable, cord, or similar element 13, which furnishes the desired energy. To operate the winding-drum with its shaft, a crank-handle 14 is provided, all of which is well known and understood in this art.

The "mixture-chamber" of the cylinder, as the rotatable cylinder *f* may be termed, is, as above described, provided at one end with an air-inlet passage and at the other with a mixture exhaust or outlet passage, both in constant communication with the inside of the mixture-chamber cylinder, and this cylinder is divided into a plurality of mixture-chambers, separated from each other by the helical blades and the liquid which forms the seal for the respective openings. It is necessary also that the air-inlet opening for each chamber, the gas-inlet opening for each chamber, and the mixture-outlet opening for each chamber be separated from each other at all times and yet communicate with such chamber at different times and in the desired order. To accomplish this, I arrange each blade or dividing-wall so that the end which is at the inlet-opening of its respective chamber (the chamber formed between such blade

and the blade which precedes it) is substantially diametrically opposite the gas-inlet opening or group of openings of such chamber.

In operation the liquid for forming the seal is kept at such a level (preferably at or above the axis of the cylinder) that when the end of the blade enters the liquid and passes downward therein a sufficient distance to form the desired seal the gas-inlet opening or group of openings of the chamber will immediately emerge from the liquid, permitting the gas to enter such chamber as its size gradually increases and during the interval in which such gas-inlet openings are exposed above the surface of the sealing liquid. Upon rotating the cylinder to the point where such gas-inlet openings enter the liquid they become sealed, and after this the "outlet" end of the blade emerges from the liquid, creating the outlet for such chamber communicating with the main mixture-outlet opening. These outlet ends of the respective blades are so arranged with reference to the gas-inlet openings of their respective chambers that they emerge from the sealing liquid, while the sealing liquid intervenes and forms a seal between the gas-inlet openings and the open outlet portion of such chamber, thus forming the desired outlet, while the open outlet portion of the chamber is cut off from all communication with both the air-inlet and gas-inlet openings of such chamber.

It will be readily understood that, having the diverging walls as described, each mixing-chamber increases in size while its gas-inlet opening or group of openings is exposed above the level of the sealing liquid and its air inlet and outlet mixture openings are sealed. The amount of air within the chamber being limited, the increase in the size of the chamber tends to draw the gas into such chamber, when it is maintained at a pressure equivalent to atmospheric pressure. I therefore maintain the gas under pressure equivalent to or in excess of the pressure of the air within the mixing-chamber and also employ the diverging walls, which increase the capacity of the mixing-chamber correspondingly to the admission of gas thereto, and find that the most satisfactory results are thus accomplished.

I claim—

1. In a machine of the class described, the combination of an outer casing forming a liquid-sealing chamber, a rotatable drum therein provided with a plurality of helical supply and mixing chambers arranged within the same, each provided with an air and a gas inlet, a supply-pipe for such rotatable drum, and a mixture-exhaust pipe for such inner drum, substantially as described.

2. In a machine of the class described, the combination of an exterior receptacle providing a fluid-supply and liquid-sealing chamber, a closed cylindrical drum rotatably mounted therein and provided with a plurality of fluid supply and mixing chambers connected with the fluid-supply chamber of the interior receptacle and each having an air-inlet, an axial fluid-supply pipe at one end of such chamber, and an axial mixture-exhaust pipe at the other end of such chamber, substantially as described.

3. In a machine of the class described, the combination of an exterior casing forming a gas-supply and liquid-sealing chamber, a closed cylinder rotatably mounted therein and provided with a plurality of perforations and a plurality of helical supply and mixing chambers therein, each chamber arranged to be connected by means of the perforations in the walls of the cylinder with the gas-supply chamber of the exterior receptacle, an axial air-supply pipe at one end of such rotatable cylinder communicating with the chambers therein, and an axial exhaust-pipe at the other end of such rotatable cylinder communicating with the other end of the chambers, substantially as described.

4. In a machine of the class described, the combination of an exterior casing forming a gas-supply and liquid-sealing chamber, a closed cylinder rotatably mounted therein provided with a multiplicity of perforations in the walls thereof, a plurality of helical blades mounted in the interior of such rotatable cylinder providing a plurality of air-supply and mixing chambers, each arranged opposite perforations in the wall of the cylinder to communicate with the gas-supply chamber of the exterior receptacle, a shaft upon which the blades and rotatable cylinder are mounted and rotated, an air-supply pipe communicating with the helical chambers of the rotatable cylinder above the water seal, and a mixture-exhaust pipe communicating with the helical chambers above the water seal, substantially as described.

5. In a machine of the class described, the combination of an exterior casing forming an air-supply and liquid-sealing chamber, a closed cylinder rotatably mounted therein and provided with perforations in the walls thereof, a plurality of helical blades arranged in such rotatable cylinder and at varying angles to form a plurality of helical air-supply and mixing chambers of increased size in cross-section at the discharge ends thereof and communicating by means of the perforations with the gas-supply chamber of the exterior receptacle, an axial air-supply pipe communicating with the helical chambers above the water seal at one end thereof, and a mixture-exhaust pipe communicating with the discharge ends of the mixing-chambers above the water seal, substantially as described.

6. In a machine of the class described, the combination of an exterior casing forming a gas-supply and liquid-sealing chamber, a closed cylinder rotatably mounted therein and provided with a plurality of perforations in its wall, a plurality of helical blades arranged in such cylinder at different angles and at different portions of their lengths to form a

plurality of air-supply and mixing chambers of increased size in cross-section at their discharge ends and communicating with the gas-supply chamber of the exterior receptacle by means of the perforations in the walls of the cylinder, a shaft upon which such blades and rotatable cylinder are supported and rotated, an air-supply pipe at one end communicating with the helical chambers above the water seal, and a mixture-exhaust pipe at the other end communicating with the discharge end of the helical chambers above the water seal, substantially as described.

7. In a machine of the class described, the combination of an exterior casing forming a gas and liquid-sealing chamber, a rotatable cylinder mounted therein provided with a plurality of helical air-supply and mixing chambers communicating with the gas-supply chamber of the exterior receptacle, an axial air-supply pipe in one end of the cylinder communicating therewith above the water seal, a mixture-exhaust pipe at the other end of the cylinder communicating therewith above the water seal, a drip-box arranged under each of the supply and exhaust pipes and communicating therewith, and siphon overflow-pipes arranged in such drip-boxes, substantially as described.

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