No. 618,002. Patented Jan. 17, 1899.

R. D. BRADLEY.

CARBURETER.

(Application filed Oct. 27, 1897.)

(No Model.) 6 Sheets—Sheet 1.

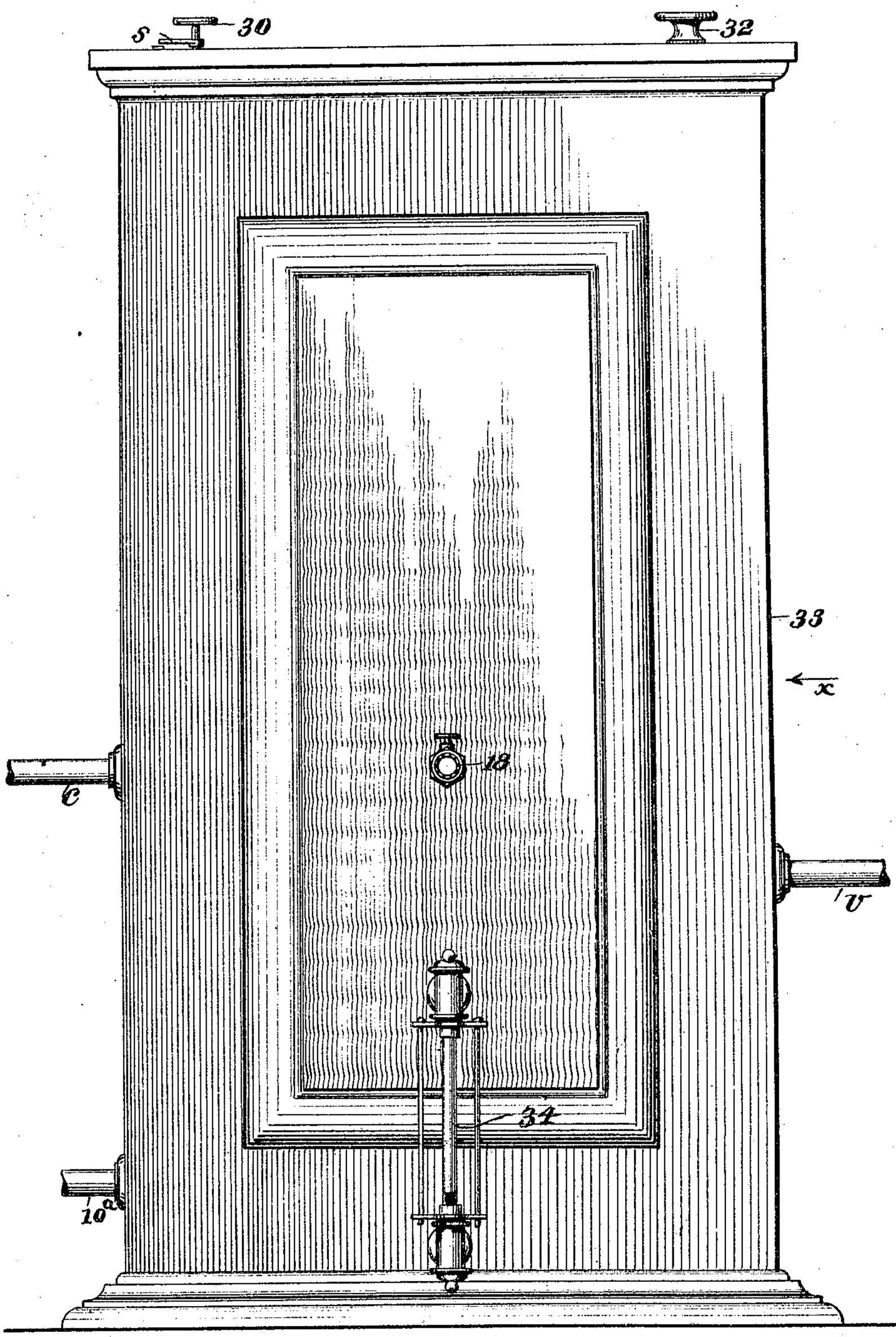

Fig. 1

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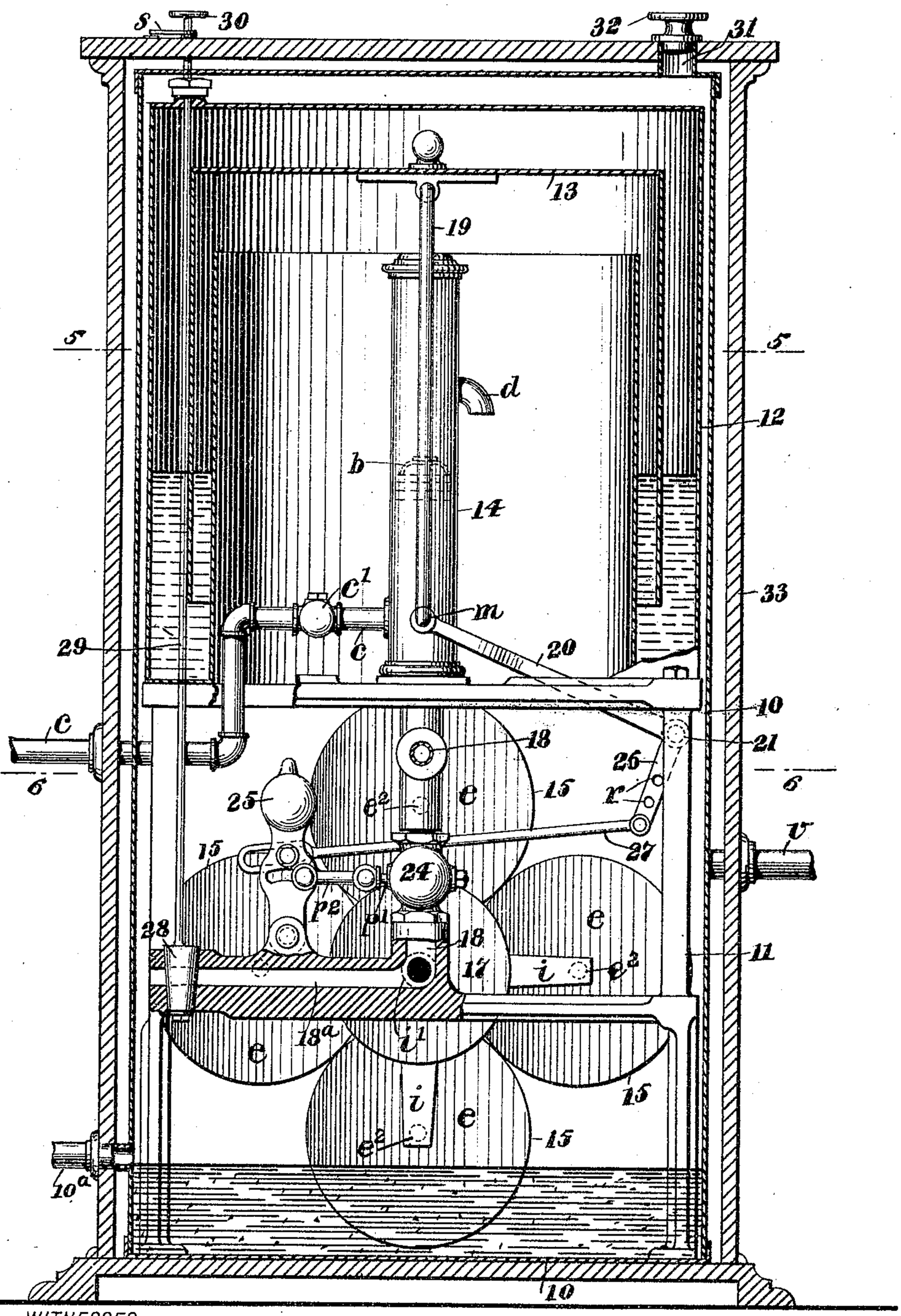

Fig. 2.

WITNESSES:

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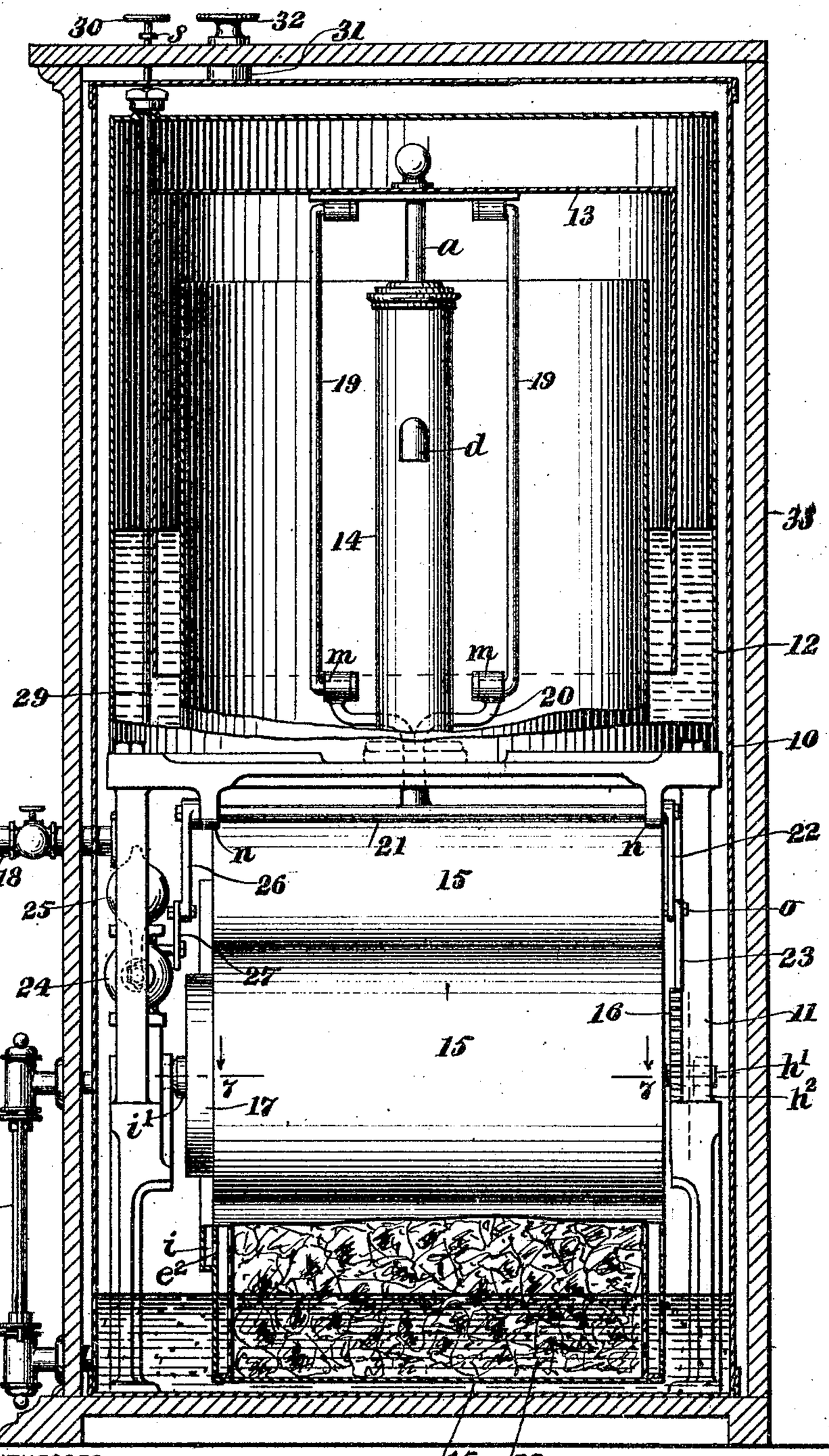

Fig. 3.

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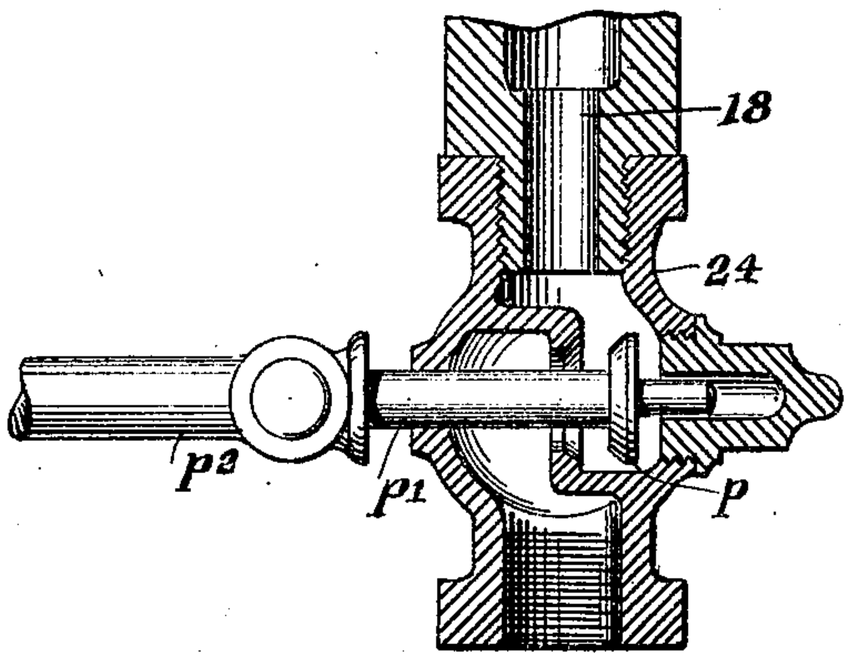
(No Model.) 6 Sheets—Sheet 4.

Fig. 3



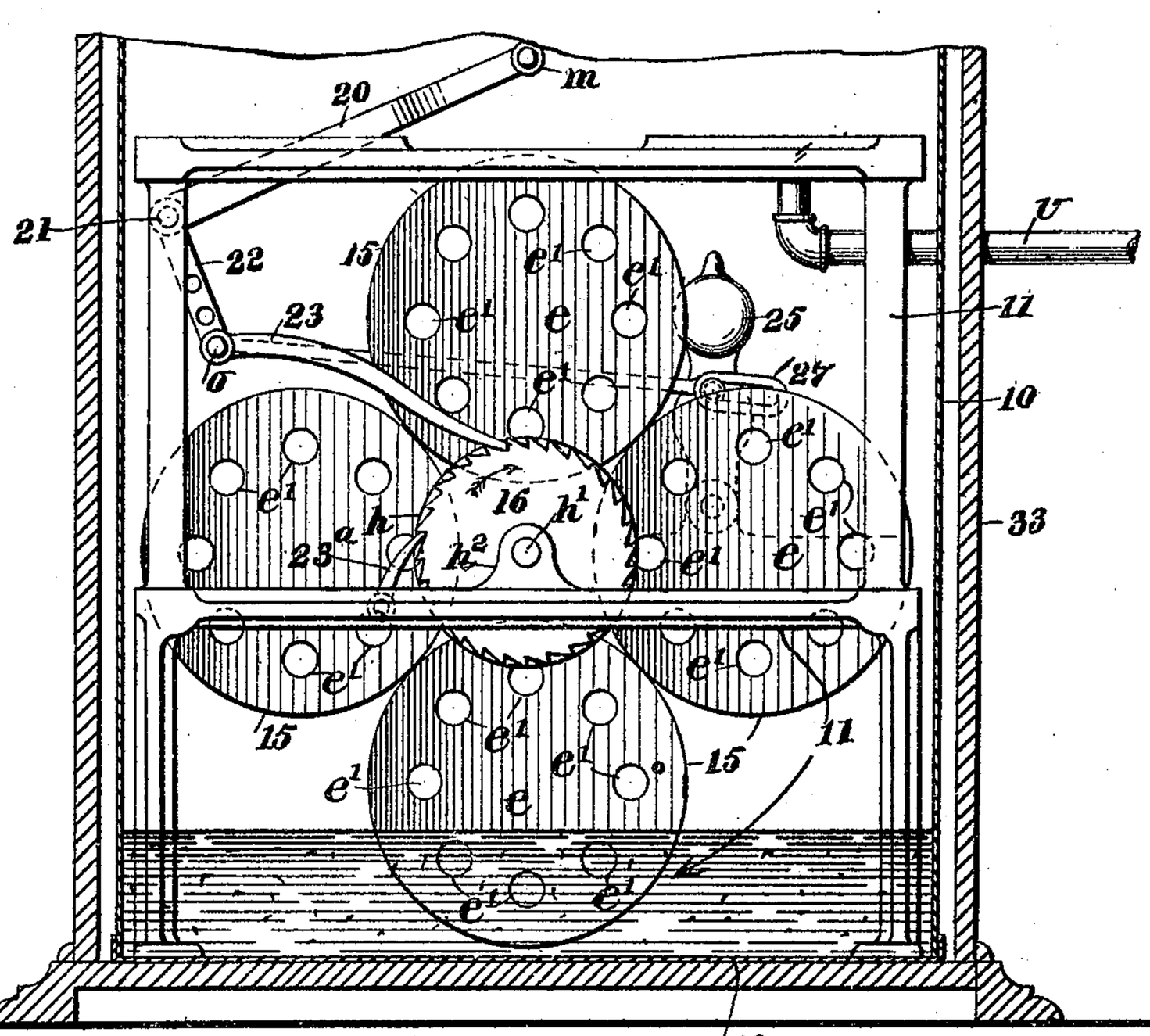


Fig. 4

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(Application filed Oct. 27, 1897.)

(No Model.) 6 Sheets—Sheet 5.

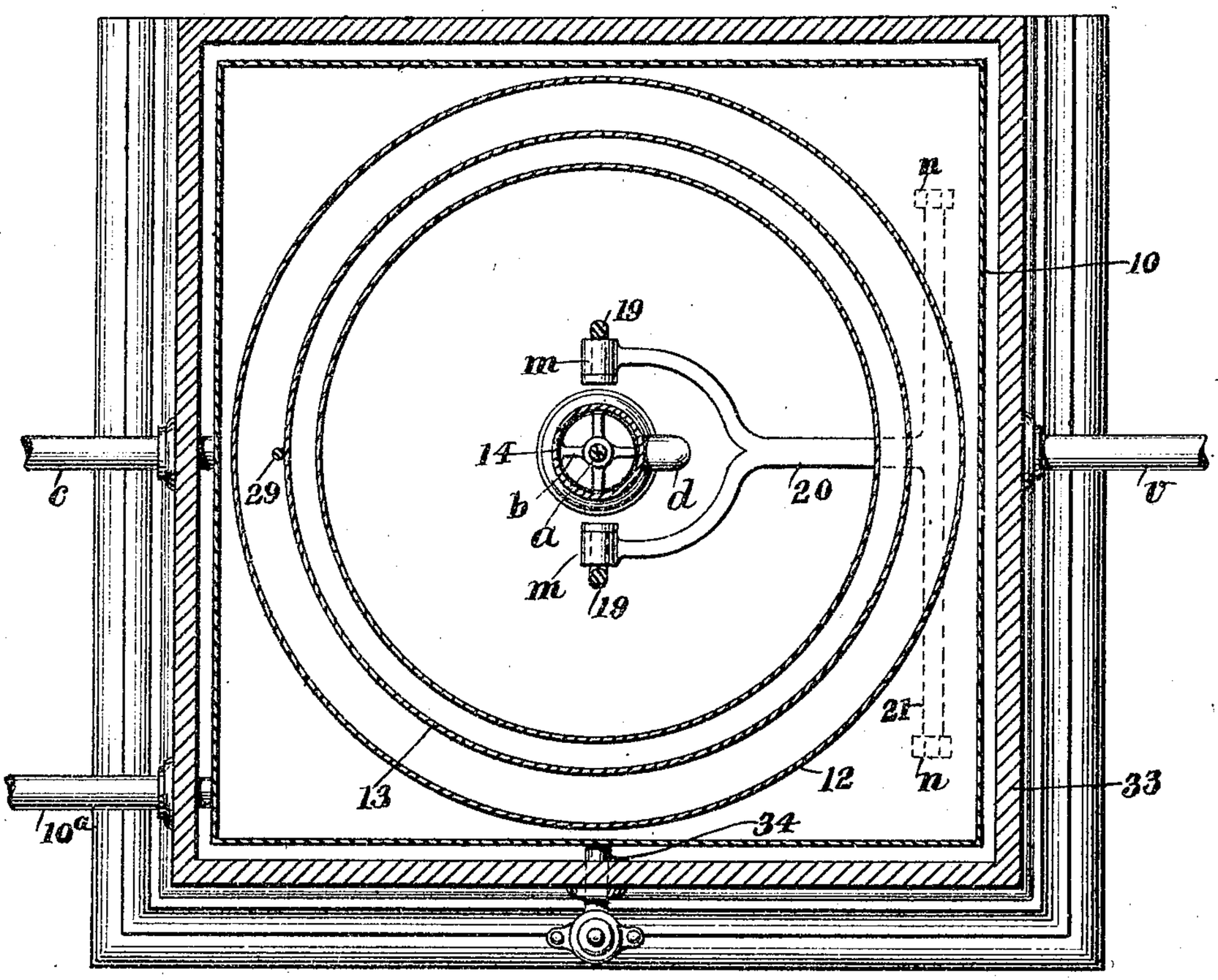

Fig. 5

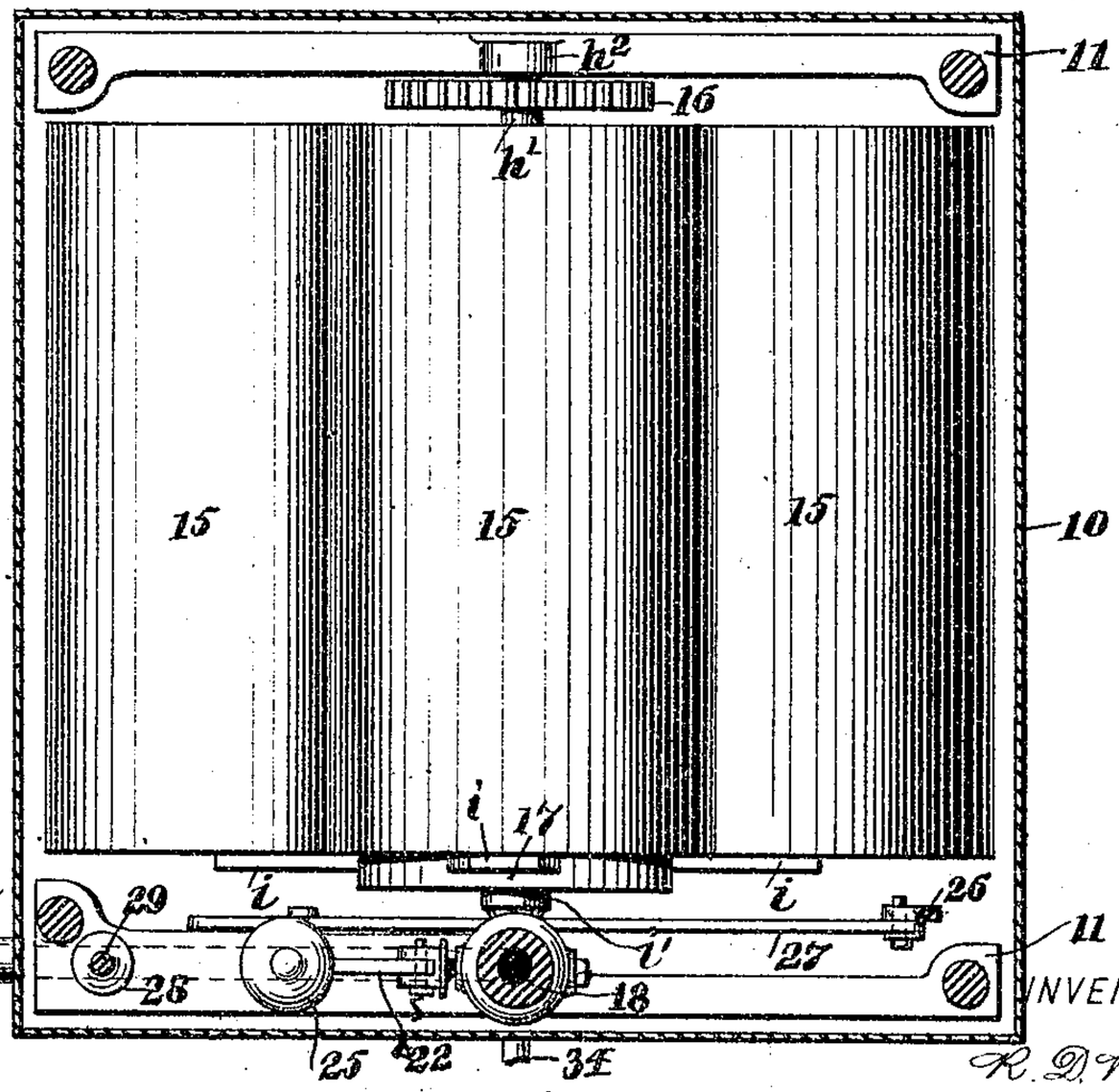

Fig. 6

WITNESSES,

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No. 618,002. Patented Jan. 17, 1899.

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(Application filed Oct. 27, 1897.)

(No Model.) 6 Sheets—Sheet 6.

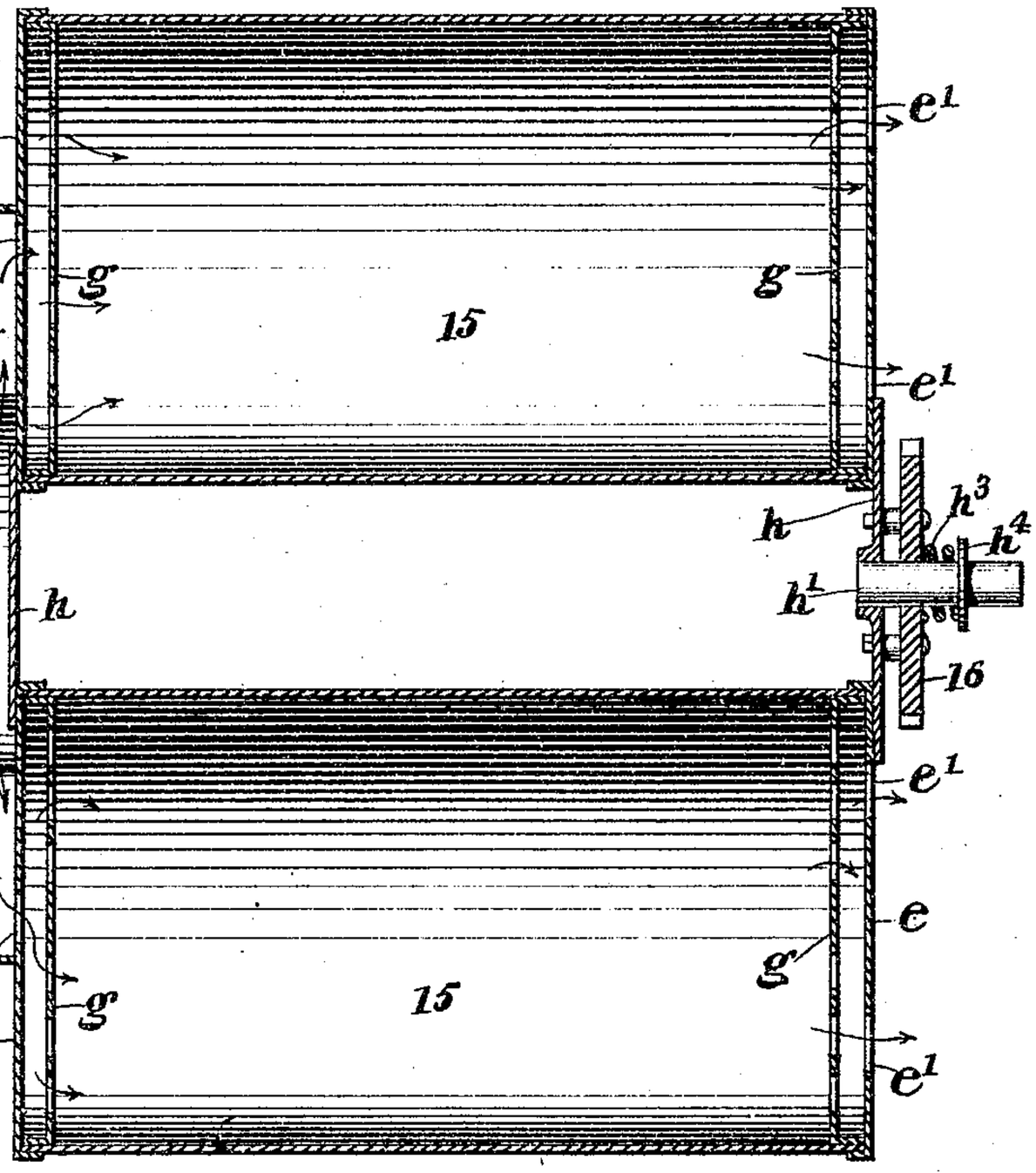

Fig. 7.

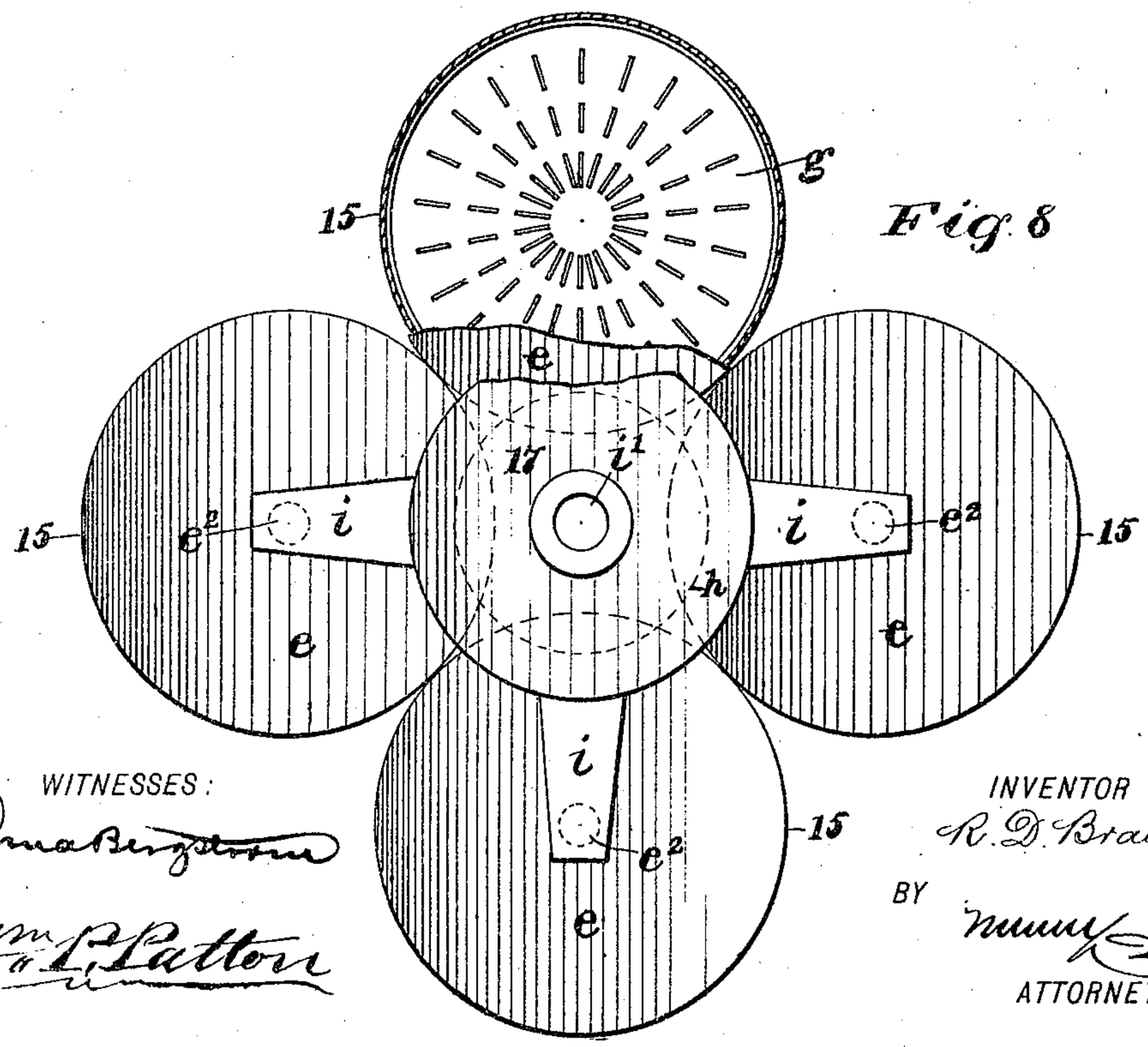

Fig. 8

UNITED STATES PATENT OFFICE.

ROBERT D. BRADLEY, OF LINCHESTER, MARYLAND.

CARBURETER.

SPECIFICATION forming part of Letters Patent No. 618,002, dated January 17, 1899.

Application filed October 27, 1897. Serial No. 656,540. (No model.)

To all whom it may concern:

Be it known that I, ROBERT D. BRADLEY, of Linchester, in the county of Caroline and State of Maryland, have invented a new and Improved Method of and Apparatus for Generating Illuminating and Heating Gas, of which the following is a full, clear, and exact description.

This invention relates to means employed for the production of aero-gaseous fluid used as a fuel or for illuminating purposes by the intimate admixture and incorporation of atmospheric air with vaporized hydrocarbon liquid.

The primary object of the invention is to provide a novel method and means whereby aero-carbon fluid of a stable nature may be rapidly and perfectly evolved for combustion as generated.

A further object is to provide a portable gas-producing apparatus adapted to freely generate a measurably-fixed aero-carbon gaseous fluid and which is of novel and simple construction, very efficient in operation, and that may be produced at a moderate cost.

The invention consists in the novel method of and apparatus for the production of gaseous fluid, as is hereinafter described, and defined in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a front view of the improved gas-producing device. Fig. 2 is a partly-sectional front elevation of the same. Fig. 3 is a partly-sectional side elevation of the apparatus seen in direction of the arrow *x* in Fig. 1. Fig. 4 is a rear elevation in part of working details of the apparatus exposed by the removal of a rear wall of the inclosing chamber therefor. Fig. 5 is a sectional plan view substantially on the line 5 5 in Fig. 2. Fig. 6 is a sectional plan view essentially on the line 6 6 in Fig. 2. Fig. 7 is a sectional plan view substantially on the line 7 7 in Fig. 3, showing the interior construction of two of the generating-chambers. Fig. 8 is a detached front end view of the gas-generating chambers, showing the front head wall of one chamber broken away to expose a reticulated partition therein; and Fig. 9 is an enlarged sectional side view of an air-induction valve, which is a detail of the apparatus.

A casing 10 in rectangular form and constructed of sheet metal, so as to be rendered gas and liquid tight, is provided of sufficient dimensions to receive and hold in operative positions the interior working parts of the apparatus. In the casing 10 a light metal frame 11 is positioned, consisting of a rectangular top portion, from the corners of which four legs depend. The height of the frame 11 is proportioned to permit the location of other details below the apertured top of the same, and upon said frame the double-walled tank 12 is seated.

The tank 12 is of sheet metal, and comprises two concentric cylindrical walls joined together at their lower edges, thus affording an annular chamber wherein any suitable liquid is to be held and in which the cylindric sheet-metal gas-receiver 13 is inverted and adapted to reciprocate when the device is in use.

Centrally within the tank-opening a pump-barrel 14 is erected upon a cross-piece forming a portion of the frame 11, and in said barrel a plunger-rod *a* is held to slide, the upper extremity of said rod being secured in or upon the top wall of the cylindric gas-receiver 13. A suitable packing-joint is provided between the rod *a* and the upper end of the pump-barrel 14, and at the lower end of the plunger-rod, a valve-cage and valve *b* of any approved construction is secured, which attachment is fitted, as usual, to slide liquid-tight in the pump-barrel, and it will be apparent that the slidable connection of parts that have been described will serve to steady and guide the reciprocatory movement of the chamber 13 in the tank 12.

From the pump-barrel 14, at one side and near the lower end, an oil-supply pipe *c* is extended laterally and is so bent as to permit said pipe to pass outward through a perforation in the casing 10, as best shown in Fig. 2. In the oil-supply pipe *c* a check-valve *c'* of ordinary form is located and constitutes the foot-valve of the pump, and when the apparatus is arranged for service this pipe is to be extended to a source of oil-supply, which the pump will draw and discharge from the spout

d at the side of the pump-barrel when the plunger-rod *a* is reciprocated by means hereinafter more fully described.

Below the rectangular top of the frame 11 four similar cylindrical chambers 15 are supported to rotate on a common center, as will presently be explained. The chambers 15, which in number may be changed, are provided for the generation of gaseous fluid in such quantity as the needs of the consumer require, and each chamber or receptacle consists of a cylindrical sheet-metal shell having outer heads or end walls *e*, which each have at one end a series of apertures *e'*, concentric with the periphery of the head and spaced apart a proper distance for effective service of the generator. The circularly-arranged apertures *e'* in one head *e* of each of the four chambers 15 have a suitable distance of separation from the circumferential edge of the head in which they are formed, for a purpose which will hereinafter appear.

Within each of the chambers 15 a finely-slitted or otherwise minutely-foraminated partition-wall *g* is loosely secured near each head wall *e*, a sufficient space being afforded between each partition and the head adjacent thereto for the free introduction of liquid between said parallel walls. The chambers 15 are disposed with regard to each other so that contiguous sides of the same will have contact, and they are firmly secured together when so arranged, which will cause their axes to be equally distant from a common center, as indicated in Figs. 2 and 4.

A preferred means for holding the cylindric chambers 15 so that they will be oppositely arranged in pairs consists in securing a keeper-plate *h* upon the heads *e* of the chambers at each end of the same when in assembled condition, these keeper-plates having sufficient area to allow them to contact with a segment of each head *e*, the junction of said plates with two chambers 15 being shown in Fig. 7. In one keeper-plate *h*, at the common center for the four chambers 15, a transverse shaft *h'* is secured by one end, and upon the body of said shaft, exterior of the keeper-plate, a ratchet-wheel 16 is affixed. A journal or trunnion end of the shaft *h'* projects beyond the wheel 16 for engagement with a box-bearing h^2 on a cross-bar of the frame 11 at the rear of the device. A spring h^3 and washer h^4, loose on the shaft *h'*, may be introduced between the wheel 16 and the box-bearing h^2.

On the keeper-plate *h* and the heads *e* at the opposite end of the chambers 15 a four-way branch piece 17 is secured, this piece being preferably cut and pressed into form from sheet metal, so as to produce four radial passages *i*, which at their inner ends intersect a shallow circular-walled compartment apertured at its center and provided with a hollow journal *i'*. The journal *i'* has a rotatable engagement with a box-bearing similar to the bearing h^2 and formed on a cross-bar of the frame 11 opposite the one on which the bearing h^2 is formed. The opposite supports for the united chambers 15 being axially coincident, it will be obvious that said chambers will be adapted for free rotation, it being only necessary that said journal-supports shall be such a distance from the bottom wall of the casing 10 as will insure clearance for the chambers therefrom. The heads *e* of the chambers 15, which are engaged by the four-way branch piece 17, have each a central orifice e^2 formed therein, and the four radial passages in the branch piece, respectively, have free communication near their outer ends with these orifices.

An air-supply pipe 18, which leads air from an air-pump (not shown) or other supply for air under pressure, which passes through a valve hereinafter described, has one end connected with the hollow journal *i'*, so as to introduce air in proper volume through the four-way 17 into each chamber 15 at one end. It will be seen that owing to the graduated restriction to a free passage of inducted air presented by the finely-perforated partition *g* in each chamber 15 an even diffusion of the entering air will be effected therein.

A yoke 19, comprising parallel arms pivoted at their upper ends upon the lower side of the top wall of the gas-receiver 13, has the lower portions of said arms loosely coupled, as at *m*, to the ends of spaced limbs on a furcated lever 20. The lever 20 projects diagonally down and away from the pump-barrel 14, and at its lower outer end is firmly secured to the body of the rock-shaft 21 near the longitudinal center of the latter. The rock-shaft 21 is journaled near its ends in depending ears *n*, that are formed or secured on the frame 11 along one side thereof. At the rear end of the shaft 21 a rock-arm 22 is secured to hang downwardly, and the body of said rock-arm has spaced perforations therein.

A pawl 23 is pivoted by one end upon the body of the rock-arm 22, the pivot-bolt *o* therefor being adapted to engage any one of the perforations in said arm, and thus alter the throw of the pawl as occasion may require. The lower end of the pawl 23 is meshed with the toothed periphery of the ratchet-wheel 16 for its rotatable movement in direction of the curved arrow in Fig. 4, and to prevent a retrograde movement of the plurality of chambers 15 on their common axes a detent-pawl 23^a is provided. This pawl, that is pivoted on the frame 11, has its toe meshed between teeth of the ratchet-wheel 16 directly below the pawl 23.

It is essential to provide means for arresting the introduction of air from an outside source into the chamber 15, and thereby limit the evolution of gas to the consumption, as there is not room in the apparatus for the storage of any considerable volume of the manufactured gas. To this end an automatically-operated air-controlling valve 24 is

employed, which valve seats upon the lower front cross-bar of the frame 11 and is located in the air-supply conduit 18, as shown in Fig. 9. Said valve is of the puppet class, having its closing-disk p secured upon the inner end of the horizontal stem p', that extends out through the valve-case, and at the outer end is jointed upon one end of the link p^2, that at its opposite end is pivoted upon the weighty tumbling-block 25. The tumbling-block 25 is pivoted at its lower end upon the frame 11, as shown in Fig. 2, so as to be adapted for rocking adjustment toward or from the valve 24.

On the forward end of the rock-shaft 21 a rock-arm 26 is secured, which arm has spaced perforations r in its body for the changeable pivotal connection of said arm with one end of the pitman 27, that is longitudinally slotted near its other end. The slotted end of the pitman 27 is pivoted upon the tumbling-block 25 above the pivoted end of the link p^2, whereby a reciprocatory movement of the gas-receiver 13 will, through the described intermediate connecting parts, periodically tilt the block 25 and open and close the valve 24.

A valve 28, from which upwardly projects the valve-rod 29, having a hand-wheel 30 on its upper end, is located in an air-conduit 18^a, which receives air from the supply-pipe 18, and there may be an index-hand s at the upper end of the valve-rod to indicate when the valve is open or closed, and also any degree of open adjustment given to said valve.

There is an oil-inlet 31 on the top of the casing 10, sealed by a removable cap 32, said inlet being provided to allow the introduction of oil when the apparatus is to be started or at any other time it may be found necessary, and if by accident a surplus of oil is introduced it will pass out through an overflow-pipe 10^a, that leads to the oil-supply holder.

The casing 10 is neatly inclosed by a cabinet 33, preferably of wood, and finished in any preferred style on the exterior, and the cabinet affords protection to the apparatus from extremes of heat and cold. Apertures are formed in the walls of the cabinet for the introduction of the oil and air supply pipes and on top to allow the valve-rod 29 to project therethrough, the hand-wheel 30 and index-hand s being upon the outer portion of the valve-rod to permit manual adjustment of the valve 28.

On the cabinet or wooden jacket 33 an oil-indicating gage 34 is located, as shown in Fig. 1. The indicating-gage is of a type having a glass tube, wherein the oil in the chamber 10 seeks its level by gravity, and to this end the upper and lower ends of the upright glass tube are held by suitable fixtures of usual construction in position at the front wall of the cabinet, said fixtures tapping the casing or oil-chamber 10, so as to conduct oil therefrom into the tube.

Each of the chambers 15 has a filling of very porous material u introduced therein between the partitions g, and such material should be slightly packed, so as to perfectly fill the space it occupies. While different substances may with measurably good results be utilized as a filling for the chambers 15, continued use has indicated that a most superior composition of matter for the indicated purpose consists of the infusoria or animalcula pervading infusions of decaying substances, correctly termed "protozoans," but commonly known as "infusorial earth," and this earth in suitable proportions is mixed with mineral wool. The two materials specified are thoroughly intermingled, so that the infusorial earth is evenly distributed throughout the area of each chamber 15. A gas-conduit or off-take pipe v projects from the casing 10 below the tank 12 to be extended to any point for supplying gas.

Assuming that a quantity of hydrocarbon liquid has been introduced within the casing 10 and accumulated to such a depth in the bottom of this casing or vessel that the lower portion of the lowermost chamber 15 is immersed therein so as to cover one or more of the perforations e' in the head e of said chamber, the liquid, which is preferably a distillate of petroleum having a specific gravity of about seventy-two degrees hydrometer gage, will be instantly absorbed by the filling in the chamber 15 and permeate throughout said filling. Air should now be introduced under pressure through the valve 24 and four-way 17 into the ends of the chambers 15 opposite the point where the hydrocarbon liquid enters the chambers.

The infusorial earth which has been saturated with the oil is a very active agent for the dissociation of the atoms of the liquid, so that the molecules of the oil become chemically separated. The mineral wool coacts with the protozoans by its mechanical action on the inducted air, which is caused by said wool to become infinitely subdivided as it filters through the mass. The atoms of air are by the described means brought separately into blending contact with the separated molecules of the hydrocarbon liquid, and thus by the natural affinity of the carbon for the oxygen in the air aero-carbon gas is generated.

On commencement of gas generation, as explained, the volume generated will quickly pass out of the chambers 15 through the orifices e' and rise into the receiver 13, which will soon move upwardly in the tank 12 under pressure of the gas. When the maximum elevation of the chamber 13 is reached, the rock-shaft 21 will have been rocked so that the rock-arm 26 will push upon the pitman 27, and this will rock the tumbling-block 25 away from the valve 24, drawing upon the valve-stem p' and disk p, so as to close the latter upon its seat in the valve-body.

The arrest of air-flow through the chambers 15 of course stops the generation of gas, and as consumption of the latter removes the volume of gas from below the receiver 13 the latter begins to fall by its gravity. As the

receiver 13 descends the yoke 19 pulls upon the forked lever 20, which so rocks the shaft 21 that the arm 26 will pull upon the pitman 27, and this in turn will tilt the block 25 so as to open the valve 24.

While the receiver 13 has been rising, the rock-arm 22, being actuated to rock away from the ratchet-wheel 16, draws upon the pawl 23, so that said pawl moves into a new position on the toothed face of said wheel. On the descent of the receiver 13, as has been explained, the pawl 23 is pushed upon, and this turns the ratchet-wheel 16, so as to partly rotate the joined chambers 15 in direction of the curved arrow in Fig. 4.

The rotatable movement of the chambers 15 will be controlled in degree by the pivotal adjustment of the pawl 23 upon the rock-arm 22, it being evident that the nearer the free end of the rock-arm the pawl is pivoted the greater will be the longitudinal movement of said pawl and consequent actuation of the chambers to give them a partial rotation. The change of position that is communicated to the chambers 15 and which has been described causes the gradual successive immersion of the major portion of the periphery of each chamber, and it will be obvious that this will conduce to a thorough introduction of hydrocarbon liquid into and through all the chambers as the generation of gas continues. The valve 28, which controls the influx of air into the conduit 18^a, that may be a hollow portion of a cross-bar of the frame 11, is ordinarily kept closed and air is furnished through the valve 24 to the generator-chamber 15.

It will be seen that a supply of air may be furnished in graduated quantity through the valve in the pipe 18, which will enable the proportion of oxygen to carbon in the gas to be varied, and that at any time the gas is too rich in carbon the valve 28 can be more or less opened to introduce more air, that enters through valve 24 directly into the gas-space in the casing 12. This provision is very essential, as the liquid may in some cases be of somewhat greater specific gravity than seventy-two degrees or said hydrocarbon liquid may be of higher specific gravity and less richness in carbon. In the latter case the valve 28 is closed and the valve in pipe 18 partially closed to admit a less volume of air. In operation each complete upward movement of the gas-receiver 13 and of the pump-rod *a* will close the valve *b*—that is, upon the lower end of said rod—and lift the oil that is above this valve for discharge from the spout *d*, from which it falls to the bottom of the chamber 10 to keep up a regular supply for the generators 15.

The operation of the apparatus is automatic after the working parts are properly adjusted, and as long as gas is burned an adequate supply under pressure will be provided, which will be regulated to suit the degree of consumption; but when the use of the illuminant is entirely discontinued it will be apparent that there can be no reciprocation of the gas-receiver 13 or movement of the working parts, so that the generation of gas ceases soon after the use of it is suspended.

The preferred use for the gas apparatus is to provide an illuminant which is brilliant, steady in burning, and of a uniform candle-power; but it is also well adapted for the generation of heating-gas, which should be of a less candle-power than that provided for illumination. A feature of advantage is that the entire apparatus for a plant of, say, twenty-five lights is so compact that it does not take up more room than a ten-light gas-meter of the usual form and may safely be placed in a living-room of a house, if desired.

The measurable fixity of the gas by cold process, which enables the use of the illuminant in a house that is warm enough to live in either in winter or in summer, is another important advantage pertaining to the improved apparatus and use of the unique composition of matter therein.

As already stated, the employment of mixed infusorial earth and mineral wool as a filling for the generator-chambers 15 produces chemical as well as mechanical action upon the carbonaceous material and air introduced, respectively, at opposite ends of said chambers, so that the hydrocarbon liquid preferably used in the manufacture of illuminating-gas by this improved process and novel apparatus may be a light-bodied coal-oil, which essentially differs from gasolene of from 80° to 86° specific gravity, that will vaporize readily in the air at a temperature of 70° Fahrenheit, if exposed thereto, and that is ordinarily used to produce carbureted air for illuminating purposes.

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

1. In a gas apparatus, of the character described, the air-induction controller, comprising the parallel-limbed yoke-piece vertically reciprocable and laterally rockable on the upper end of a reciprocating gas-receiver, a supported rockable shaft having a serially-perforated arm, a forked lever loosely connecting the yoke-piece and rock-shaft, a tumbling-block supported to rock, a pitman loosely connecting the rock-arm and tumbling-block, and a valve in the air-induction passage, having its stem pivoted upon the tumbling-block, whereby the automatic reciprocation of the gas-receiver is adapted to periodically open and close the valve, as specified.

2. In a gas apparatus of the character described, the rotatable gas-generator device comprising a plurality of cylindrical chambers, each having two perforated heads, and two partitions inside and near each head, a four-way conduit for air at one end of the generator, and adapted to communicate with an orifice in each chamber, and a valve controlling the air-passage leading from the e

terior of the apparatus to the four-way conduit, as specified.

3. In a gas-generator for an aero-hydrocarbon-gas apparatus, the four cylindrical chambers laterally connected at the ends by disks and pivoted at their centers, each chamber having a head at one end that is serially perforated near the periphery thereof for induction of oil, and at the opposite end has an orifice for introduction of atmospheric air, and the device for periodically giving a rotative impulse to the combined cylindric chambers, comprising a ratchet-wheel on a trunnion at one end of the joined chambers, a pawl engaging the ratchet-wheel, a push-pawl also meshing with said wheel, and means to periodically reciprocate the pawl and thereby rotate the generator by pressure of gas as it is generated, as specified.

4. In a gas apparatus of the character described, the gas-generator comprising four cylindrical chambers, which are laterally joined and supported to rotate at each end on a common center, a head at one end of each chamber having a series of spaced perforations therein near the periphery, a head at the opposite end of each chamber having a single aperture, said apertures being for introduction of air, two perforated partitions in each chamber near the heads thereof, a suitable porous filling in each generator-chamber, means to supply hydrocarbon liquid to the generator-chambers at one end, a device for rotation of the generators when gas is being generated, means to introduce air at the opposite end of the generator-chambers, all the aforesaid parts being inclosed within a vertical casing, as specified.

5. The combination of a gas-receiver movable by the volume of gas, a carbureter comprising a cylindrical chamber mounted to turn, a ratchet-wheel in connection with said chamber, a push-pawl coacting with the ratchet-wheel, and a connection between the gas-receiver and the pawl which reciprocates the latter, substantially as shown and described.

6. In a gas apparatus, the combination of a gas-receiver movable by the volume of gas, a carbureter, a ratchet-wheel in connection with the carbureter for turning the same, a pawl engaging the ratchet-wheel, a rock-shaft having connection with the pawl to operate the same, an arm fixed to the rock-shaft, and a link attached to the arm and to the receiver to operate the rock-shaft upon the movement of the receiver.

7. In a carbureter, the combination of a series of cylindrical chambers lying parallel with each other, each chamber having a foraminated wall located adjacent to each end thereof and the walls being within the chambers, and a branch piece having passages leading to the respective chambers and being in communication therewith, the branch piece serving as an air-inlet.

8. In a gas apparatus, the combination, with the casing, adapted to contain oil, and the gas-receiver, adapted for vertical movement as specified, and the carbureter adapted to rotate in the body of oil, of the yoke pivoted to said receiver and adapted to swing, the rock-shaft, arranged horizontally, an arm connecting it with said yoke, the air-inlet, a valve located in the latter, a pitman and link connecting said rock-shaft and valve, and a pawl and ratchet for rotating the carbureter, as specified.

9. In a gas apparatus, the combination, with the casing adapted to contain oil and the gas-receiver, adapted for vertical movement as specified, and the carbureter adapted to rotate in the body of oil, of the yoke pivoted to said receiver, and adapted to swing, the rock-shaft arranged horizontally, an arm connecting it with said yoke, the air-inlet, a valve located in the latter, a pitman and link connecting said rock-shaft and valve, the pivoted tumbling-block having a slot connection with said pitman and link, and a ratchet and pawl for rotating the carbureter, as shown and described.

10. The improved gas apparatus, comprising a vertical casing, a frame arranged therein, an oil-pump and vertically-movable gas-receiver, both supported on said frame within the casing, a rotatable air-carbureting apparatus mounted in the frame, and mechanism connecting the same with the gas-receiver proper, for automatically and intermittently rotating the carbureter, substantially as shown and described.

ROBERT D. BRADLEY.

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