No. 859,807. PATENTED JULY 9, 1907.

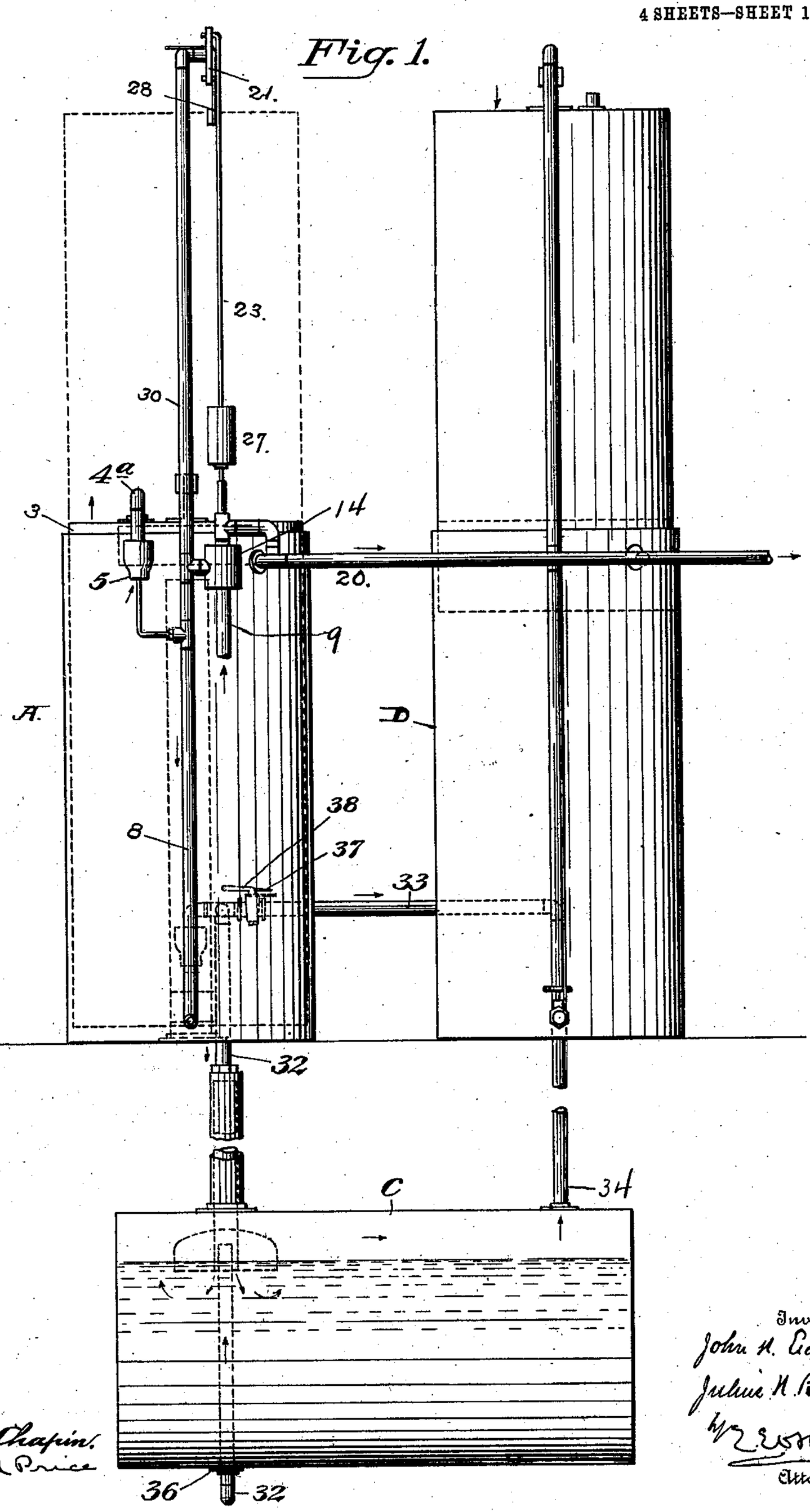
J. H. EICHLER & J. H. BECKER.

GAS MACHINE.

APPLICATION FILED AUG. 10, 1905.

4 SHEETS—SHEET 1.

Fig. 1.



Witness
Chas. E. Chapin.
Howard Price

Inventors:
John H. Eichler;
Julius H. Becker
by Osborn
Attorneys

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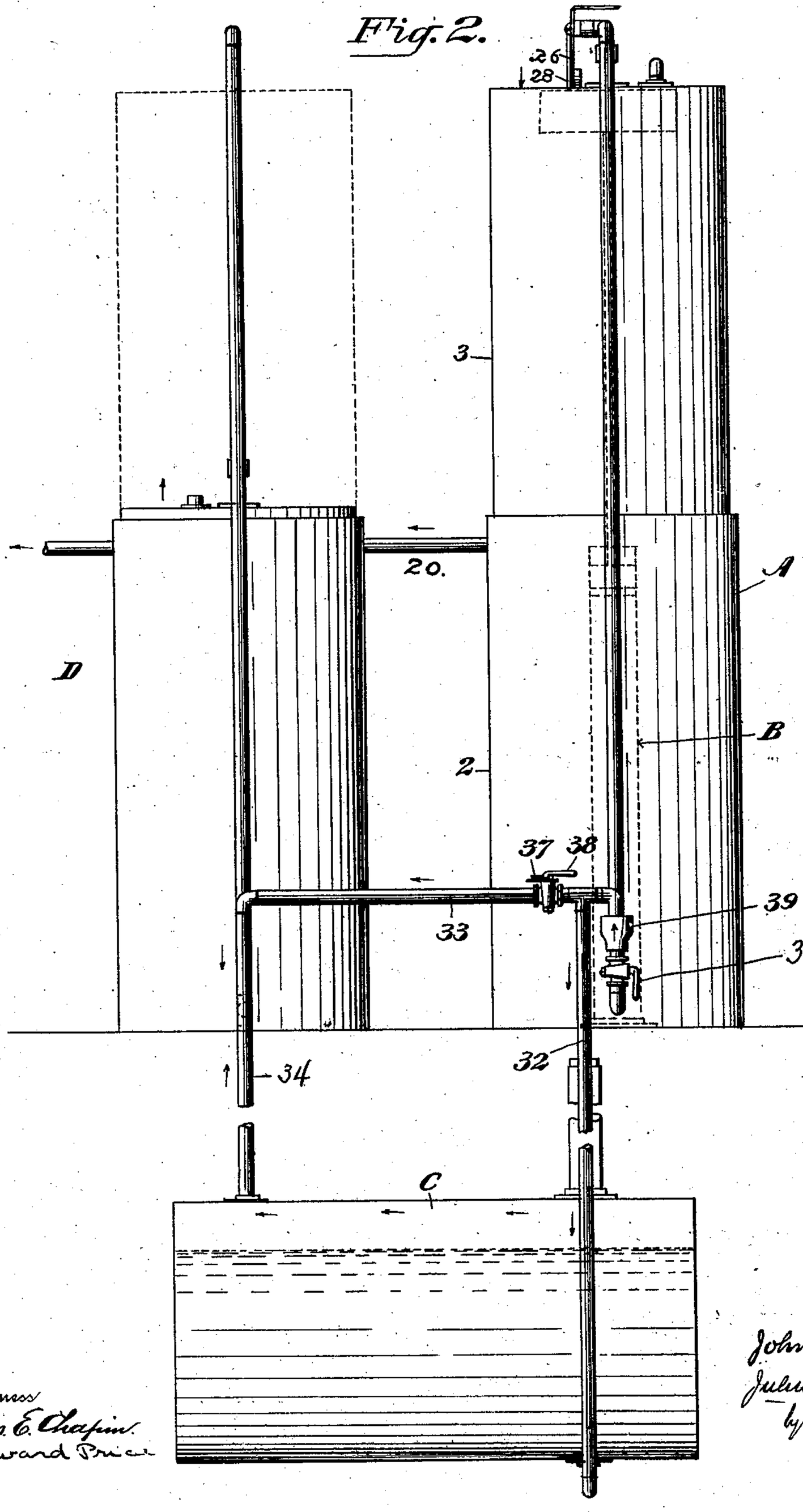
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

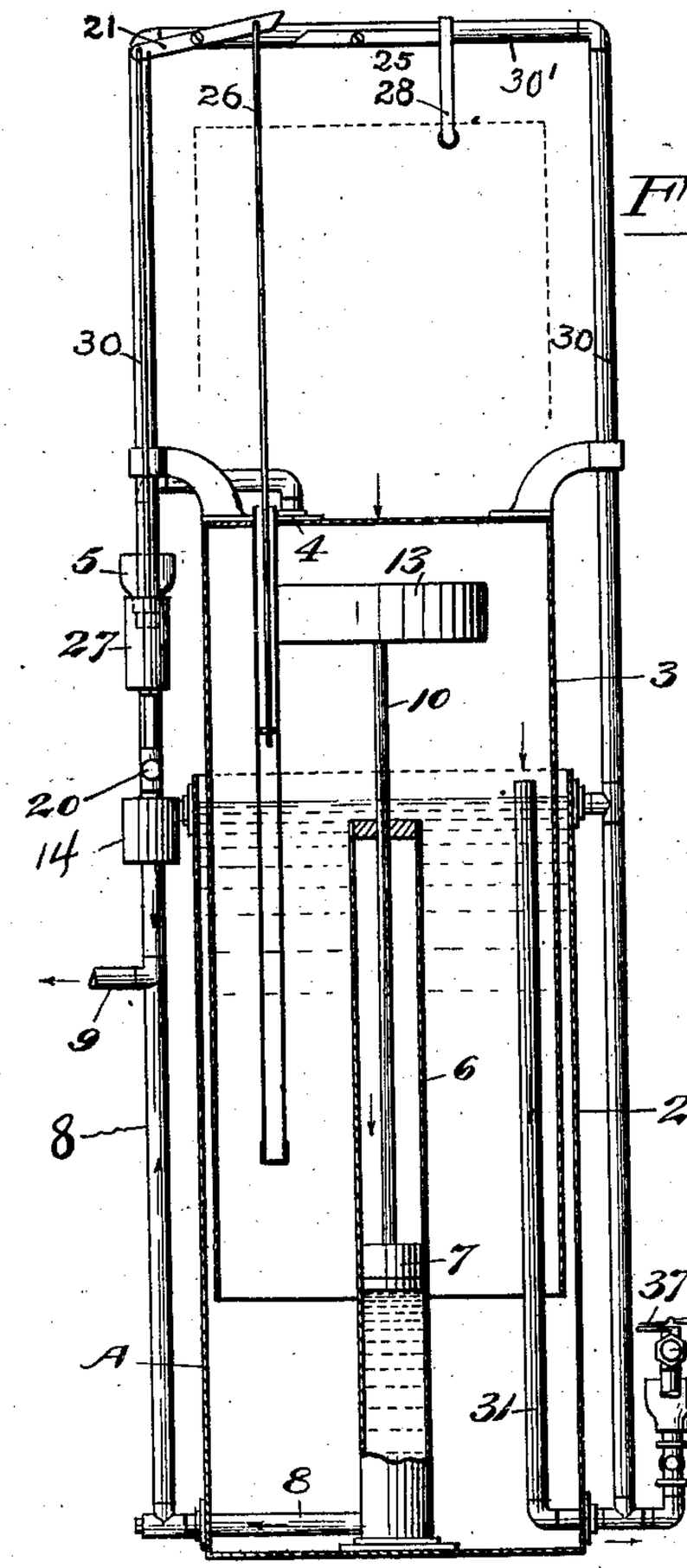


Fig. 4.

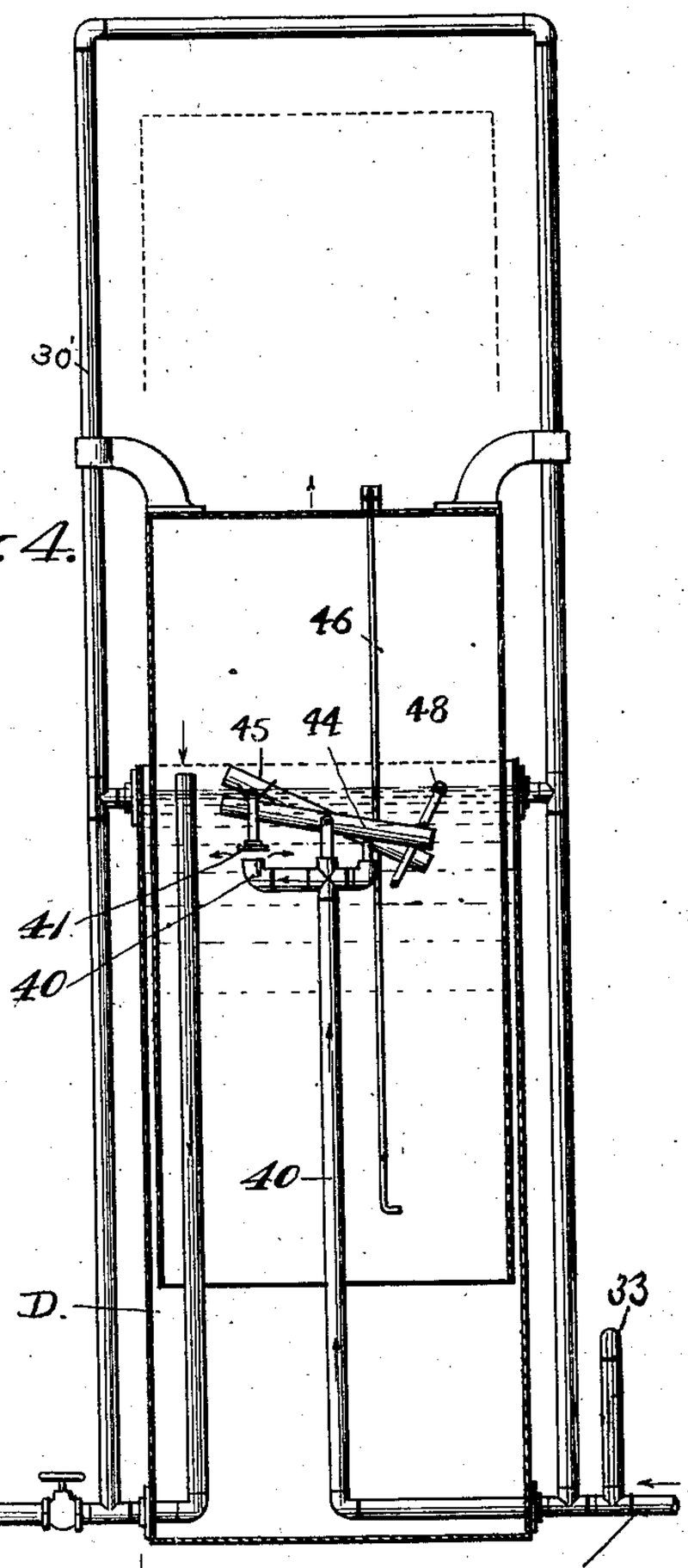
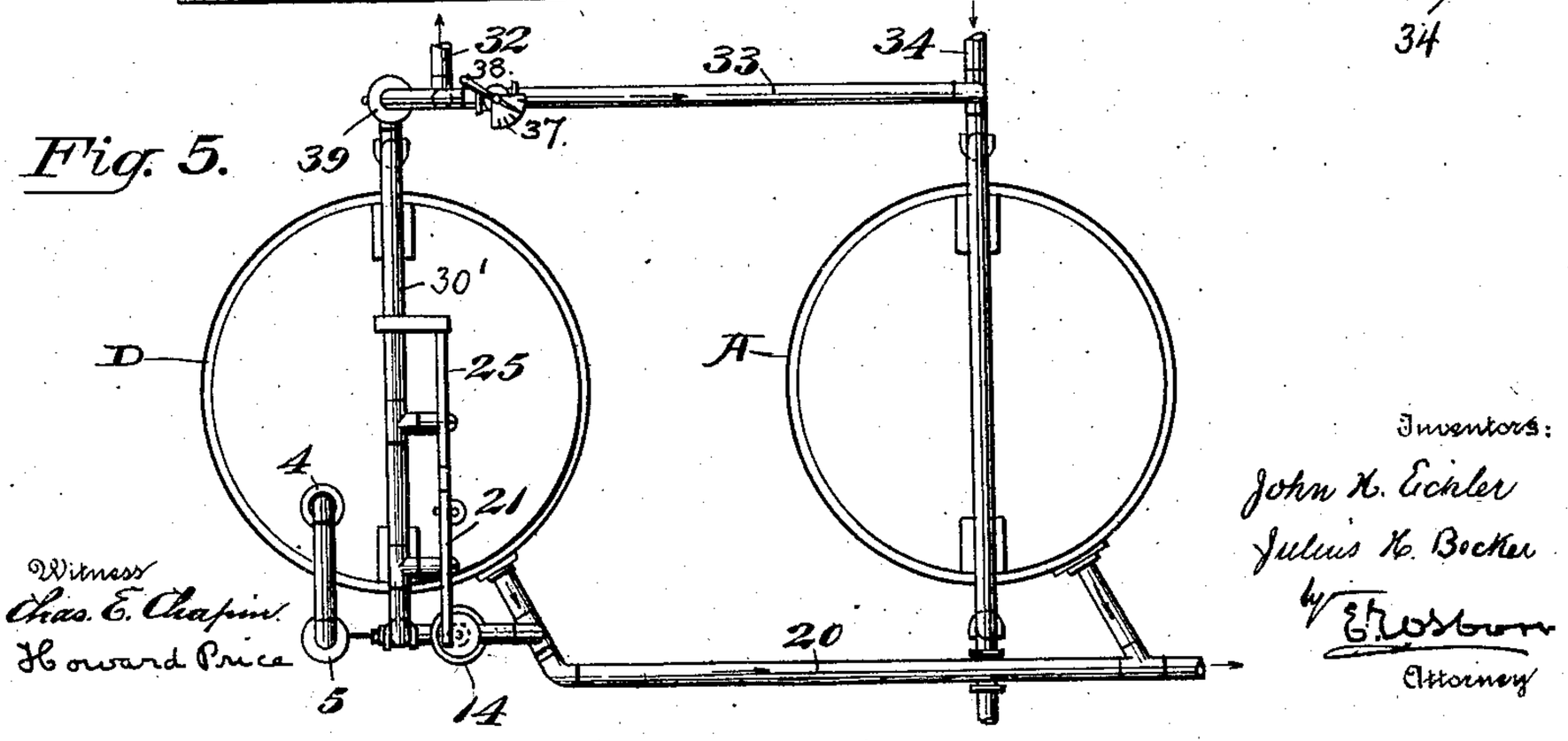


Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6.

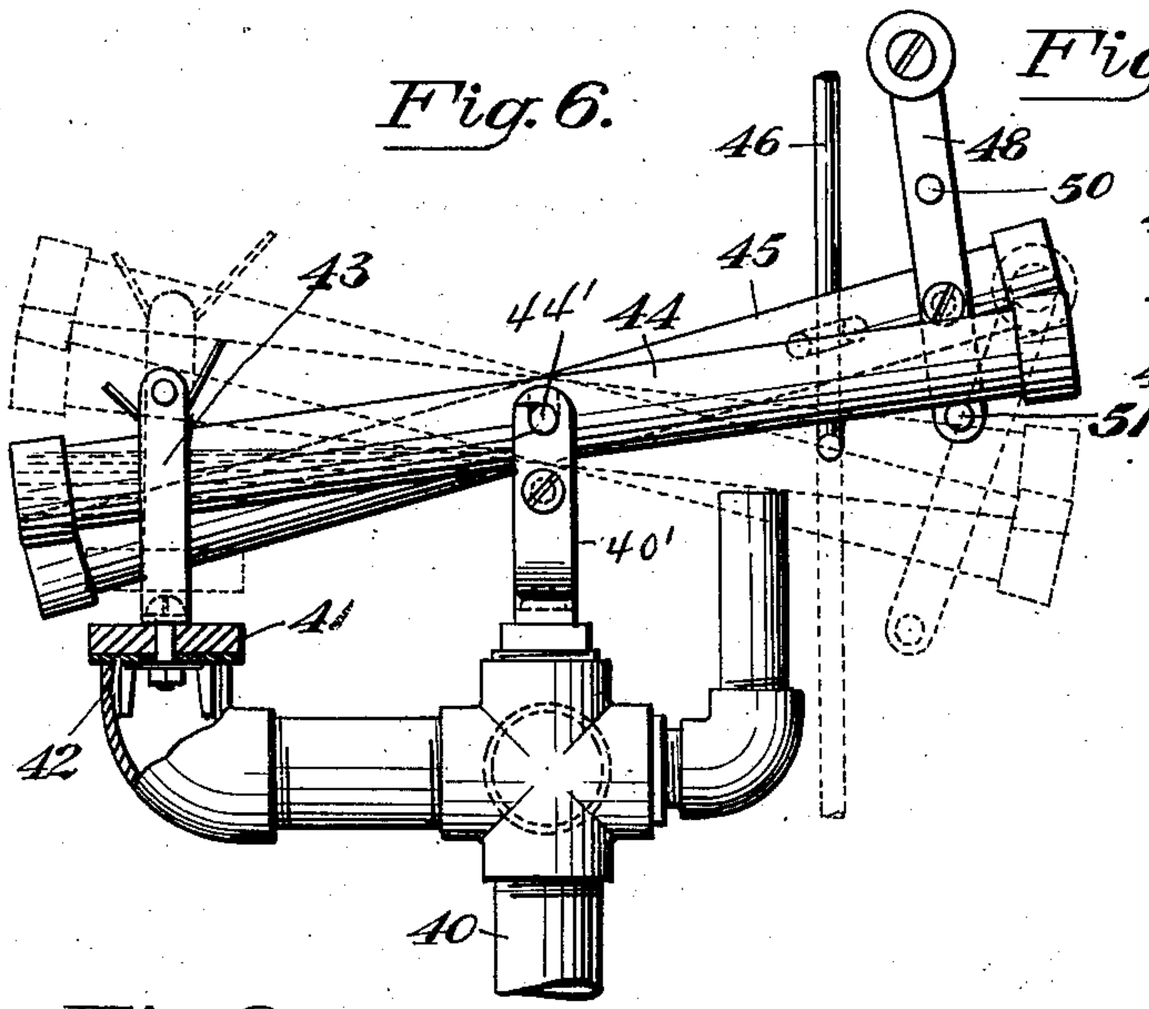


Fig. 7.

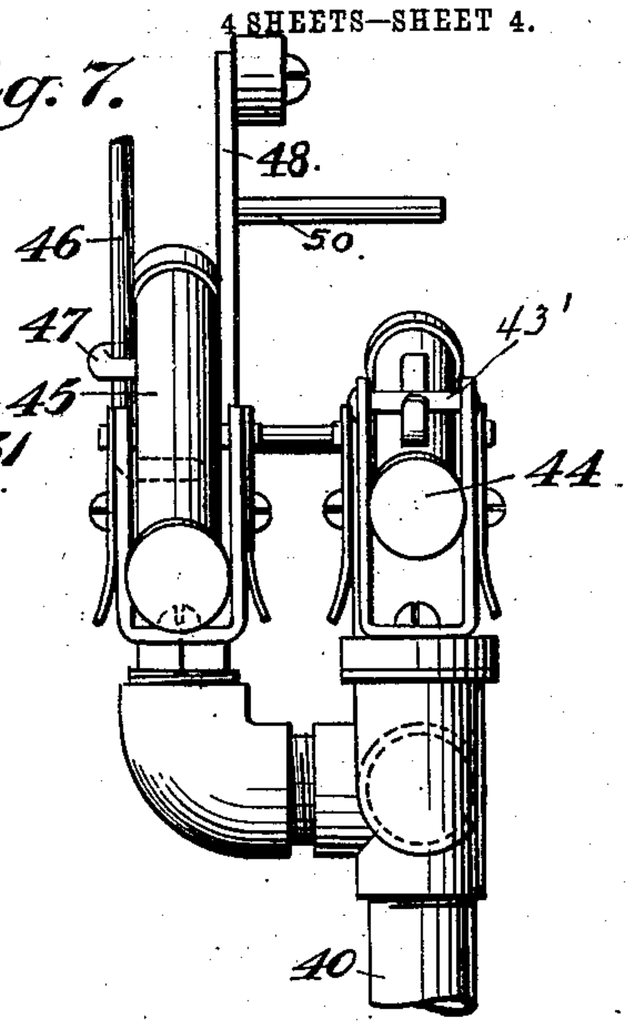


Fig. 8.

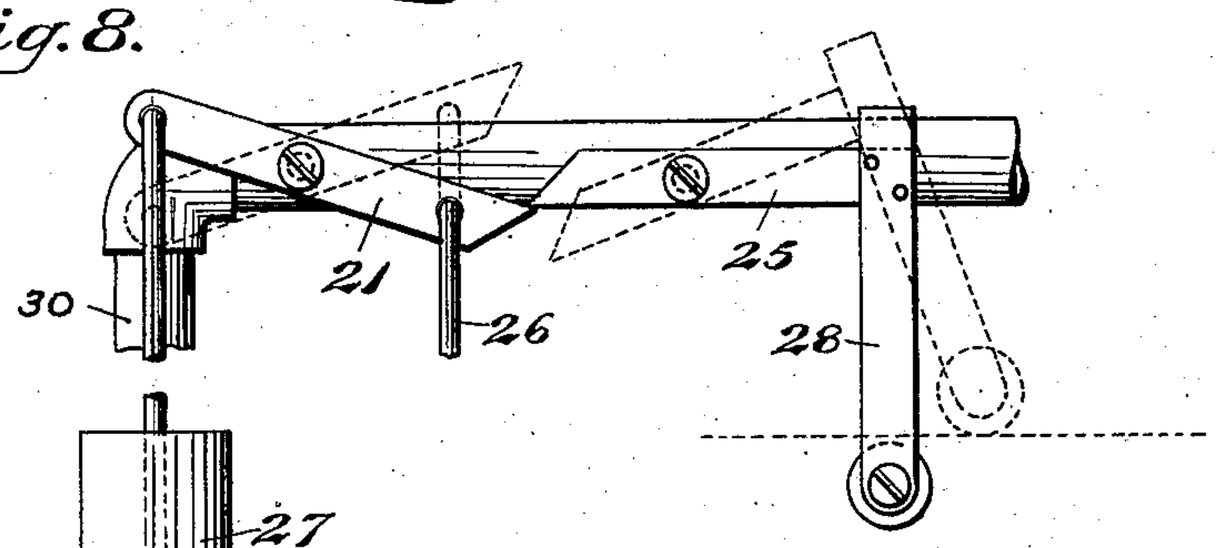


Fig. 9.

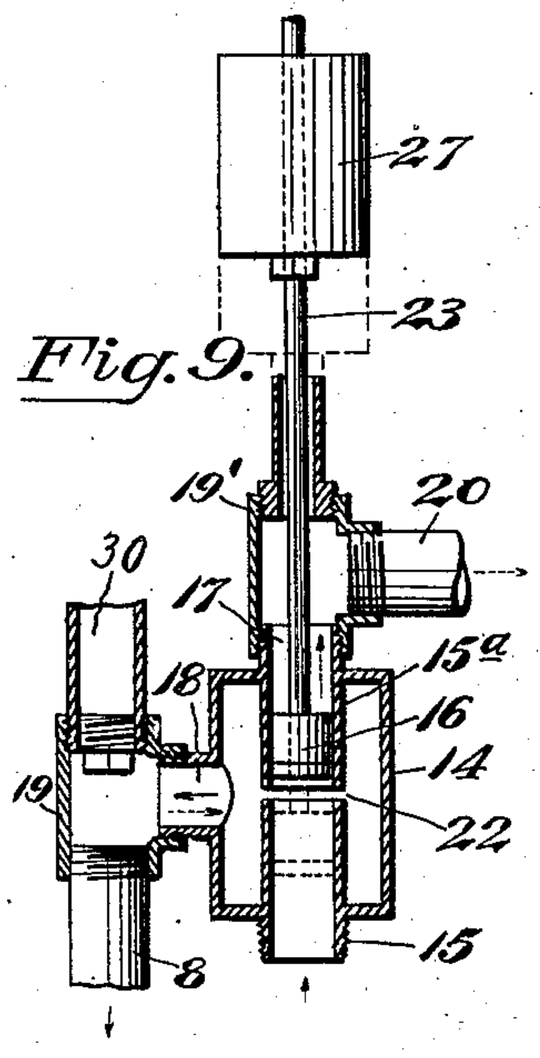
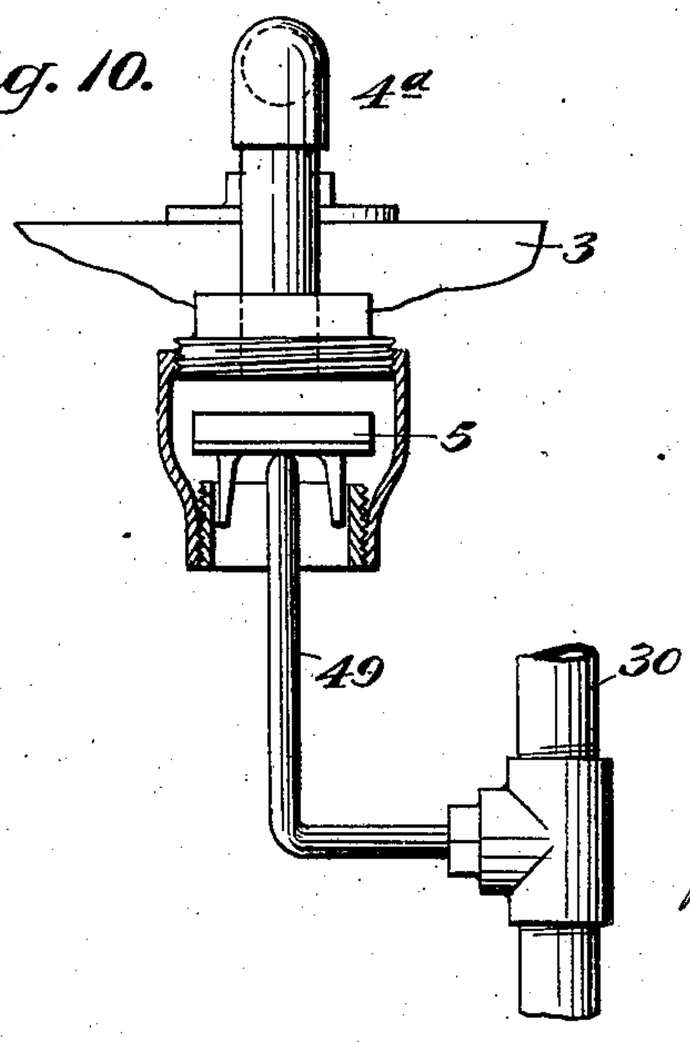


Fig. 10.



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Julius H. Becker
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Attorney

UNITED STATES PATENT OFFICE.

JOHN H. EICHLER, OF SAN FRANCISCO, AND JULIUS H. BECKER, OF OAKLAND, CALIFORNIA.

GAS-MACHINE.

No. 859,807. Specification of Letters Patent. Patented July 9, 1907.

Application filed August 10, 1905. Serial No. 273,505.

To all whom it may concern:

Be it known that we, JOHN H. EICHLER, a citizen of the United States, residing in the city and county of San Francisco, State of California, and JULIUS H. BECKER, a subject of the Emperor of Germany, residing in Oakland, in the county of Alameda and State of California, have invented new and useful Improvements in Gas-Machines, of which the following is a specification.

This invention relates to improvements in apparatus for producing gas for illuminating purposes from gasolene and similar products.

The invention has for its object, chiefly, the production of an improved apparatus or machine having several features in its construction and operation that render it well adapted for manufacturing gas from liquid hydro-carbons such as gasolene either on a small scale for household purposes, or on a large scale for supplying a number of buildings or a district from one plant. It can be readily adjusted and handled by persons of ordinary intelligence without danger; it is capable of being regulated while in operation to vary the richness of the gas being produced. After being charged and set in operation it produces the gas only as rapidly as it is carried away and consumed, the quantity of gas made being always in proportion to the quantity being used, and the production ceases automatically at the moment the gas is shut off at the burners. These and other points and features are secured in and by the following means and mechanical devices, the construction and operation of which will be described with reference to the accompanying drawings illustrating what we consider to be the best embodiment of our invention.

Figure 1 is a front-elevation of a machine intended for household purposes, and capable of supplying burners. Fig. 2 is a rear-elevation of Fig. 1. Fig. 3 is a transverse section through the tank and part of the apparatus on the left side in Fig. 1. Fig. 4 is a similar sectional-view of the tank on the right side in Fig. 1. Fig. 5 is a top-view of the two upright tanks in Fig. 1, without the horizontal tank at the lower part of that figure. Figs. 6 to 10 inclusive are details on an enlarged scale. Fig. 6 is a front-elevation of the automatic valve in the gas-holder through which the outflow of the gas from the gas-holder to the burners is controlled by the rise and fall of the movable head or inverted cylinder of the holder. Fig. 7 is an end-view of Fig. 6; taken from the right side of that figure. Fig. 8 is a front-view of the tripping mechanism that sets the air-pumping mechanism in operation and throws it out of operation through the rising and falling movement of the air-pump. Fig. 9 is a longitudinal sectional-view of the valve that controls the air-pump operating mechanism. Fig. 10 is an elevation, partly in section of the self-closing valve that controls the air-inlet of the air-pump.

In the following description the principal parts of this machine are designated as the air-pump A; the hydraulic motor B; the gasolene tank C, and the gas-holder D. The air-pump and the gas-holder may be placed in close relation to each other, and within the building which is to be supplied with gas. The tank containing the liquid hydro-carbon, such as gasolene, is usually sunk in the ground outside the building at a distance from the other parts of the machine with which connection is made through pipes properly arranged to carry the air from the pump through the liquid and into the gas-holder.

The air-pump comprises a stationary tank 2 containing a water-seal in which an inverted cylinder or "bell", 3 is raised by hydraulic power and is allowed to fall by gravity drawing in atmospheric air in the upward movement through an inlet 4 controlled by a valve 5, and forcing the charge of air into and through the gasolene tank by the descending movement of the bell. These movements are produced by hydraulic pressure acting against a plunger, behind which the pressure is alternately admitted and cut off in a novel manner through mechanism operated by the ascending and descending movement of the bell 3. The operation of this part of the machine is automatic and also self regulating in character, as will be more fully explained hereafter.

The construction and operation of the pump and the hydraulic motor will be described with reference to Figs. 1, 3, 8, 9 and 10.

Within the tank 2 an upright cylinder 6 closed at both ends and fitted with a piston 7 is connected by a pipe 8 at the bottom with any water-supply under pressure that may be at hand.

The end of the piston-rod 10 extending through the head of the cylinder 6 is provided with a weighted head 13 which by contact with the closed end of the bell 3 as the piston moves upward in its cylinder raises the bell in the tank; and on the other hand, as the pressure is withdrawn from behind the piston 7 the bell is allowed to descend by gravity. The rapidity of this movement is varied and regulated at will by placing weights of different mass on the top of the bell.

The pressure or motive force to operate the motor is obtained directly from the water main or the service-pipe of the house, where the same is available for the purpose; and in the present construction a service-pipe 9 is coupled to an inlet 15 in the chamber or casing 14 of a piston-valve 16 controlling three apertures, of which the lower one 15 is the pressure-inlet, the upper one 17 is the waste or discharge outlet, and the intermediate one 18 is alternately the inlet for pressure to the cylinder, and the outlet for discharge of the

water, according as the piston 16 stands above or below the inner end of the inlet-tube 15 in the casing. The pipe 8 leads from the bottom of the cylinder 6 outward through the casing 2 where it is turned at approximately right angles and extends upward and is connected to the aperture 18 in the side of the casing 14 by a tee-coupling 19. The pipe connected to the top of the valve-casing 14 leads from an outlet 17 in the casing to the sewer by means of a pipe 20 connected to the outlet 17 by a tee-coupling 19′, or is laid to a point of discharge where the waste water may be utilized for any purpose.

The piston is fitted to slide in a chamber surrounded by the casing and composed of a tube divided transversely at a point 22 midway of the casing and extending at both ends through the casing; the end 15 being threaded for coupling the supply-pipe 9 and the opposite end taking the coupling 19′ for the waste-pipe 20. A rod 23 having the piston 16 fixed on one end and attached to a tilting lever 21 on the stationary frame 30′ over the tank moves the piston up and down in its tube, with a sufficient length of stroke to raise it above the aperture 22, or in the opposite direction to set the piston out of the section 15ª into the section 15.

In the first position the piston being drawn into the tube 15ª puts the pipe 8 in communication with the water pressure through the apertures 22 and 18, and the water flowing into the motor-cylinder behind the piston forces that part upward, with the effect to raise the bell 3 in its tank. In the second position of the piston, when it is forced out of the tube 15ª and into the tube 15, the water pressure is cut off, and communication is set up between the pipe 8 and the waste-pipe 20 through the apertures and passages 17—18. The piston valve in these two positions thus controls both the admission and the discharge of the pressure-medium behind the motor-piston through the single pipe 8, and the position of the valve is changed at the end of every ascending and every descending movement of the bell 3 by the combined action of the tilting latch 25 on the stationary frame and a rod 26 attached to the tilting-lever 21 on the end opposite to that where the piston-rod 23 is connected; these two parts are arranged for operation in such manner that as the bell completes its descending movement in the tank it will draw down the end of the lever 21 by means of the rod 26, thereby elevating the opposite end of that lever and setting the piston 16 in the position represented by the full lines in Fig. 9, in which the water-pressure is admitted to the motor-cylinder and the waste outlet is closed. When set in that position the tilting lever 21 being caught and held down by the latch 25 retains the piston 16 in its elevated position for the full length of the upward stroke or movement of the motor-piston, or until the lever 21 is released from the latch 25. When that part is tripped, which is done by the bell 3 in its rising movement striking and throwing off the latch, the piston 16 is shifted to the opposite side of the aperture 22, and the pipe 8 and passages through the valve casing 14 become a discharge for the water from behind the motor-piston. A weight 27 is fixed on the piston-rod 23 to move the piston downward against the pressure of the water behind the piston. The tilting-lever 21 and the latch 25 are pivotally attached to the cross-bar 30′ of the stationary frame on the tank, and the latch is provided with a depending arm 28 against the end of which the top of the bell 3 comes in contact in its ascending movement.

The weight 13 on the rod of the motor-piston causes the piston to descend more rapidly than the bell 3, and thus prevent the piston-rod from interfering with the descent of the bell in the tank.

Through the operation of this part of the machine atmospheric air is forced in regular quantities or charges through the body of gasolene in the tank C; and in connecting the space beneath the bell 3 with the last-mentioned tank, provision is made for diverting a portion of the charge of air into the gas-holder and passing the remainder through the gasolene tank, instead of carrying the whole charge or body of air through the gasolene. For this purpose an air-pipe 31 extending from the confined space beneath the bell and above the level of the water-seal is divided outside the tank into two branches or members 32—33, the latter of which is carried directly to the gas-holder and is connected by an elbow or union to a gas-conducting pipe 34 leading from the gasolene tank at or near the point where it is carried into the gas-holder. The other branch or member 32 of the air-pipe is connected to an inlet 36 in the bottom of the gasolene tank so as to deliver its air into the confined body of gasolene.

A cock 38, having a graduated scale 37, on the pipe 33 and a cock 38′ on the pipe 32 are provided for varying and regulating the proportion of the air in every charge passing through each pipe.

By dividing the air before it enters the gasolene tank, instead of passing the whole charge through the tank, the richness of the gas being produced can be kept at the required standard under all conditions of operation, both when the gasolene tank is newly charged and contains its full working quantity of liquid, and also when the body of liquid has been materially reduced by its evaporation.

At the beginning of the operation, with the gasolene-tank filled to its working level only a portion of the whole charge of air from the tank A is allowed to pass through the tank C to become charged with the vapors; and this portion is diluted or brought to proper degree of richness by mixing with it the portion of air which has not passed through the gasolene. The proportions of these two bodies of air are readily regulated by setting the cocks 38—38′ to give a greater or less area of opening; the flow of air through the pipe 32 connecting with the gasolene-tank being increased and the portion diverted through the branch-pipe 33 being decreased from time to time as the body of gasolene in the tank becomes reduced. A check-valve 39 in the pipe leading into the gas-holder prevents a back flow of the gas into the bell when the latter is drawing in air.

The pipe 34 leading from the gasolene tank and entering the gas-holder terminates in a standing member 40, the end of which is arranged to discharge the gas into the gas-holding space and below the level of the water-seal; and in connection with this pipe a valve controlling the discharge of the gas into the holder is operated automatically in the rising and falling movements of the holder to shut off the flow of gas as soon as the holder is full and to open the gas-inlet when the quantity of gas in the holder is reduced by its consumption to a certain limit. For this purpose an upwardly

opening-valve 41 fitted to a seat 42 on the end of the gas-pipe is provided with a stem formed of a yoke 43 and a tilting-lever formed of a tube 44 closed at both ends and supported on pivots 44′ formed in the upright pieces 40′ mounted on the upper end of the pipe 40. One end of the lever 44 is adapted to lie in yoke 43 of the valve stem and is connected thereto by a cross-bar 43′. The tube being partially filled with quicksilver, stands in an inclined position, with the valve-carrying end depressed and held down by the confined body of quicksilver, and the opposite end elevated when the valve is closed.

By reversing the position of the tube 44, the valve is lifted and held off its seat, uncovering the gas-inlet, until the tube is again tilted.

The first-mentioned movement of the tube to shut off the gas from the holder is produced by the rising movement of the gas-holder by the following means, the construction and operation of which will be understood more clearly perhaps by referring to Figs. 4, 6 and 7. A second lever 45 also formed of a loaded tube and turning loosely along side of the first mentioned tube and on the same axis is tilted in one direction by a rod 46 depending from the top of the gas-holder and passing through an eye 47 on the side of the tube 45; the end of the rod being turned up to prevent it from becoming detached from the tube. This rod acts to elevate the end of the tube 45 on the side of the pivot away from the valve and depress the opposite end as often as the gas-holder becomes full. The movement of the tube 45 in the other direction having the effect to depress the outer end and elevate the end nearer the valve is produced by a bar 48 fixed in the side of the tube 45 and carrying a roller 49 on the upper end which by contact with the closed top of the movable holder as the latter reaches the ascending movement presses down that end of the tube 45. In these movements of the tube 45 the other tube 44 connected directly to the valve is thrown over the center and in the same direction as the tube 45 by two prongs 50—51 fixed on the bar 48 and standing one beneath and the other above the tube; the prongs being set at such distance apart that the tube 45 is allowed to acquire a little momentum before the prongs come in contact with the other tube. The effect of this arrangement and the use of loaded tubes—quicksilver being preferred for that purpose on account of its fluidity and its high specific gravity—is to produce quick opening and closing movements of the valve; thus shutting off the gas at the instant that the gas-holder becomes full and admitting gas to refill it when the gas-holder is nearly empty.

As the air-containing spaces in the air-tank are in communication with the gas-holding space through the pipes and connections already described, it will be obvious that the bell 3 of the air-pump will not descend while the inlet-valve 41 is closed, and consequently no air will flow through the gasolene tank and no gas will be produced until the valve 41 is lifted and the inlet remains open. The valve-mechanism therefore controls and regulates the operation of the gas-generating part of the apparatus, causing the production of gas to be suspended as the gas-holder becomes full, and to resume the production to refill the gas-holder as often as the quantity stored in the gas-holder is reduced below a given limit. The apparatus is thus made automatic in its operation.

Provision is made for opening the air-inlet valve 5 at the end of every descending movement of the bell 3, for the purpose of allowing the bell 3 to drop a short distance and thus acquire sufficient momentum to throw the piston-valve 16 full open, thereby giving a full flow of water to the motor-piston at the beginning of every ascending movement of the bell 3. For that purpose the air-inlet valve 5 is placed on the end of a downwardly bent tube 4^a on the top of the bell and an upright rod 49 is fixed on the frame 30 directly under and in line with the valve 41 so as to lift the same as the bell 3 nearly completes its downward movement. This arrangement is seen in Fig. 10.

In the operation of the machine as the bell 3 assumes the position represented in Fig. 1, the air-inlet valve is held open by the rod 49 and the piston-valve 16 being set above the inlet-aperture 22, as indicated by the full lines in Fig. 9, the water enters the cylinder through the pipe 8, forcing up the motor-piston and causing the bell to ascend in the tank. This upward movement of the bell 3 draws in air from the outside through the outlet until the top of the bell 3 striking the latch 25 trips the lever 21 and releases the valve-rod 23. The piston-valve thereupon descends below the aperture 22, and remains in the position indicated by the dotted lines in Fig. 9, cutting off the water-pressure and opening an outlet for the waste water from behind the motor-piston through the pipes and passages 8. As the bell 3 reaches the end of its descending movement the piston-valve is again raised above the inlet-aperture 22, and the operation of raising the bell is repeated. Air is thus forced through the body of gasolene at every descending movement of the bell 3 in its tank, the richness of the product being regulated by causing a greater or less proportion of the air to flow through the pipe and mix with the carbureted portion that has passed through the gasolene, that being done by adjusting the cocks 38—38′ as the conditions call for from time to time. The generator continues to operate in this manner until the production exceeds the consumption and the gas accummulates in the gas-holder, filling the same and raising the movable cylinder in its tank. At the end of its upward movement that part causes the loaded tube 45 to tilt and close the gas-inlet valve 41, thereby shutting off the generator and suspending the production of gas until the charge or quantity in the gas-holder is reduced to a given extent. The opening and closing movements of the inlet-valve 41 are timed and regulated by varying the length of the rod 46 and bar 48 that throw the tilting tube over the center.

What we claim as our invention and desire to secure by Letters Patent is:—

1. In a gas-machine, a gasolene-tank, an air-pump adapted to force charges of atmospheric air through the gasolene-tank, a gas-holder for receiving the carbureted air from said tank, a connection between the said tank and the gas-holder having a controlling valve, and a rocking lever actuated by the rise and fall of the gas-holder operating to shut off said valve when the gas-holder reaches the end of its upward movement and to open said valve in the downward movement of the said holder.

2. In a gas-machine, the combination with a gasolene tank; of an air-pump having a closed top, inverted cylinder movable in a water-seal tank, means for raising the cylinder in the tank including a hydraulic cylinder con-

taining a piston, a piston-rod adapted to engage the inverted cylinder, a conductor connecting the hydraulic cylinder with a source of pressure a waste-pipe leading from said conductor, a valve in said connection for controlling the flow of pressure to the said hydraulic cylinder or to said waste-pipe, and means actuated by the inverted cylinder in its ascending and descending movements for positively operating said valve.

3. In a gas-machine, the combination of a gasolene-tank, an air-pump, a gas-holder, a pipe connecting the gas-holder with the generating space of the gasolene-tank, a valve in said pipe, means actuated by the movable member of the gas-holder for closing said valve when the gas-holder has reached the limit of its upward movement, separate means for opening such valve when the said holder has descended to its lowest position, and connections between the gasolene-tank and the air-pump.

4. In a gas-machine, the combination with a gasolene tank and a gas holder, of an air pump comprising a stationary cylinder containing a water seal and an inverted cylinder movable therein, a motor for raising said movable cylinder, a conductor leading from a source of pressure to said motor, a controlling valve in said conductor for opening and closing communication between the motor and the source of pressure, an inlet valve for admitting air to the movable cylinder during its rising movement, and means for opening the said inlet valve at a predetermined point in the descending movement of the movable cylinder to cause the latter to drop with sufficient momentum to operate the controlling valve quickly.

5. The combination with a gasolene-tank of an air-pump having a closed top inverted cylinder adapted to descend by gravity into a surrounding water-seal, a hydraulic cylinder within the said air-cylinder, a piston movable therein and arranged to raise the air-cylinder, a chamber having an aperture, a waste-pipe leading into said chamber on one side and a conductor pipe leading from the opposite side thereof to said hydraulic cylinder, a plunger valve slidable in said waste-pipe and conductor pipe for alternately opening and closing communication therewith, a connection between the aperture in the said chamber and a source of pressure, and means operating the said plunger valve.

6. The combination with a gasolene-tank, of an air-pump having a closed-top inverted cylinder adapted to descend by gravity within a surrounding water-seal, a hydraulic cylinder beneath the said air-cylinder operating to elevate the said cylinder, and means for alternately connecting the said hydraulic cylinder with a source of pressure and with a waste outlet, including a pipe leading into the hydraulic cylinder, a pipe connecting with a head of water, a waste water pipe, a piston-valve interposed between the said pipes having a valve-chamber provided with a separate coupling for each of the said pipes and means for shifting the piston valve to alternately open and close the communication between the hydraulic cylinder and the head of water and between the said cylinder and the waste-outlet, consisting of the tripping-lever, a rod connecting the piston-valve therewith, a draw-rod on the opposite end of the tripping-lever connecting the same with the movable cylinder of the air-pump, a latch adapted to retain the tripping-lever in one position and means for throwing off said latch in the ascending movement of the cylinder.

7. In a gas-machine, the combination with a gasolene-tank, of an air-pump adapted to force charges of air through the gasolene-tank, a gas-holder, a conductor connecting said tank with the gas-holder, and having an upright member terminating in the gas-containing space of the said holder, and means for opening and closing the outlet of said conductor, comprising an upwardly-acting valve, a tilting lever formed of a closed tube containing a body of quick-silver, a yoke connecting the valve with the said lever on one side of its fulcrum, and means actuated by the movements of the gas-holder for tilting the said lever in one direction in the ascending movement of said holder, and in the opposite direction in its descending movement.

In testimony whereof we have hereunto set our name to this specification in the presence of two subscribing witnesses.

JOHN H. EICHLER.
JULIUS H. BECKER.

Witnesses:
LOUIS SIEGRIEST,
EDWARD E. OSBORN.