4 Sheets—Sheet 1.

T. B. FOGARTY.

GAS-MACHINE.

No. 171,607. Patented Dec. 28, 1875.

Fig. 2.

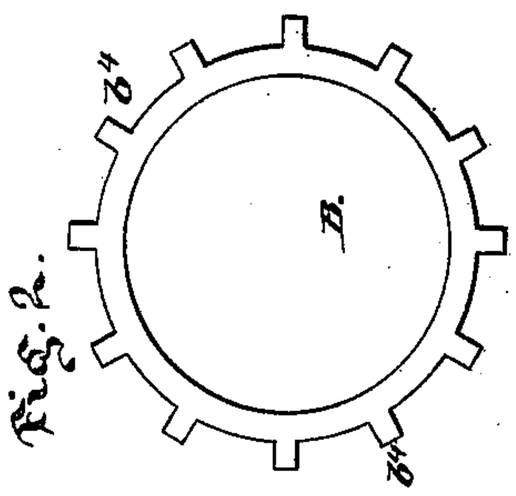

Fig. 1.

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4 Sheets—Sheet 2.

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GAS-MACHINE.

No. 171,607. Patented Dec. 28, 1875.

Fig. 4.

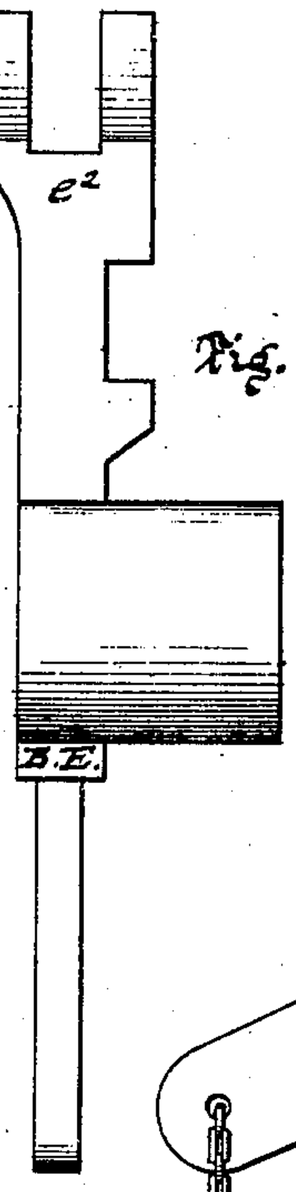


Fig. 3.

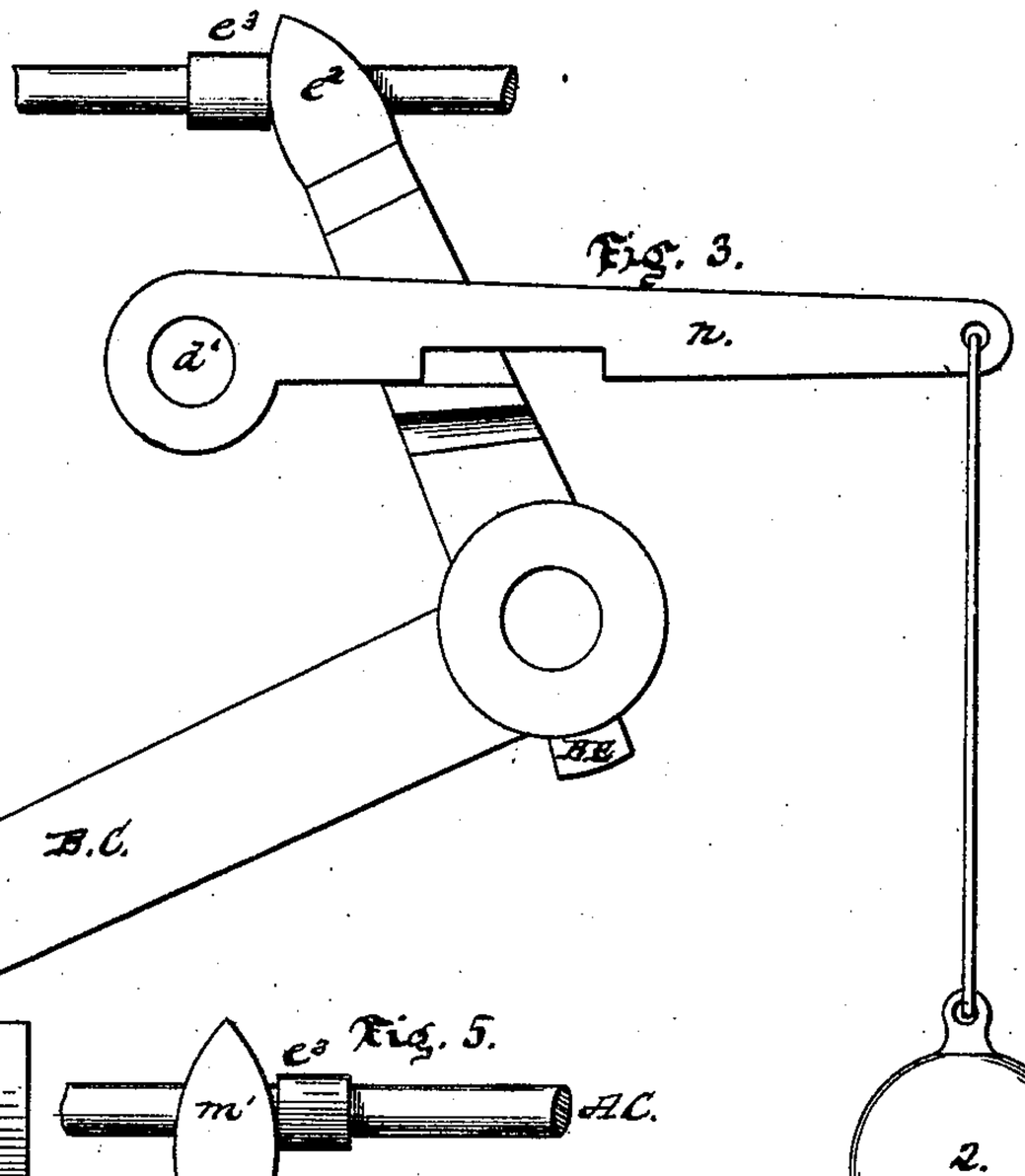


Fig. 5.

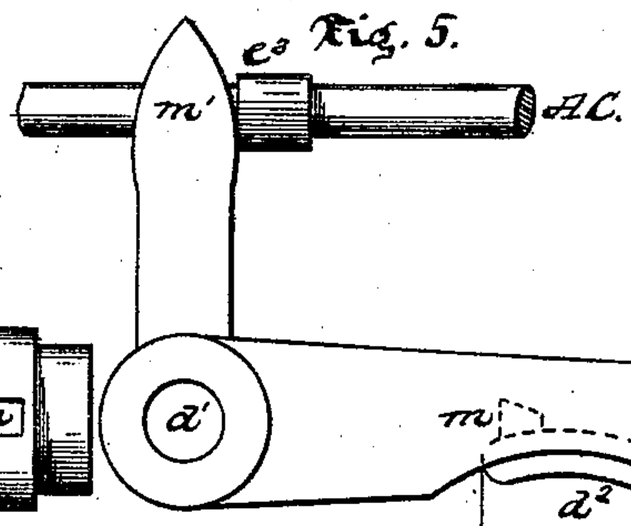
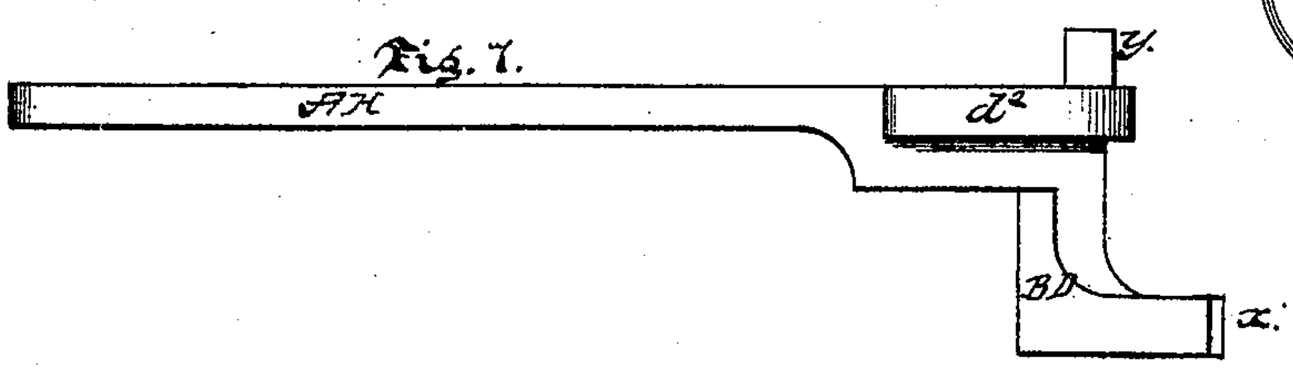


Fig. 6.

Fig. 7.



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4 Sheets—Sheet 3.

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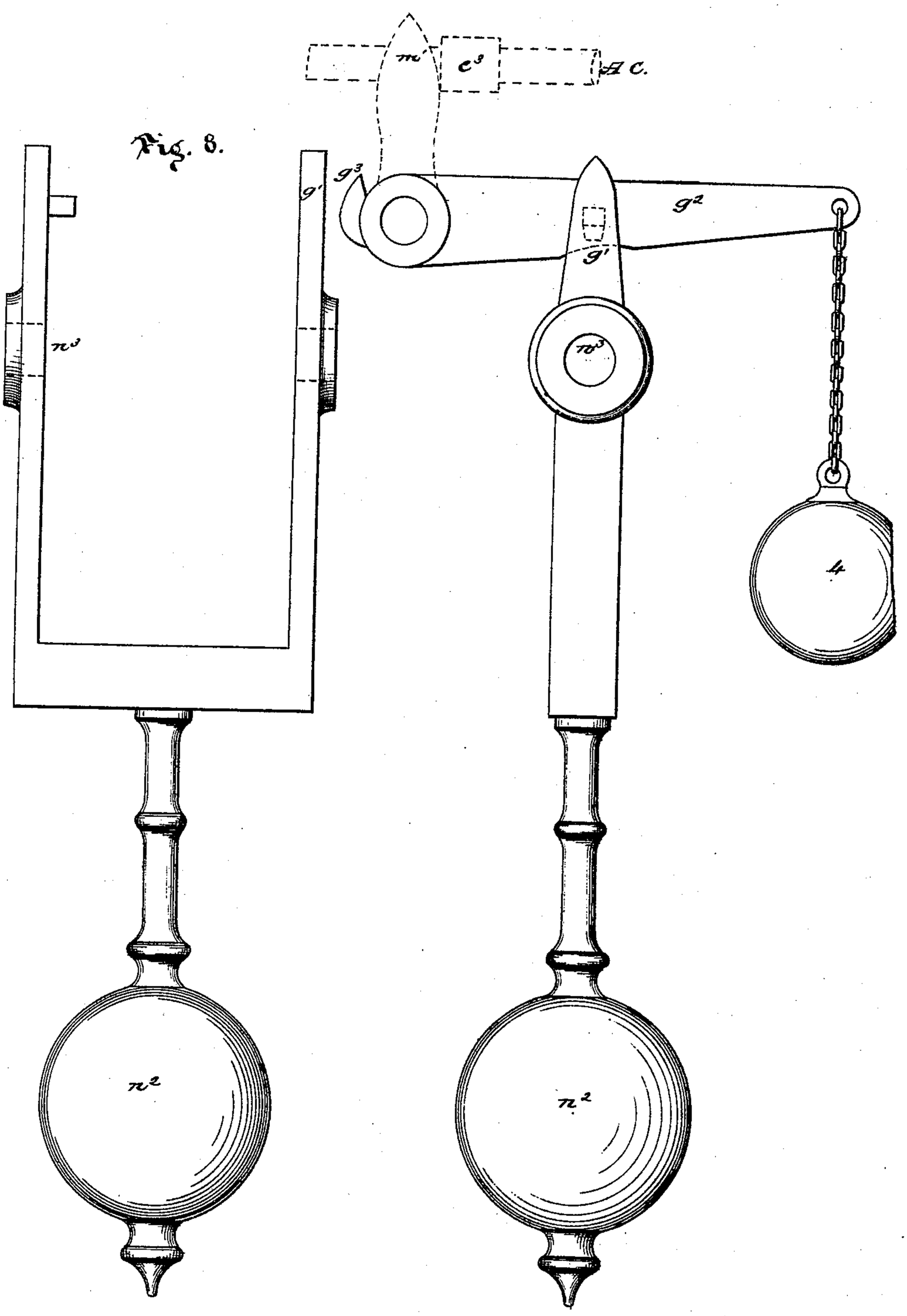
GAS-MACHINE.

No. 171,607. Patented Dec. 28, 1875.

Fig. 8.



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4 Sheets—Sheet 4.

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GAS-MACHINE.

No. 171,607. Patented Dec. 28, 1875.

Fig. 9.

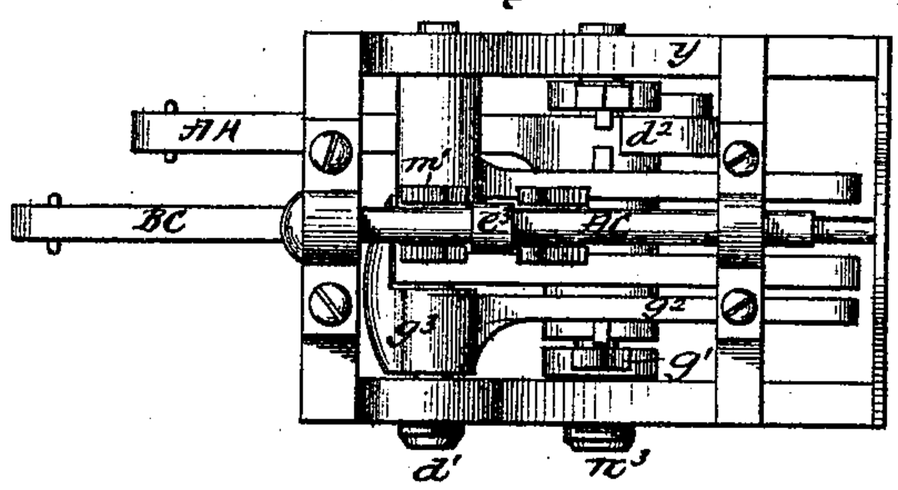
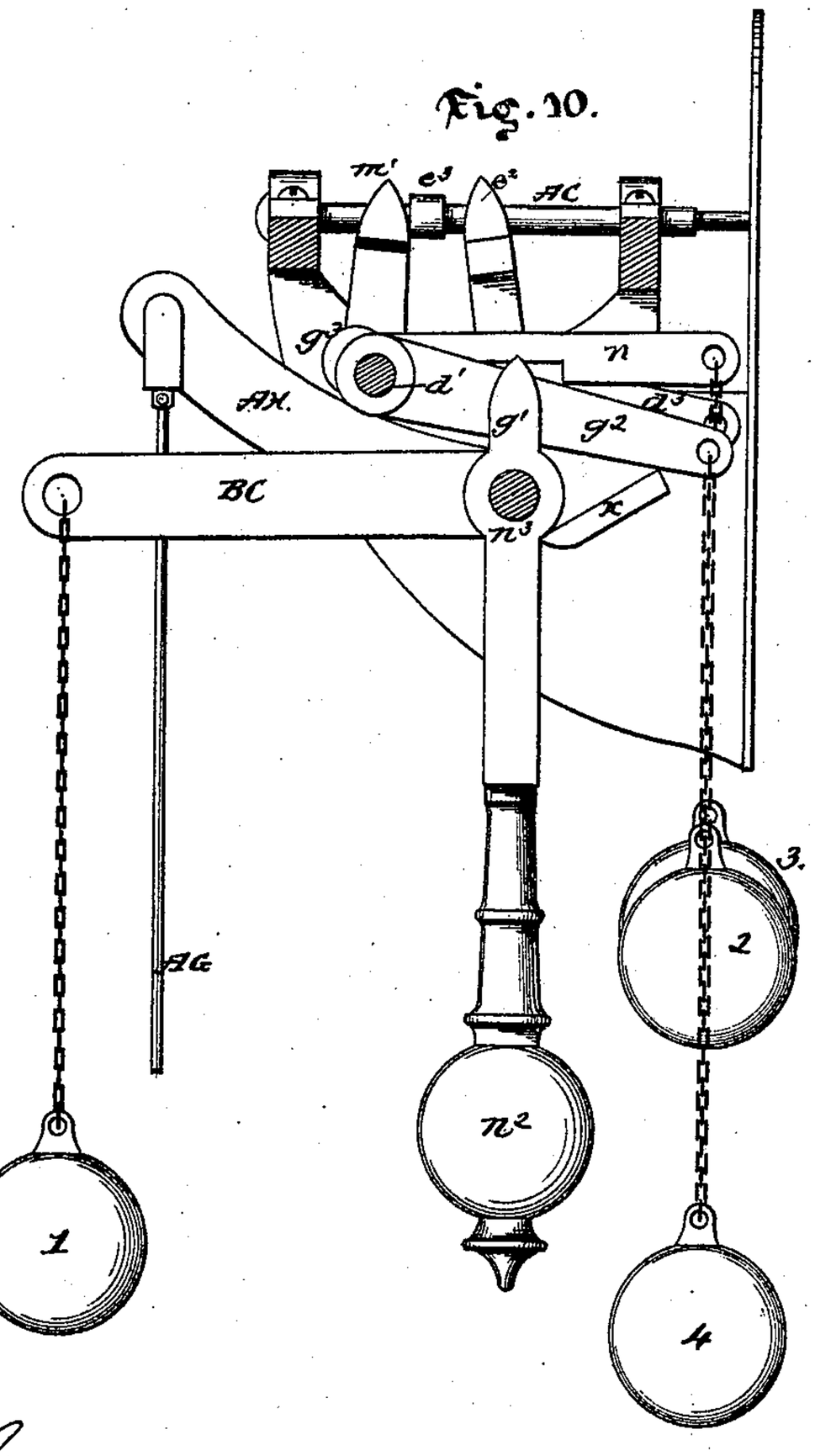


Fig. 10.



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Inventor:
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UNITED STATES PATENT OFFICE.

THOMAS B. FOGARTY, OF NEW YORK, N. Y.

IMPROVEMENT IN GAS-MACHINES.

Specification forming part of Letters Patent No. **171,607,** dated December 28, 1875; application filed November 10, 1875.

To all whom it may concern:

Be it known that I, THOMAS B. FOGARTY, of New York, in the county and State of New York, have invented certain Improvements in Gas-Machines, of which the following is a specification:

My invention relates to that class of gas-machines in which hydrocarbon liquid is vaporized under pressure in a heated retort, and in which a proper supply and admixture of air is induced and maintained by the inductive force of hydrocarbon vapor escaping through a small jet or opening, the manufacture and supply of gas being regulated and controlled automatically by the rising and falling of the gas-holder.

The object of my improvements is to simplify the action of such machines, and to render them more definite, positive, and reliable in their functions, and less liable to accident; and this I effect by the addition and combination of certain devices.

I will now proceed to describe my improved gas-machine, and the manner of its construction and operation, which will be more readily understood by referring to the four accompanying sheets of drawings, which represent a complete gas apparatus in section, and figures of special parts of the valve-gearing.

The material from which I manufacture gas in my machine is a volatile product of the distillation of petroleum, commonly known as gasoline. I place the gasoline in a suitable tank or reservoir, A, which I connect with the retort B of my machine by a suitable pipe, C, provided with the stop-cock D. The gasoline is forced into the retort B under a pressure of fifteen pounds, more or less, such pressure, when practicable and convenient, being procured by placing the tank A at such an elevation above the machine that the weight of the liquid itself will give the desired pressure. In most cases, however, it is impracticable and inconvenient to do this, so that I usually prefer to use the well-known device for forcing liquids by pneumatic pressure, as shown in the drawing.

In the drawing, A represents my tank, hermetically closed by the plug a^1, as shown. The tank is represented as being partially filled with liquid, as shown at a^2, and having an air-space at top, as shown at a^3. I now, by means of the air-pump E, force air into the tank until the tension of the compressed air in the tank equals the desired pressure, as indicated by a gage, F. The elastic force of the compressed air, acting upon the surface of the liquid in the tank, will now cause it to rise in the pipe C and flow into the retort. The pipe G, which is shown in section, extends down into the tank, but so that there is a considerable space between the end of the pipe and the bottom of the tank. This pipe serves as a test or gage pipe, by which to learn when the liquid in the tank is nearly exhausted, for, as shown in the drawing, I provide it at top with a small cock, by opening which I can learn whether the liquid in the tank has been exhausted to below the end of the pipe; for if the cock throws out a jet of liquid, I know that the end of G is still immersed in gasoline; but if it throws out a stream or jet of air, I know that the liquid has been exhausted to below the end of the pipe, and that it is time to look after a fresh supply.

I have now shown the means by which I supply the hydrocarbon liquid to my retort—viz., hydrostatic pressure where I can, and where I cannot avail myself of that, pneumatic pressure. In the former case I require only an ordinary tank or reservoir, with an eduction-pipe or outlet at bottom, and an air-vent at top; but in the latter case I require a tank absolutely air-tight, and it ought to be capable of standing from within a pressure of at least fifty pounds; and I use in combination with it, and as a means of forcing liquid into the retort, and for the other purposes described, the several pipes, and cocks, and the air-pump, as described.

I now close the vapor-valve H, in the manner hereafter to be described, and, having opened the cock D, allow the liquid to enter and fill the retort B. I next open the cock I upon the pipe J, taking care that the cock K upon the pipe L has been previously closed, so as to cut off communication between the pump E and the tank A. I now, by means of the pump E, force air through the pipe J into a small carbureting-drip, M, communicating with the gas-holder, and containing a small quantity of gasoline, in its passage through

which the air becomes carbureted sufficiently to admit of its being burned as gas. I now light the burner S under the retort.

This device for heating the retort differs from that described and claimed in my patent of June 6, 1871, No. 115,592. In the specification of this patent I described and claimed "a hydrocarbon-tank for forcing compressed air, &c.," whereas in my present specification I describe a device for pumping air through a carbureting-drip communicating with the gas-holder. In the former the air was carbureted in a close tank, while in the present it is carbureted in an open drip communicating freely with the gas-holder.

It will be remembered that the valve H was closed before allowing the retort to fill with gasoline; consequently the only outlet from the retort is the supply-pipe through which the gasoline entered it. Now, as soon as the retort attains sufficient heat, vapor will begin to form, and as it forms will displace the liquid in the retort and force it back to the tank, for, as communication is open between the retort and the tank, it is evident there must be a perfect equilibrium of pressure between them, for as soon as the pressure in the retort exceeds that in the tank in the slightest degree it will force its contents back to the tank and out of the influence of the heat, so that no more vapor can form until some of that in the retort is allowed to escape, when the pressure within it becomes reduced below that in the tank, which immediately forces back to the retort liquid for the formation of vapor sufficient to restore the equilibrium.

I do not claim that there is any novelty in the above method of regulating the supply of liquid to, and the pressure in, the retorts of gas-machines. I refer to this method of supplying liquids to retorts, and describe it here, only because such description is necessary to the proper understanding of the construction and operation of my machine, and make no claim whatever to it, or the devices by which I carry it into effect, except in so far as they are part of my apparatus and in combination therewith.

I shall here describe the retort B, in which I convert the hydrocarbon liquid into vapor, and the stove O, as these constitute an important part of my invention. I construct my retort of any suitable material, but preferably of iron, and furnish it with heat-conducting flanges b^4, as shown in Fig. 2. These flanges answer the double purpose of serving as guides to retain the retort in its proper position in the stove, and also as heat absorbers and conductors. They also serve to distribute the heated products of combustion more evenly over the surface of the retort. I also construct the retort so that a flange, b'', attached to its top, will form the top of the stove. This flange is provided with a suitable outlet for the products of combustion, and also with a circular flange, b''', made to fit into the space between the walls o' of the stove O. The advantage of this construction of the retort is, that it greatly facilitates and cheapens the construction of the machine, as it enables me to dispense with the set-screws formerly used in constructing machines. The circular flange b''', fitting between the walls of the stove O, also serves to render the point of contact between them and the retort impervious to the passage of flame.

I construct my stove in such a manner that the fire within it will be absolutely isolated from the interior of the gas-house, thereby rendering accident from fire impossible; and to this end I construct it in the following manner: I first make its walls o' double—that is, with a space between them—and by means of the circular flange b''', or its equivalent, or in such other manner as may be most convenient, I make the joint between the stove and the top of the retort impervious to the passage of flame, so that it will be impossible for the burners within the stove to communicate with and inflame an inflammable gaseous mixture surrounding the stove externally. I also attach the door-frame of the stove (not shown in the drawing) in such a manner that at its points of junction with the side of the stove it will make a joint impervious to flame. I also plane the face of the door-frame and of the door itself, so that when the door is closed the metals will be brought into such close contact that the passage of flame between them will be impossible. I next connect the chimney with the stove by a joint sufficiently tight to prevent the passage of flame, and I make the joints of the chimney itself sufficiently tight for the same purpose. I make the point of junction between the stove and the bed-plate of the machine, and all the joints connected therewith, as well as the holes through which the gasoline-pipe G and the pipe Q, through which gas is supplied to the burner S, pass, sufficiently tight to prevent the passage of flame. I also make a flame-proof joint around the stem R of the burner-cock of the burner S under the retort. In this or in an equivalent manner I isolate the interior of the stove from the external atmosphere or gases, except through the flue T and the pipe U, through which air is supplied for the support of the combustion within the stove, for, as the heated products ascend and escape through the pipe P, a supply of cold external air descends and enters the stove through the pipe U and flue T. I carry these pipes U and T to the outside of the gas-house, and consequently, these being the only means of communication with the interior of the stove, the latter is completely isolated from the atmosphere or vapors contained in the gas-house. I do not, however, confine myself to this method of isolating the interior of the stove, as the same purpose might be effected by inclosing the entire stove in an isolated chamber, the opening of which would have no communication with the interior of the gas-house.

Having now described the mode of constructing my stove and retort, as well as the

manner of supplying hydrocarbon liquid to the latter, and of the conversion of said liquid into vapor, as well as the manner of regulating and controlling the supply of gasoline to, and the pressure within, the retort, I shall now describe the process by which the vapor so formed is mixed in the proper proportions with atmospheric air, the devices by which such mixture is effected, regulated, and controlled, and also the method of regulating and controlling the manufacture of gas, and its supply to the burners as required for use, as well as the several devices and apparatus which I use for this purpose.

The method of inducing a current of air in any desired proportion, by means of a jet of vapor issuing at a light velocity through a small opening, H, into the mouth of a larger tube, V, has been so often described, and is so well understood, that it is unnecessary for me to describe it here, especially as I do not claim that there is any novelty in this part of my invention; nor do I claim that there is any novelty in an automatic gas-holder, as the same has been often previously described; but I do claim that there is novelty in the valve-gear, the essential working parts of which are represented on Sheets 2, 3, and 4, by the action of which the holder automatically regulates and controls the manufacture and supply of gas according to the requirements of the consumption. I also claim that there is novelty in the carbureting-drip Y, the float y^1, and the valve y^2, and also in the safety-float A B, and these I shall now proceed to describe.

In the automatically-working valve-gears heretofore described, and used by Maxim, myself, and others, the opening and closing of the jet H were effected by means of springs or weights operating the valve A C, and moved to either side of the center of motion through the agency of levers suitably connected with the gas-holder, and operated thereby. In some of the movements so described, the action of the springs or weights was in some measure checked and regulated by a detent. In nearly all, however, there was no detent whatever, the springs or weights being free to act at either side of the center of motion whenever their tendency to that side would become sufficiently powerful to operate the valve-gear. My new valve-gear differs most radically from all that have gone before it, inasmuch as there is no center of motion, the opening and closing movements of the valve being governed by the movements of separate levers operating separately and alternately, yet in harmony with each other, each part being operated by a separate weight, and the movements of all being controlled by a series of cams and detents.

On reference to the drawing, it will be seen that the gas-holder is attached, by the center rod A D, to the horizontal bar A E, which is hung in the stud A M under the stove, and carries at its projecting end the counter-balance A F. The bar A E is connected at the point e^1, by the rod A G, to the lever A H, to which it communicates the motions of the holder as it rises or falls, so as to operate the valve-gear, and automatically stop and restart the manufacture of gas, according to the requirements of the consumption.

As represented in the drawing, the valve H is open, and the holder is being inflated with gas, and, consequently, is rising out of the water-seal. On looking at the drawing, it will be seen that the vapor-valve A C is kept open by the action of the weight No. 1, attached to the lever B C, bearing down the end of this lever, to which it is attached, and so causing its upper end e^2 to press against the boss e^3 upon the stem of the valve A C, and thus hold it open. In the position in which the machine is represented in the drawing the lever B C is perfectly at rest, and does not move at all; but as the holder is inflated and rises out of the water, carrying with it the lever A H, a projecting spur, B D, upon the latter engages with a similar spur, B E, upon B C. The levers A H and B C now interlock, and, as the holder becomes inflated and rises, have a corresponding upward motion imparted to them. The boss e^3 upon the valve-stem is now released from the pressure of e^2, which releases it, being forced to do so by the upward movement of B C, part of which it is, the valve, meanwhile, continuing wide open. As soon as the holder has risen to nearly the upper end of its stroke a detent, n, which works upon the supporting-rod d^1, falls behind the upper end e^2 of the lever B C, and engages in it, preventing its backward movement. This detent is actuated by the weight No. 2. Meanwhile a sector or cam, d^2, upon A H has been moving in union with it, and has been retaining in its position the lever d^3. This lever d^3 carries a laterally-projecting pin, m, which rests upon the upper surface of the sector d^3. Immediately, however, after the lever B C has been locked in position by the detent n, as before mentioned, the sector d^2 passes from under the projecting pin m of the lever d^3, allowing the weight No. 3 to operate this lever, so as to bring its upper end m^1 to bear upon the boss e^3 and close the vapor-valve A C, and, simultaneously with it, the air-valve m^2, connected with it by the rod n^1. The manufacture of gas being now stopped, the holder commences to fall, carrying with it the lever A H. The lever B C, however, does not move in unison with A H, for it must be remembered that it has been locked by the detent n falling behind it, so that, as A H is carried downward by the falling gas-holder, the spurs B D and B E become unlocked from each other, and the lever B C remains stationary, its upper end e^2 being locked by the detent n into such a position that it shall not press against the boss e^3, which, as I have said before, is acted on so as to keep the valve A C closed by the weight No. 3 acting on the lever d^3, so as to bring it to bear against it, and to keep A C closed. When, however, the holder descends, carry-

ing A H with it, a projecting arm, x, upon the latter raises the detent n, and so releases B C, the weight upon which immediately operates it, so as to bring its upper end e^2 against the boss e^3, and throw open the vapor and air valves with a quick snap motion.

It will be remembered that the vapor-valve had been closed and kept closed by the weight No. 3 bringing the upper end m^1 of the lever d^3 to bear against the boss e^3. The weights No. 1. and No. 3 are, however, so proportioned to each other that, while No. 3 has power enough to keep the vapor-valve tightly closed against the pressure of the vapor, No. 1 has got power enough to open this valve against the pressure of No. 3. Both sets of weights and levers are thus made to act alternately, their mutual dependence and reciprocal action being regulated by the movements of the lever A H, which is, in turn, operated by the rising and falling of the gas-holder.

Having described the working parts of the valve-gear, I shall now describe the part played by the hanging bob n^2. This bob, it will be perceived, is merely intended to keep in a vertical position a bracket hung upon the supporting-rod n^3. The lever A H carries upon its hub a spur, y, projecting across this bracket, so that, if by any chance the holder should rise or fall above or below the normal limits of its movement, the spur upon its hub will engage in the bracket attached to n^2, carrying it with it, and causing its upper end g^1 to describe a short arc of a curve. Now, g^1 carries a projecting pin, which projects under and supports a corresponding pin or stud projecting from the arm g^2, working upon the supporting-rod d^1, and having attached to it the weight No. 4. The bracket is kept in a perpendicular position by the hanging bob n^2, and it continues in this position as long as the holder does not exceed to any extent the limits of its upward or downward stroke. As soon, however, as this occurs, which can only be through want of pressure, or some derangement of the machine, the stud y upon the hub of A H engages in the bracket, and causes its upper end g^1 to describe a short arc of a circle, in consequence of which the projecting pin upon g^1 becomes disengaged from that upon the arm g^2, which, being thus released, is carried down by the weight No. 4 attached to it. Now, the arm g^2 carries upon its hub a spur, g^3, so adjusted that it will not ordinarily interfere with the normal working of the lever d^3; but as soon, however, as the arm g^2 is released through some derangement of the machine, as already described, and is brought into action by the weight No. 4, the spur g^3 engages the vertical portion of d^3, which, it has been said, is actuated by the weight No. 3, when the action of the combined weights Nos. 3 and 4, being thus brought to bear upon d^3, are sufficient to close the valve even against the opposing influence of weight No. 1. Thus the bob n^2 and the bracket g^1 remain perfectly quiescent during the normal working of the machine, and come into play only in case of loss of pressure or other derangement of the machine, in which case they close the vapor-valve, and thus prevent an escape, and consequent loss, of gasoline. It will be seen that by placing the counter-balance A F upon either side of the stud A M the pressure of the gas-holder can be increased or diminished at pleasure. The weights are represented as being suspended from the levers; but it is evident that fixed weights or springs might, in some cases, be advantageously employed.

I shall now proceed to describe the carbureting-drip Y. This drip serves for a double purpose. As I have already said, I use it as a means of carbureting air for the purpose of heating the retort to start the machine when there is not a supply of gas on hand for that purpose. I also use it as a safeguard or preventive against an overflow, and consequent loss, of gasoline. If a derangement should occur when there is a large number of lights burning, and there is consequently a heavy consumption of gas, and the holder should consequently rise or fall above or below the normal points for reversing its motion, the bracket will release the arm g^2, which will fall and close the vapor-valve, so as to prevent a loss of gasoline. If, however, such derangement should occur when there are but a few burners lighted, an overflow of gasoline would probably take place. The vapor produced by the warm gasoline would probably be sufficient to feed the few burners lighted; consequently the gasoline would continue to overflow, and though a time would eventually come when the arm g^2 would be brought into action, so as to stop the flow of gasoline by closing the vapor-valve, a considerable loss of gasoline would, however, take place meanwhile. It is for the purpose of preventing this loss by hastening the action of g^2, and making it almost coincident with the first overflow of gasoline through the jet H, that I have devised the combination of the carbureting-drip Y, float y^1, and valve y^2, as shown in the drawing; for the moment gasoline begins to come over it will flow into the drip Y, when the float y^1 will raise the valve y^2, in consequence of which there will be a rapid escape of gas from the holder, the same as if there was a large number of burners lighted. The holder will now fall rapidly, and thus bring the arm g^2 into operation, so as to close the jet H, and stop the further flow of gasoline.

I will now describe the float A B inside the holder on the top of the inlet or outlet pipe. This float is intended to prevent the water in the holder-tank being allowed to fall too low, for, in this case, the float will fall with the water, and the cap p on top will close the pipe, and stop the flow of gas, so that the water-seal must be renewed before the machine can be used again. When the machine is working the gas enters the pipe through openings at the sides p'.

I do not here claim the stove having an air-tight jacket, with connections extending to the outside of the apartment in which it is placed, for the purpose of preventing explosion or danger by fire, as it is the subject of another application.

I claim—

1. In automatically-working gas-machines, two weighted levers, B C and d^3, alternately opening and closing the vapor-valve A C and the air-valve m^2 of such machines, substantially as described.

2. A lever, A H, furnished with one or more sectors or cams, d^2, and one or more spurs, B D, and also with one or arms, x, substantially as described.

3. The combination of the levers B C d^3 and A H with the gas-holders of automatically-working gas-machines, substantially as described.

4. The combination of a weighted detent, n, and lever B C, substantially as described.

5. The combination of a weighted arm, g^2, with a lever, A H, and bracket, substantially as described.

6. The combination of the arm g^2, lever A H, and bracket n with a lever, d^3, substantially as described.

7. In automatically-working gas-machines, the combination of the carbureting-drip Y, float y^1, and valve y^2, substantially as described.

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