(No Model.)

H. COTTRELL.

GAS APPARATUS.

No. 270,181. Patented Jan. 2, 1883.

Fig1.

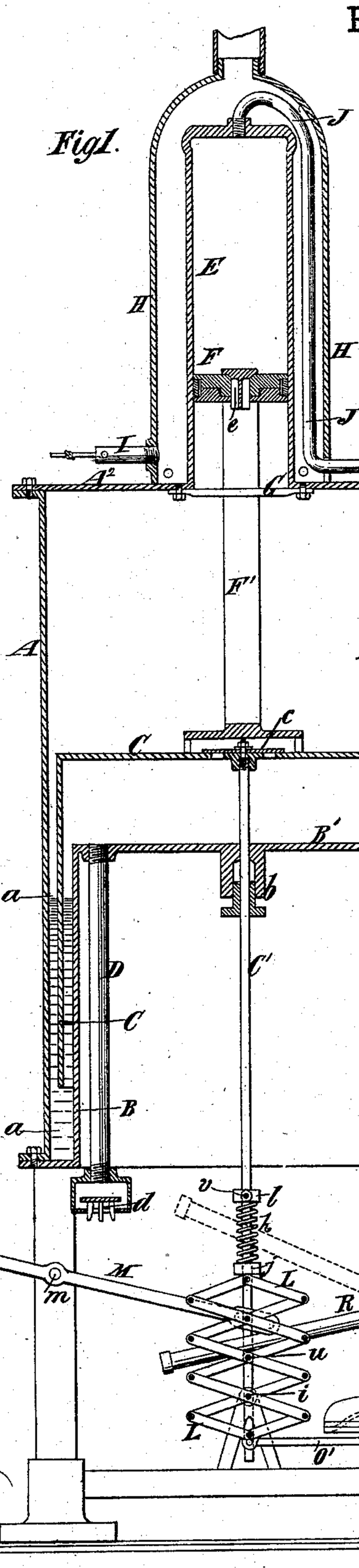

Fig2.

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GAS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 270,181, dated January 2, 1883.

Application filed July 28, 1882. (No model.)

To all whom it may concern:

Be it known that I, HERBERT COTTRELL, of the city of Newark, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Gas Apparatus, of which the following is a specification.

My invention relates to apparatus for making gas for illuminating purposes, which comprises an air-pump, a motor-cylinder, and piston connected with the air-pump for operating it.

In apparatus of this class it is common to vaporize hydrocarbon liquid and to employ the expansive force of the vapor acting upon the motor-piston for operating the air-pump, and after the vapor has performed its work it escapes into the air pump or chamber with which the pump communicates, and in which the hydrocarbon vapor mingles with the air to form a desirable illuminating-gas.

One feature of my present invention relates to the construction of the air-pump; and it consists in the combination of an air-pump cylinder provided with an annular extension, an inverted cup-shaped plunger provided with a valve for the passage of air above it, and working in said cylinder and extension, a seal of quicksilver or other fluid in said extension for sealing the plunger, a pipe for admitting air to the cylinder below the plunger, an opening for admitting hydrocarbon vapor above the plunger, and a service-pipe for conducting the gas from said pump.

My invention also consists in the combination, with the above, of a weight connected with the plunger for making the upward stroke or operating the plunger in one direction, and a motor-cylinder and piston adapted to be operated by hydrocarbon vapor for operating the above-described pump-plunger in its downward stroke or in the other direction.

The invention also consists in a novel means of supplying hydrocarbon liquid to the motor-cylinder in a more uniform manner than heretofore, so that the motor-cylinder will receive exactly the same quantity at each stroke of its piston and the air-pump plunger, as hereinafter fully described.

The invention also consists in details of construction and combinations of parts hereinafter described.

In the accompanying drawings, Figure 1 represents a sectional elevation of an apparatus embodying my invention, and Fig. 2 represents a side view of the motor-piston and its rod.

Similar letters of reference designate corresponding parts in both figures.

A designates the cylinder of an air-pump, and A′ designates an annular extension at the lower end thereof. The cylinder A is closed at the upper end by a head, A^2, and the annular extension is formed by a second cylinder, B, of smaller diameter than the cylinder A, inserted into the latter and connected therewith at its lower end. The upper end of the cylinder B is closed by a head, B′.

C designates a plunger, which is of inverted-cup shape, and its cylindric portion extends into the annular extension A′ and is immersed in quicksilver *a* or other fluid, which forms a seal and prevents air from passing the plunger. The plunger C is fixed to a downwardly-extending rod, C′, which works through a stuffing-box, *b*, in the head B′ of the inner cylinder, B.

D designates an inlet or suction pipe, through which air enters the cylinder A below and within the plunger, and in the top of the plunger is an upwardly-opening valve, *c*, through which air passes above the plunger. The valve *c* consists of a flexible disk or flap, secured in place at the center by a nut on the rod C′, so that it can rise from its seat at the periphery.

At the lower end of the inlet or suction pipe D is a suction-valve, *d*, and as the plunger C rises air is drawn in under it through the pipe D, while as the plunger falls or is forced down the air escapes through the valve *c* into the portion of the cylinder A above the plunger.

E designates a motor-cylinder erected on the head A^2 of the cylinder A; and F designates a piston fitting therein, and connected with the plunger C by a piston-rod, F′, composed of two bars or rods, as best shown in Fig. 2. At the lower end of the cylinder E is a stationary cross-bar or abutment, G, which extends between the two bars or rods of the piston-rod F′, and in the piston F is an up-

wardly-opening valve, *e*, which is opened as the piston reaches the lower end of its stroke by striking against the cross-bar or abutment G.

H designates a chamber or stove, which surrounds and incloses the motor-cylinder E; and I designates a Bunsen burner, which is employed for heating the stove or chamber. The stove or chamber H is provided with openings or perforations at the bottom for the ingress of air, which will be heated by the burner, and the motor-cylinder will be surrounded by heated air, which will vaporize any hydrocarbon liquid therein.

J designates a pipe, through which the hydrocarbon is introduced into the motor-cylinder. In said pipe is a stop-valve, *f*, which provides for entirely shutting off the supply when desired, and a check-valve, *g*, which prevents the expansive force of the vapor in the motor-cylinder from forcing back the hydrocarbon liquid in the pipe. As here shown, the pipe J enters the stove or chamber H, near the bottom, and thence passes upward between the motor-cylinder and the stove or chamber to the top of the cylinder, where it enters. By the passage of the hydrocarbon liquid through the portion of the pipe J in the stove or chamber H it is vaporized or so highly heated that when it enters the cylinder it will be at once vaporized. The expansive force of the vapor in the motor-cylinder E forces the piston F and the air-piston downward, and as the piston reaches the lower terminus of its movement the valve *e* strikes the cross-bar or abutment G and is opened, allowing the vapor to escape into the cylinder A above the plunger, where it becomes mingled with the air. The open end of the cylinder E and the aperture in the top of the cylinder A, over which it is placed, constitute an opening through which the hydrocarbon vapor may enter the cylinder A of the air-pump. The gas passes from the air-pump through a service-pipe, K, which is provided with a check-valve, *h*, and the gas for supplying the burner I may be taken by a pipe from the service-pipe K.

L designates a series of lazy-tong levers, which are mounted upon a fixed center, *i*, and at the upper end of these lazy-tong levers is a collar, *j*, through which the rod C′ of the plunger C works loosely; and *k* designates a spring arranged on the said rod between the loose collar *j* and a collar, *l*, fast on the rod C′. As the plunger C is forced downward, more or less motion is transmitted to the lazy-tong levers L through the spring *k*, and as the lazy-tong levers are contracted that portion above the fixed center *i* is depressed, while the portion below said center is raised. The downstroke of the air-pump is always made quickly, but the upstroke is slow, in proportion as gas is drawn from the service-pipe K, and is effected by a lever, M, pivoted or fulcrumed at *m*, and having a weight, M′, secured upon it. The action of the weight causes a pressure of the gas in the cylinder A, and this pressure may be varied by shifting the weight and securing it in any desired position on the lever M.

N designates the supply-pipe of the hydrocarbon liquid, which may lead from a tank or other source of supply; and O designates a diaphragm-pump, which is operated by a lever, O′, which is fulcrumed at *n* and is connected with the lower end of the lazy-tong levers L. The pump O is provided with a suction-valve, *o*, and a discharge-valve, *o′*, and the liquid discharged by the pump at each downward movement of the plunger C is discharged into an air vessel or accumulator, P, from which the pipe J extends.

Q designates a valve-box, arranged in the pipe J and containing a valve, *p*, which is operated by a toe on the rock-shaft *q*, which is oscillated by an arm, *r*, which is connected with a beam or tilting-lever, R, by a link, *s*, so that as said beam or lever is vibrated or rocked the valve *p* will be opened and closed. The beam or lever R consists of a closed tube, containing or loaded with mercury or analogous substance, which is fulcrumed at *t*, and which forms a desirable device for quickly opening and closing the valve *p* at the desired times. When the lever R is in the position shown in full lines the valve *p* is closed; but as the plunger C rises the lazy-tong levers expand and a pin or stud, *u*, therein acts upon the lever to tilt it. As soon as the lever passes the horizontal position the mercury runs to the right-hand side of the center and completes the movement of the lever, bringing it into the position shown in dotted lines and opening the valve *p*. As the plunger C moves down, a pin, *v*, in the fixed collar *l*, acts upon the lever R and depresses its left-hand end, and after the lever is moved beyond a horizontal position the mercury changes its position and shifts the lever R so as to close the valve *p*.

The closing of the valve *p* during the downstroke of the plunger cuts off the supply of hydrocarbon liquid to the motor-cylinder, and consequently the generation of power is stopped until the plunger rises far enough, as the gas is consumed, to trip the lever R in the reverse direction and open the valve.

The pump O keeps a supply of liquid in the air chamber or accumulator P under the pressure of air compressed therein by the entrance of the liquid, and as soon as the valve *p* opens the air forces liquid out of the air chamber or accumulator P. It will also be observed that the air-pressure in the accumulator P reacts upon the pump O and forms a resistance to its operation, and therefore it will be understood that as the plunger descends the lazy-tongs and pump O will not be operated until the spring *k* is compressed so that its force is equal to the resistance offered to the pump O by the air-pressure in the accumulator. Hence it will be seen that the pump will make a shorter stroke and a less quantity of liquid will be discharged into the accumulator, and at all times the movement of the lazy-tongs and

pump will be proportionate to the amount of liquid and the resultant tension of the air in the accumulator P.

The spring *k* constitutes a means through which the plunger C operates on the pump and regulates automatically the quantity of liquid forced into the accumulator, and this in turn regulates the quantity forced through the valve *p* and pipe J into the motor-cylinder E.

To start the apparatus the weighted lever M is operated by hand to produce an air-pressure in the cylinder A, the stop-valve in the pipe J is then opened and the burner I lighted, the plunger C and piston F being down at the time and the valve *e* opened.

I am aware that it is old in a gas apparatus to arrange an air-pump cylinder over a motor-cylinder and to connect their pistons, the motor being operated by hydrocarbon vapor, and I do not claim broadly such a construction as included in my invention. In such old apparatus there has been no direct communication for the passage of exhaust hydrocarbon vapor to the air-pump, but the exhaust-vapor together with air from the air-pump, has been discharged into a common main, wherein they were mixed together.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a hydrocarbon-gas apparatus, the combination of an air-pump cylinder provided with an annular extension, an inverted-cup-shaped plunger provided with a valve for the passage of air through its top and working in said cylinder and extension, and a seal of quicksilver or other fluid in said extension for sealing the plunger, a pipe for admitting air to the cylinder below the plunger, an opening for admitting hydrocarbon vapor above the plunger, and a service-pipe for conducting gas from said pump, substantially as specified.

2. In a hydrocarbon-gas apparatus, the combination of an air-pump cylinder provided with an annular extension for quicksilver or other liquid, an inverted-cup-shaped plunger working in said cylinder and extension and provided with a valve for the passage of air through its top, a weight, and connections between said weight and plunger for operating the latter in one direction, a motor-cylinder and piston for operating said plunger in the reverse direction, and a valve for admitting the hydrocarbon vapor from said motor-cylinder to said air-pump cylinder, substantially as specified.

3. The combination, with the air-pump cylinder A and the motor-cylinder E, erected thereon and open at the lower end, of the air-pump plunger C and the motor-piston F, connected together, the valve *e* in the said piston, and the abutment G for opening said valve, substantially as specified.

4. In a hydrocarbon-gas apparatus, the combination, with an air-pump and a motor for working the air-pump, of an air chamber or accumulator, a pipe leading therefrom to the motor for supplying liquid hydrocarbon to said motor, a liquid-pump for maintaining a supply of liquid in the accumulator, and devices for operating the liquid-pump from the air pump or motor, comprising a spring through which the power is transmitted to said liquid-pump, substantially as and for the purpose specified.

5. In a hydrocarbon-gas apparatus, the combination, with an air pump and a motor for operating the same, of an accumulator, a pipe through which liquid is supplied to said motor from said accumulator, a valve controlling communication between said accumulator and motor, and connections between said motor and valve through which said valve is opened and closed positively by said motor, substantially as specified.

6. The combination of the air-pump A C, the motor E F, the accumulator P, the pump O, the oil-supply pipe J, the valve *p*, the lever R, and devices connecting it with said valve, and the lazy-tong levers L, and connecting-rod C′, substantially as specified.

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Witnesses:
CHANDLER HALL,
T. J. KEANE.