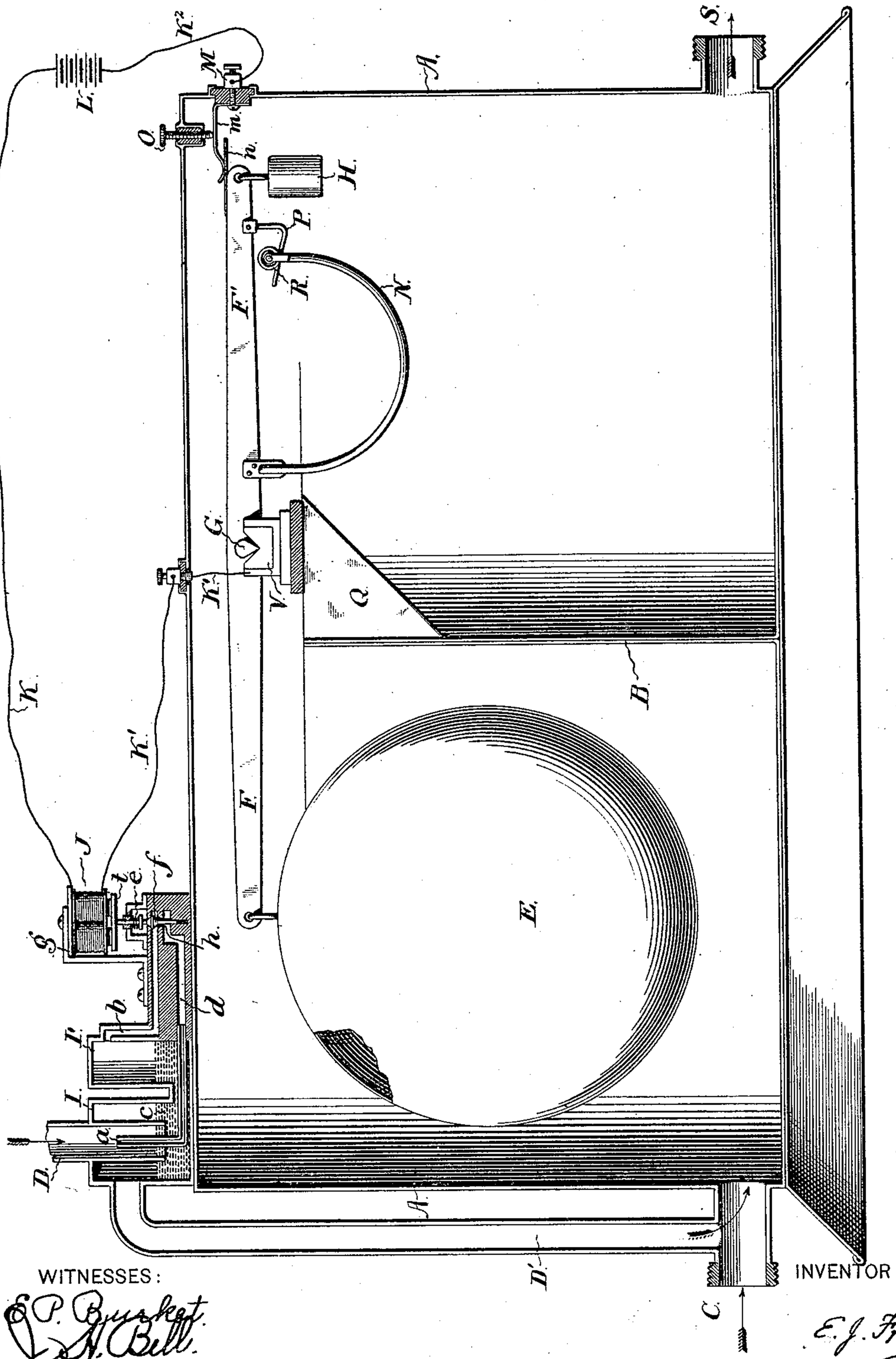
(No Model.)

E. J. FROST.

DEVICE FOR REGULATING THE QUALITY OF CARBURETED VAPOR OR GAS.

No. 451,037. Patented Apr. 28, 1891.



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DEVICE FOR REGULATING THE QUALITY OF CARBURETED VAPOR OR GAS.

SPECIFICATION forming part of Letters Patent No. 451,037, dated April 28, 1891.

Application filed July 6, 1888. Serial No. 279,204. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. FROST, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Devices for Regulating the Quality of Carbureted Vapor or Gas, whereof the following is a specification, reference being had to the accompanying drawing, which represents a vertical central section through the apparatus.

In Letters Patent of the United States No. 381,619, granted to me under date of April 24, 1888, I have described an apparatus for the above purpose.

My present invention relates to a device of the same general character, but with improved details of construction, which render it much more sensitive and efficient under the conditions of use.

In the accompanying drawing, A represents a closed cylindrical vessel mounted upon a suitable base and partially divided by a vertical partition B, which extends from the bottom of the vessel to a short distance from the top thereof. The inlet-pipe C for gas and air is situated near the bottom of one of the divisions made by the partition B, while the exit-pipe S is similarly situated upon the other side of said partition. The carburetor may be of any of well-known types, and I do not deem it necessary to describe the same. Upon the frame Q, secured to the partition B, I provide a suitable fulcrum V for the knife-edge G of a scale-beam F F′. Upon one arm F of this scale-beam is suspended a "float" E, preferably an air-tight globe of thin copper or other metal, and upon the other arm F′ is a counter-weight H. In addition to said counter-weight, I provide the following compensating device adapted to maintain equilibrium under changes of temperature.

A closed U-shaped metal tube N is attached at one end to the under side of the arm F′ and carries at its other or free end a small friction-roller R, which rests upon a finger P, also attached to the under side of the arm F′. The counter-weight H is somewhat less in weight than the globe E, the difference being made up by the weight of the tube N, which is filled with alcohol or other non-congealable liquid.

When the temperature rises, the alcohol in the tube N expands, and the pressure tends to straighten the tube, thus forcing its free end outward, the friction-roller moving along the finger P. This different distribution of the weight upon the arm F′ can be made to exactly compensate any disturbance of equilibrium which would otherwise occur from changes of temperature affecting the other arm F and the globe E.

The method by which the air-supply is controlled will now be described. The air-current arrives through the air-supply pipe D, which terminates near the bottom of a cylindrical chamber I, from whose upper portion an air-conducting pipe D′ leads to the inlet-pipe C of the gas. At the bottom of the chamber I a lateral passage leads to a second chamber I′. A pipe *a*, of small bore, leads from the interior of the air-supply pipe D some distance above its end, and then extends at a right angle across to a passage *d*. From a point near the top of the chamber I′ a passage *b* leads downward, and then turning at a right angle extends along above the passage *d*, with which it communicates near its end by a small opening *h*, tapered on its upper side to form a seat for a double cone-valve *f*. The passage *b* communicates with the outside air by means of a second tapered opening situated immediately above the opening *h* and controlled by the reverse cone of the valve *f*. The stem of said valve extends up through a suitable guide and carries an armature *t* of an electro-magnet J, mounted upon an overhanging standard *g*. The stem is also provided with a spring *e*, which normally tends to hold the valve *f* down upon the seat *h*. Said electro-magnet is in circuit with a battery L, the circuit being formed through the wire K, leading from one pole of said battery, the wires K^2, leading from the other pole of said battery to a binding-post M, connected with the contact-piece *m*, which normally is in contact with the second contact-piece *n*, mounted upon the end of the arm F′, and the wire K′, which leads (suitably insulated in passing through the top of the vessel A) to the fulcrum V. The apparatus is operated with a closed circuit, and the electro-magnet J is normally energized, so that the valve *f* is raised to its highest po-

sition. This closes the opening to the outer air and opens connection between the passages *b* and *d*. The lower portion of the chambers I I′ is filled with mercury, which rises therein to the level indicated at *c*, slightly above the delivery end of the air-pipe D.

Assuming that the apparatus has been set to maintain the gas at a definite degree of richness, and that the scale-beam is in equilibrium, with its contact-piece just touching the piece *m*, the maintenance of the circuit retains the armature *t* in its uppermost position. An equilibrium of air-pressure in the chambers I I′ is maintained through the pipe *a* and passages *d b*, so that the mercury in both chambers will stand at the same level, as indicated in the drawing. This seals the end of the pipe D, so that no air is admitted to dilute the gas. As soon, however, as the density of the gas increases above the desired standard the float E is buoyed up and the arm F′ of the scale-beam descends, breaking the circuit by separating the contact-pieces *m n*. The circuit being thus broken, the electro-magnet J ceases to act, and the spring *e* forces down the valve *f* upon its lower seat *h*, thus cutting off connection between the passages *d b* and opening the passage *b* to the outer air. Thereupon the air which has been confined in the chamber I′ will escape, and the mercury will be forced down in the chamber I and into the chamber I′ until the end of the pipe D is no longer sealed, whereupon the air-current will enter the chamber I, and thus pass by the air-conducting pipe D′ to the inlet-pipe C, diluting the gas. The spring *e* must be of sufficient strength to overcome the pressure of the air upon the under side of the valve *f*, so that it may be maintained in the closed position above mentioned. So soon as the gas has been sufficiently diluted to restore its specific gravity to the normal standard the float E will descend and reestablish the contact between the pieces *n m*, whereupon the electro-magnet J will again be energized and draw up its armature *t* and raise the valve *f* to the normal position. The mercury will then descend until the level of the mercury in the two chambers I I′ is the same. I have described the system as operated by a closed circuit; but obviously an open-circuit system might be employed, the valve *f* being in such case held in its closed normal position by its spring and opened by the positive action of the magnet when energized by the movement of the scale-beam closing the circuit.

Having thus described my invention, I claim, in a regulating device for carburetors having the usual air-supply, the following combinations of parts interposed between the carburetors and the burners:

1. The combination of an inclosing receptacle into which both the vapor-pipe and air-blast pipe lead, a balance-beam, a float mounted upon one arm thereof, an electro-magnet controlling the valve, which in turn controls the air-blast pipe, an electric circuit for said magnet, and devices, substantially as set forth, whereby said circuit is modified in correspondence with the movements of the balance-beam.

2. The combination of the closed vessel having an exit-pipe and a vapor-inlet pipe, the air-conducting pipe communicating with said vessel, the float and its balance-beam within the vessel, the air-supply mechanism provided with the communicating passages and air-outlet opening, the valve controlling said outlet-opening and the communication between said air-passages, the electro-magnet actuating said valve, the electric circuit including the balance-lever, and the contacts, one of which is carried by the balance-lever, substantially as and for the purpose set forth.

3. The combination of the closed vessel having an exit-pipe and a vapor-inlet pipe, the air-conducting pipe communicating with said vessel, the float and its balance-beam within the vessel, the communicating chambers containing mercury, with one of which chambers the air-conducting pipe connects, the air-supply pipe projecting down into the chamber from which the air-conducting pipe leads, the communicating air-passages, one of which is supplied with an air-outlet opening, the pipe establishing communication between the other of said passages and the air-supply pipe, the valve controlling the air-outlet and the communication between the air-passages, the electro-magnet actuating said valve, the electric circuit including the balance-lever, and the contacts, one of which is carried by the balance-lever, substantially as and for the purpose set forth.

4. The combination of the closed vessel having the exit-pipe and the vapor-inlet pipe, the air-conducting pipe communicating with said vessel, the float and its balance-beam within the vessel, the communicating chambers containing mercury, with one of which chambers the air-conducting pipe connects, the air-supply pipe projecting down into the chamber from which the air-conducting pipe leads, the communicating air-passages, one of which is supplied with an air-outlet opening, the pipe establishing communication between the other of said passages and the air-supply pipe, the valve controlling the air-outlet and the communication between the air-passages, the spring acting upon the valve, the armature also actuating the valve, the electro-magnet, the electric circuit within which the balance-lever is included, and the contact-pieces by which the circuit is made and broken, substantially as and for the purpose set forth.

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