(No Model.) 4 Sheets—Sheet 1.

E. DELAMARE-DEBOUTTEVILLE & L. MALANDIN.

GAS OR CARBURETED AIR ENGINE.

No. 511,593. Patented Dec. 26, 1893.

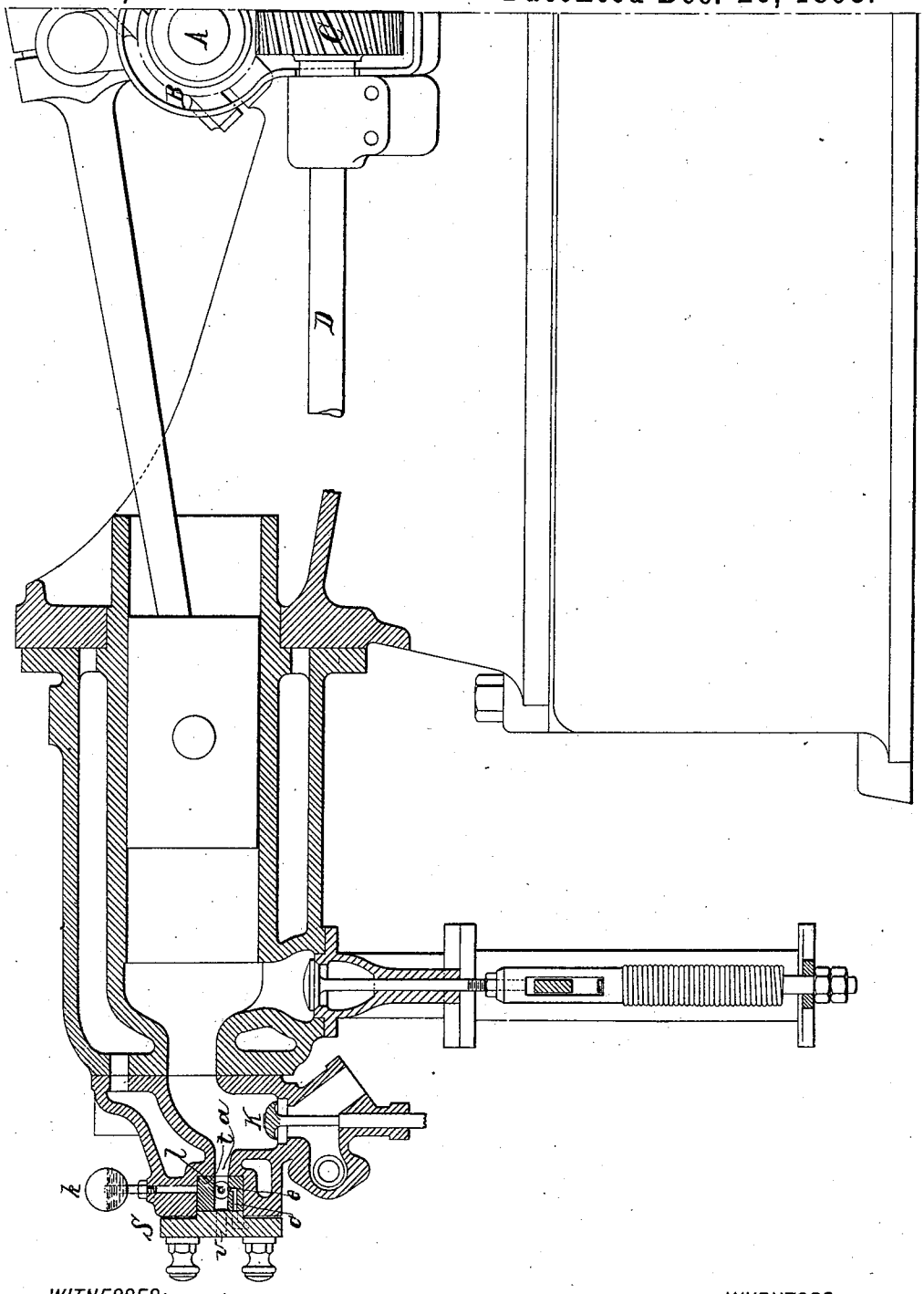

FIG. 1.

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FIG. 4.

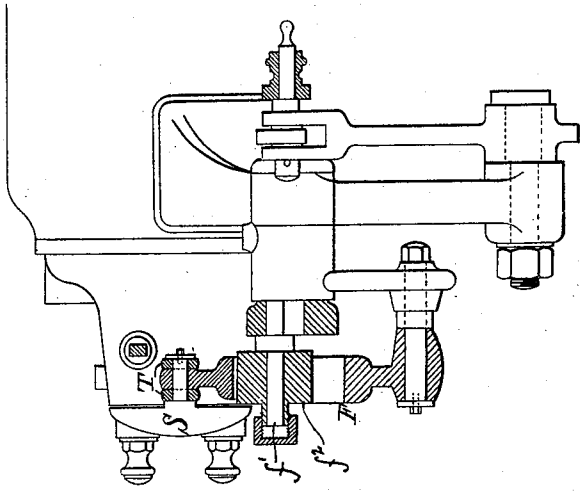

FIG. 2.

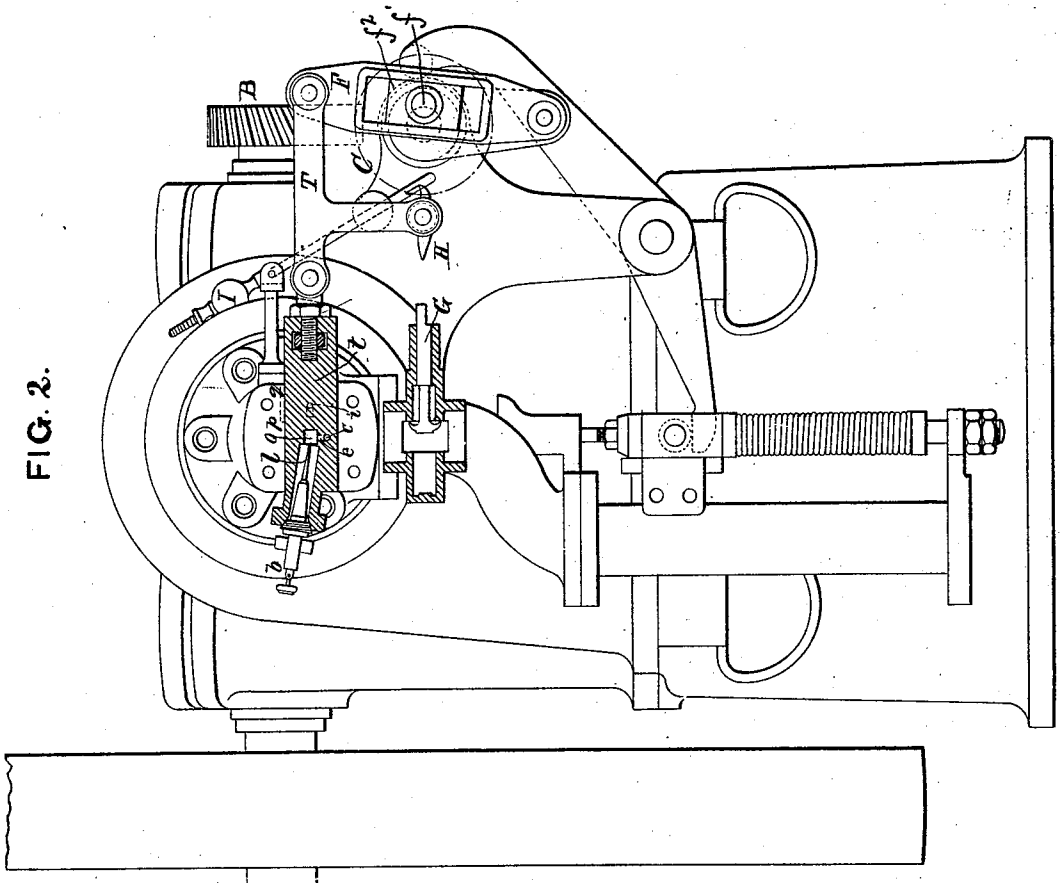

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FIG. 3.

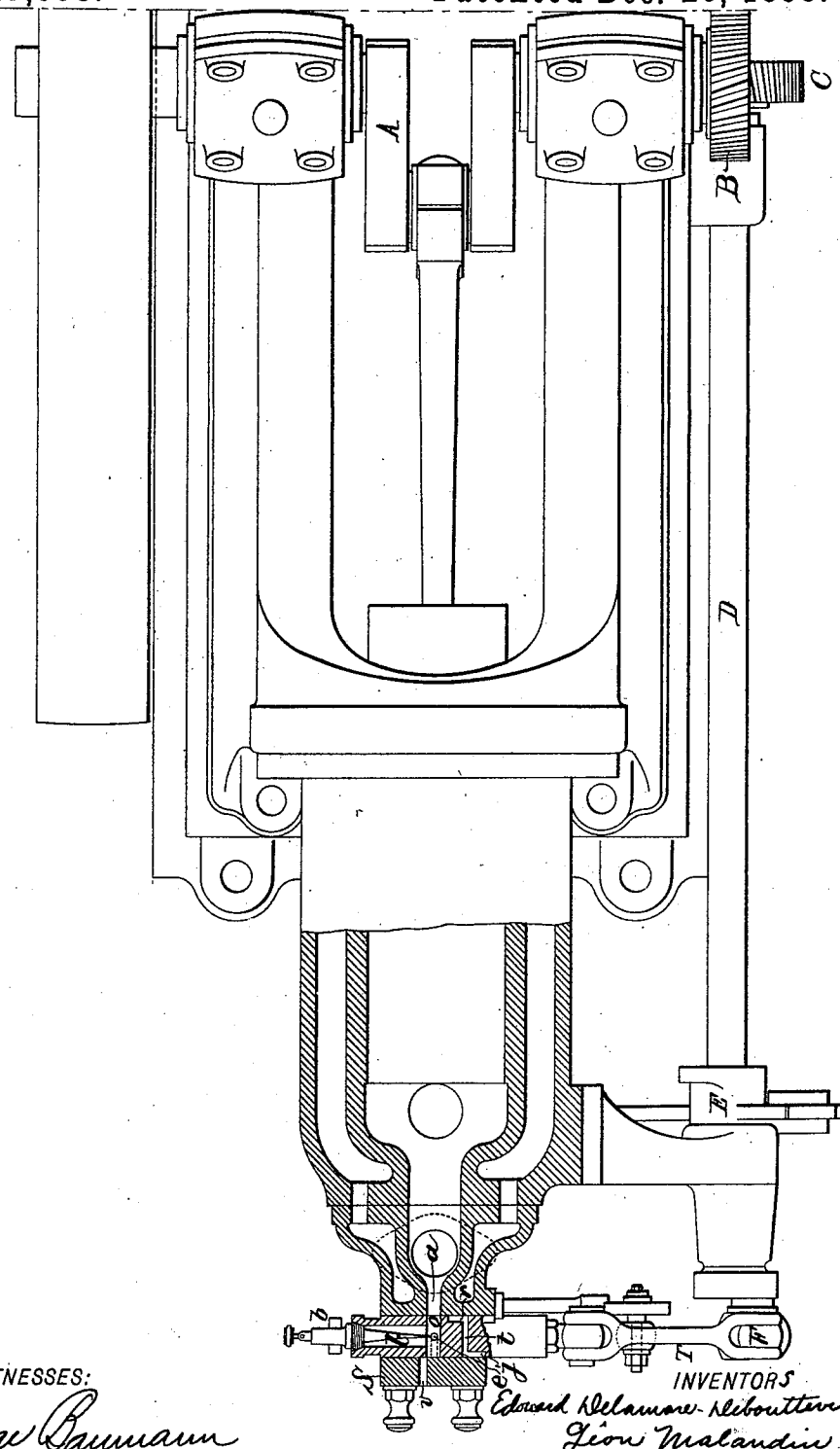

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FIG. 10.

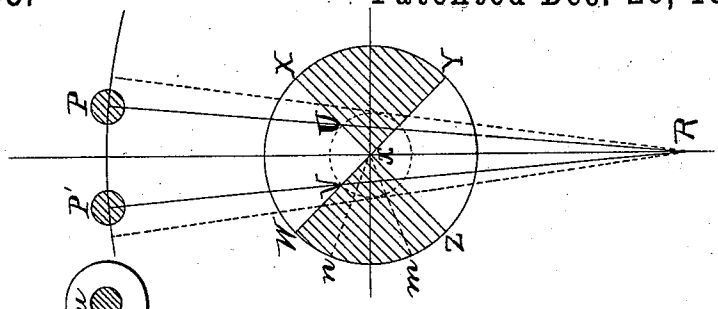


FIG. 9.

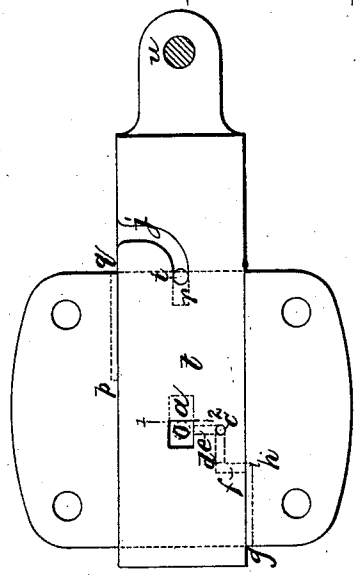


FIG. 9a.

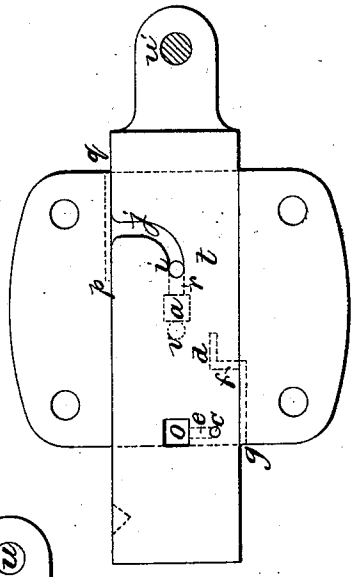


FIG. 5.

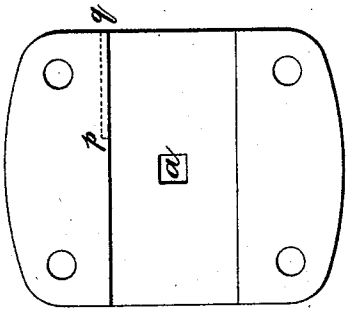


FIG. 6.

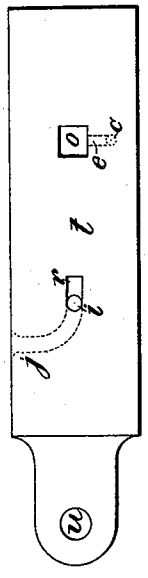


FIG. 7.

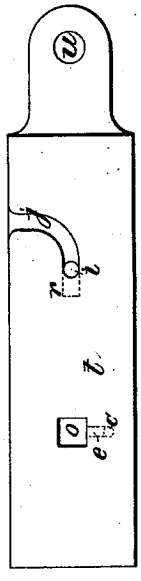
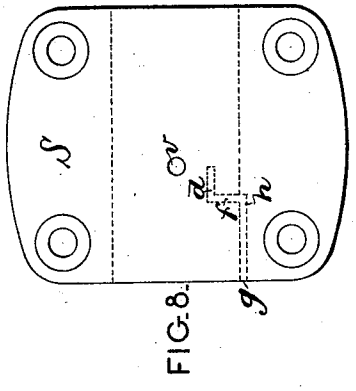


FIG. 8.



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UNITED STATES PATENT OFFICE.

EDOUARD DELAMARE-DEBOUTTEVILLE AND LÉON MALANDIN, OF FOUNTAINE-LE-BOURG, FRANCE.

GAS OR CARBURETED-AIR ENGINE.

SPECIFICATION forming part of Letters Patent No. 511,593, dated December 26, 1893.

Application filed July 8, 1892. Serial No. 439,364. (No model.)

To all whom it may concern:

Be it known that we, EDOUARD DELAMARE-DEBOUTTEVILLE and LÉON MALANDIN, citizens of the Republic of France, and residents of Fountaine-le-Bourg, (Seine-Inférieure,) France, have invented Improvements in Gas or Carbureted-Air Engines, of which the following is a specification.

Our present invention has reference to certain improvements in the construction of the gas or carbureted air engine for which we have obtained Letters Patent of the United States, Reissue No. 10,951, dated July 31, 1888, No. 400,754, dated April 2, 1889, and No. 424,099, dated March 25, 1890.

Our present improvements have more particular reference to the construction of the slide valve and the mechanism for operating the same, as hereinafter more fully described.

In the accompanying drawings, Figure 1 is a vertical and longitudinal section of our improved engine. Fig. 2 is an end view, partly in section, the cover of the slide being removed. Fig. 3 is a plan view, partly in section. Fig. 4 is a side view, also partly in section, of the end of the cylinder, and part of the valve mechanism. Fig. 5 represents a face view of the end of the cylinder, but with the slide and its cover removed. Fig. 6 is a view of that face of the slide which moves in contact with the face of the cylinder. Fig. 7 shows the external face of the slide which is in contact with the cover. Fig. 8 is an end view of the cover. Figs. 9 and 9ª show the end of the cylinder and the slide with the latter in different positions. Fig. 10 is a diagram to illustrate the four periods in the operation of the engine.

The ignition of the gaseous mixture is produced by a continuous electric spark in the slide. For this purpose a conducting wire insulated in a porcelain plug *b*, Figs. 2 and 3 terminates in the platinum point in an aperture *l* of the slide. The spark plays between this platinum point and the wall of the opening or chamber *o* which may be furnished with a platinum point or not as desirable. One of the terminals of the electric circuit is in connection with the conductor in the plug *b* while the other connects with the metallic frame of the engine.

By a reciprocating movement the slide *t*, actuated by a rod T, puts the opening *o* in the slide and the port *a* in the end of the working cylinder in communication with each other at the desired moment to cause the ignition of the explosive mixture which thus imparts its energy to the piston. When we made the opening *o* communicate only with the end of the cylinder, as in our former construction, we experienced objections which led us to apply the electric igniting device to the cover of the slide. Now we make this opening communicate also with the cover S, that is, the opening *o* is cut entirely through the slide so that the pressure produced by the explosion instead of acting directly upon the slide acts upon the cover, and the objections previously experienced entirely disappear. By this construction the valve is balanced. In the slide and cover are provided two sets of passages, one set *c*, *d*, *e*, *f* and *g*—*h* to permit of the purging or discharge of the burned gases from the opening *o* in the slide at the desired moment, while the other set of passages *i*, *j*, *p*—*q* permits of the admission of air to facilitate ignition at a certain point in the movement of the slide. The piston makes two reciprocations for each reciprocation of the slide.

The diagram, Fig. 10, illustrates the four periods in the operation of the engine corresponding with each complete back and forth movement of the slide, as follows: From Z to W represents the period of admission to the engine cylinder of the mixture of air and gas through the opening controlled by the valve K (Fig. 1), and during that time the piston is making an outward movement; from W to X in the diagram, Fig. 10, represents the period of return movement of the piston and compression of the gaseous mixture in the cylinder; from X to Y represents the ignition and explosion period and consequently the second outward movement of the piston, and finally from Y to Z represents the period of the second inward movement of the piston and discharge of the burned gases from the cylinder. When the vibrating lever F for operating the slide has reached the point U in the diagram, Fig. 10, at the commencement of the ignition, the head of this arm is at P, and the point of con-

nection with the slide is at *u*, Fig. 9. At this moment the opening *o* of the slide ought to be edge for edge with the port *a* at the end of the cylinder, and the piston at the end of its compression stroke; also at this moment the opening *c*, Figs. 1 and 7, is in communication (Fig. 9) with the passage *d* in the cover of the slide, Fig. 8. Then the purging of the opening *o* in the slide commences through the openings *e c d* and *f* and the long narrow slot indicated at *g h* in the cover of the slide in a manner similar to that described in our reissued Patent No. 10,951. The ignition then takes place, and the piston is driven back in the cylinder during a period corresponding to the sector X to Y, Fig. 10. During the expulsion period following, corresponding to the sector Y to Z, the slide has moved toward the position Fig. 9ª, and when the slide has reached a position corresponding to *m* in the diagram, Fig. 10, the opening *i* of the slide, Figs. 6 and 7, is put in communication with the port *a* at the end of the cylinder. Air is then introduced through the slide into the end of the cylinder at the port *a*, during a period corresponding with the sector *m*, *x*, *n*. Fig. 9ª shows this introduction at the moment when the operating lever has arrived at V, Fig. 10, the end of the air and gas admission; the head of this lever is then at P′ and the connection with the slide at *u′*, Fig. 9ª. This introduction of air is made through the passages *i*, *j p q*, in the slide and cover and for the purpose of adding oxygen to the gases immediately at the port *a*, and offering a small body of more inflammable mixture at the point of ignition to facilitate the explosion. This introduction of air through the slide can be prolonged to W, Fig. 10, by employing a slot *r* as shown in Fig. 6. The slot *p q* is made in the cover of the slide and a lubricator *k*, Fig. 1, may be provided to permit a little oil to be drawn in with the air, if desired, for lubrication.

There will be observed in the cover S, Fig. 8, an opening *v* pierced through and in such a form that it may communicate with the end of the cylinder, Fig. 9. This opening is employed for starting the engine. When the introduction of the explosive mixture is to be made through this opening the orifice *o* is put in communication with the port *a*.

Movement is transmitted through the crank A to the worm pinions B, C, Figs. 1, 2 and 3, the pinion C being keyed upon the longitudinal shaft D, which also carries the escapement cam E and which operates the slotted vibrating lever F through the crank pin *f′* and slide f^2. This lever F, which is pivoted at its lower end to the frame and at its upper end to the connecting rod T controls the gas valve G, Fig. 2, through the movement of this T-shaped connecting rod T. The connecting rod T controls, through its upper part, the slide, and through its lower part, the gas valve by means of the oscillating knife edge H. The knife edge H is itself controlled by the pendulum I, as described in our above mentioned Letters Patent No. 424,099.

The valve K which controls the admission of the gaseous mixture to the cylinder may be automatic in its movement, as indicated in the drawings or controlled by a special lever actuated by a cam.

We claim as our invention—

1. A gas or carbureted air engine having a valve for the admission of the air and gas and provided with igniting devices and a slide to determine the point of ignition, the said slide having also an air inlet to admit a small quantity of air to the explosive mixture in the cylinder near the ignition port, prior to the compression, substantially as and for the purpose described.

2. A gas or carbureted air engine having a valve for the admission of the air and gas and provided with igniting devices and a slide to determine the point of ignition, the said slide having also an air inlet to admit a small quantity of air to the explosive mixture in the cylinder near the ignition port, prior to the compression, and a lubricator communicating with the said air inlet to admit a small quantity of oil to be drawn in with the air.

3. A gas or carbureted air engine having a valve for the admission of the air and gas and provided with igniting devices and a slide provided with an ignition chamber and a purging passage leading from the said chamber to the external air the said slide having also an air inlet to admit a small quantity of air to the explosive mixture in the cylinder near the ignition port, prior to the compression, substantially as and for the purpose described.

4. The combination of a gas engine cylinder provided with a valve for the admission of air and gas, and provided with igniting devices and a slide to determine the point of ignition, with a longitudinal driving shaft having a crank pin with a vibrating lever acted upon by the said crank pivoted at one end to the frame and a T-shaped connecting rod connecting the vibrating lever and the slide, and adapted to act upon the said air and gas admission valve, substantially as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

EDOUARD DELAMARE-DEBOUTTEVILLE.
LÉON MALANDIN.

Witnesses:
EMILE CHESNÉE,
C. GERMAIN.