

(No Model.)

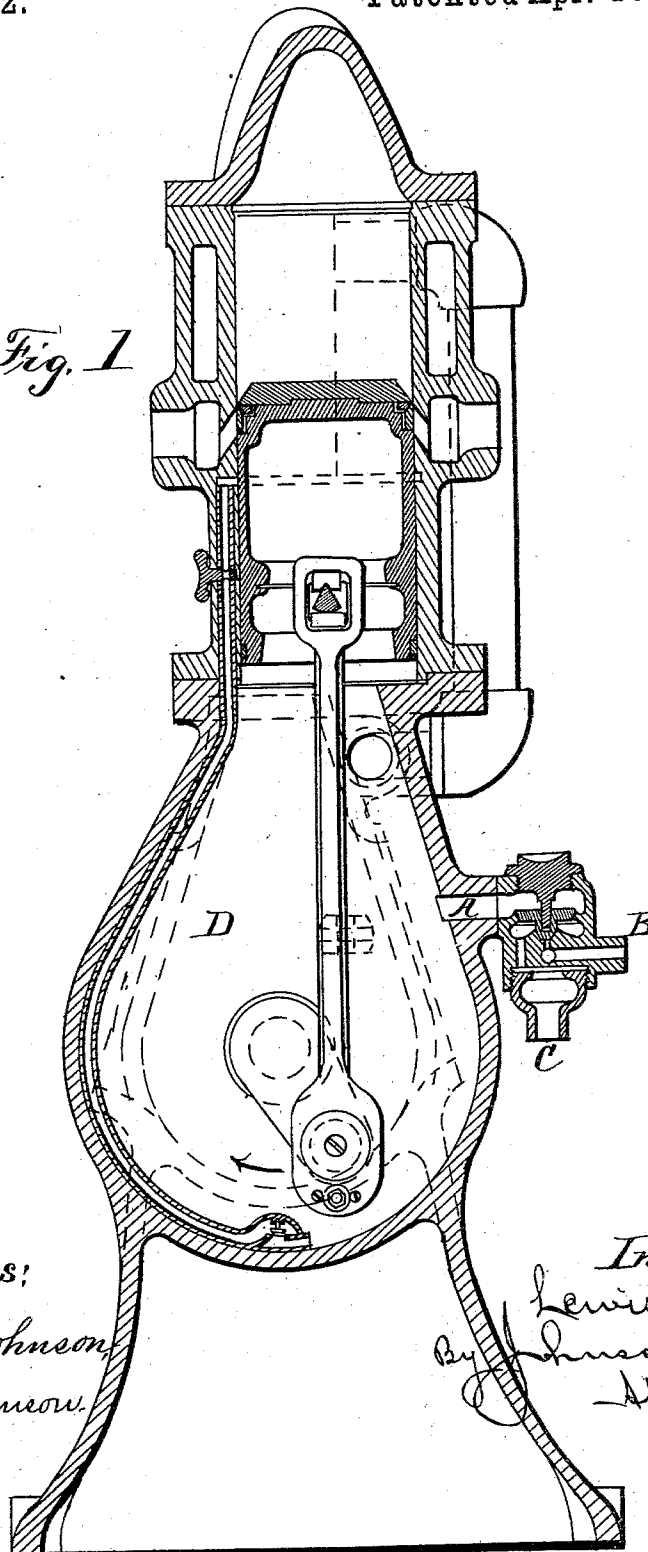
2 Sheets—Sheet 1.

L. H. NASH.
FUEL MIXING DEVICE FOR GAS ENGINES.

No. 401,452.

Patented Apr. 16, 1889.

Fig. 1



Witnesses:

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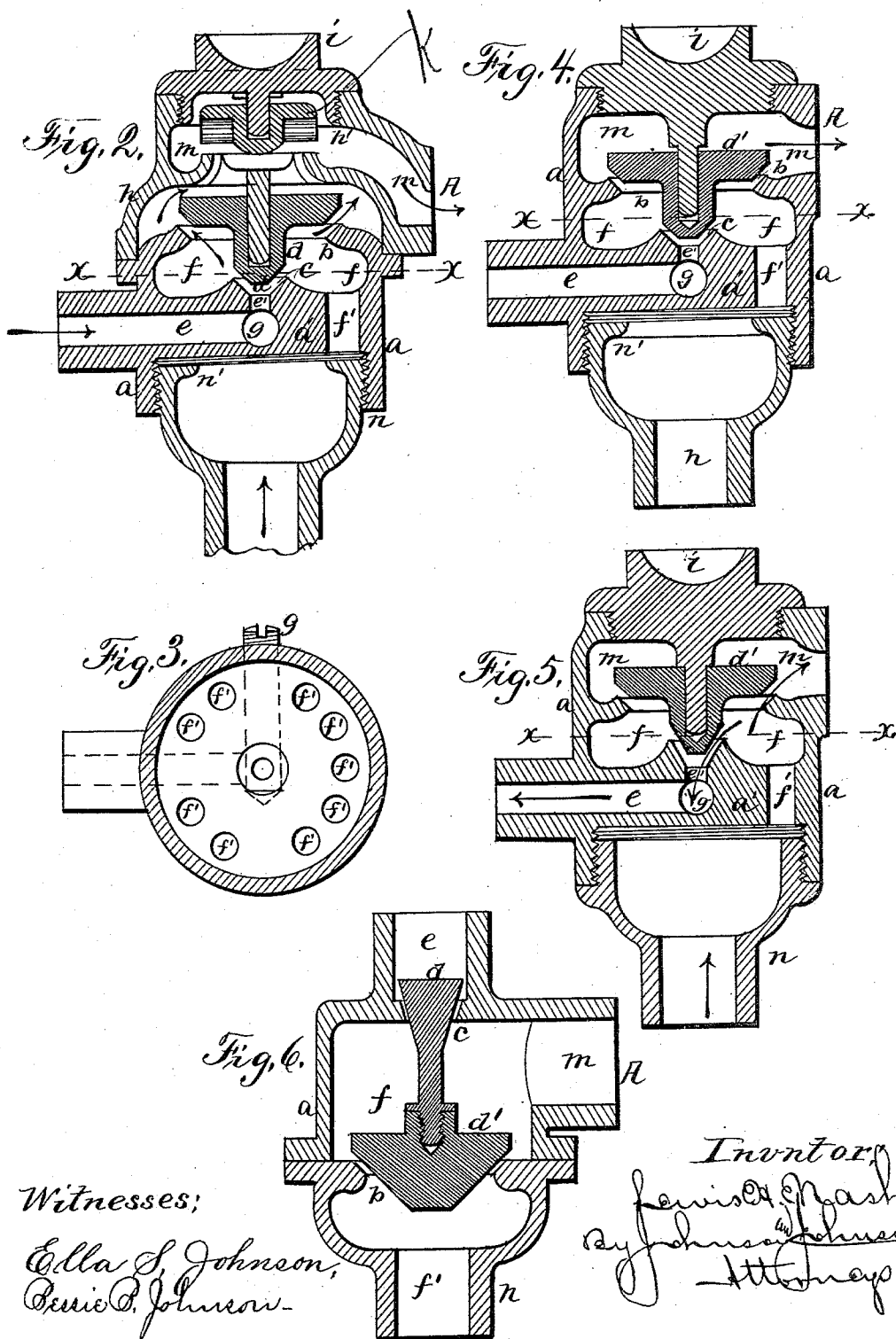
Lewis H. Nash

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UNITED STATES PATENT OFFICE.

LEWIS HALLOCK NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

FUEL-MIXING DEVICE FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 401,452, dated April 16, 1889.

Application filed October 6, 1886. Serial No. 215,417. (No model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Fuel-Mixing Devices for Gas-Engines, of which the following is a specification.

My invention relates to devices for supplying gas-engines with a combustible mixture for the charge; and the object of my improvement is to automatically regulate the relative proportional supply of gas and air to the power-cylinder, so that the charge of combustible mixture shall be of uniform quality. In affecting this object a mixture of any desired density is formed by varying the relative proportion of the gas and air. As the heat-giving power of gas varies according to its quality, the adjustment of the relative area of separate valve-ports to produce the best working mixture for gases of different qualities is an important advantage in the working of a gas-engine. For this purpose I use a weighted check or lift valve having two separate joint-forming faces, operating separate ports of unequal capacities leading, respectively, to the air and gas supply passages. In their flow the gas and air in separate currents lift the valve, so that they pass through ports of definite capacities, and the relative quantities of each constituent are regulated by the relative size of these ports. I use a comparatively heavy valve to cause a definite resistance to be offered to the flow of the separate currents, so that the relative resistances to their flow shall be of an amount great enough at all times to control the proportional flow of each constituent, and the valve is therefore made heavy enough to make certain that there shall be a certain definite resistance to the flow of each constituent in all cases when the engine is working. Provision is made for preventing leakage of gas being forced back into the supply-pipes and diluting the succeeding charge of gas, so as to destroy its uniform proportions.

I have shown several constructions of my improved mixing-valve adapted to various conditions of use with a gas-engine, which I

will now describe in connection with the drawings, in which—

Figure 1 represents a vertical section of an engine having my mixing device; Fig. 2, an enlarged vertical section of my improved mixing device having coacting check-valves; Fig. 3, a horizontal section on the line xx of Figs. 2, 4, and 5, the mixing-valve being removed. Fig. 4 shows a modification in which the separate check-valve is not used. Fig. 5 shows a modification in which the cone-seats do not have the same taper. Fig. 6 shows a modification in which the smaller conical valve-seat is above the larger valve.

The device forms an attachment for a compression-pump, D, of the engine, as seen in Fig. 1, the connection with the compression-pump being made at A, so that the pump draws its charge through the mixing device, which connects with the gas-supply pipe at B and has a perpetual open-air inlet at C. The case a of the device is formed with an interior chamber, f , and two valve-ports, b and c , of unequal area, with which a conical valve of corresponding separate valve parts operates vertically by its weight to control the flow of gas through the smaller valve-seat, c , and to control the flow of the air through the larger valve-seat, b . In the construction shown in Figs. 1, 2, 3, 4, and 5 the chamber f is formed between the valve-seats, and the larger of the latter is directly above the smaller, the valve being central with both. The case a is preferably of circular form and has a horizontal partition-plate, a' , which forms the bottom of the chamber f and has a central opening, e' , which opens in the small upward-flaring valve-seat c and into said chamber, and communicates with the gas-supply by the horizontal passage e in said partition-plate.

The chamber f is supplied with air through a series of openings, f' , in the bottom plate, which are made of definite size in relation to the gas-supply valve-seat opening. The upper valve-seat, b , flares upward and is formed in the top of the chamber f , and the valve has conical seats corresponding with the seat-openings b and c , the upper valve being formed by a disk, d' , and the lower valve by

a downward central cylindrical projection, d , from said disk, forming a lifting-valve guided by a fixed central pin upon which the valve is fitted. The valve-chamber is inclosed by a cover, h , which in the construction shown in Fig. 2 carries the guide-pin for the valve d d' , and has a seat, h' , for a check-valve, k , operating in a suction-passage, m , of said cover, which communicates with the compression-pump of the engine. The valve k is guided upon a pin depending from a nut, i , which covers the suction-passage m . The check-valve k has a flat seat formed in the bottom of the suction-passage, and the latter communicates with the chamber f by the valves. The supply of gas to the chamber f is controlled and regulated by a screw-plug, g , fitted in a screw-threaded horizontal opening in the case, so that the inner end of said screw-plug crosses the central opening, e' , below the lower valve-seat, c , and is set to open and to close said opening more or less, the adjustment of said plug being made from the outer side of the case a , as seen in Fig. 2.

The supply of air to the chamber f is controlled and regulated by a screw-cup, n , which screws into the lower open end of the case a , so as to close more or less the openings f' in the bottom plate, a' , of said chamber f , the inner end of said cup for this purpose being formed with an inward-projecting rim, n' , wide enough to close said openings f' when the cup is driven up against the said bottom plate.

The modifications shown in Figs. 4, 5, and 6 will be explained hereinafter.

In the operation of the mixer the force of the suction of the compression-pump in drawing its supply through the device lifts the valves k and d , so as to open communication of the compression-pump with the chamber f , which thereby opens communication of the gas and air passages e' and f' with the said pump. Now the relative quantity of gas and air that will be drawn into the chamber f will depend upon the relative size of the supply-passages e' and f' . To increase the supply of gas, the screw-plug g is drawn out to increase the area of the supply-opening e' , and the screw-cup n is driven in to lessen the supply-openings f . To increase the air-supply over the gas-supply the reverse of these adjustments is made, and these adjustments may be made separately to regulate the supply of the gas or of the air.

The double-seat valve is made of sufficient weight to greatly overcome the pressure of the gas in the pipe e , so that whenever the device is in action the force of the suction will be considerable, and the slight variations in the pressure of the gas-supply usual in service-pipes of cities will therefore have little effect as compared with the suction of the pump in controlling the flow of the gas and air. It is therefore practically necessary only to consider the gas as having approximately the same pressure as the air, and the conditions

are obtained whereby the two currents are drawn from separate supply-passages having substantially equal pressures into a chamber in communication with the compressor. Under these conditions the flow of each constituent will be proportional to the capacity of the supply-passages $e' f'$. When the suction of the pump stops, the double-seated valve closes by its weight, cutting off both gas and air until the next action of the pump.

The advantage of using the supplemental check-valve k is that it may be relied upon to make the joint in the device perfect between the pump and the gas-supply pipe e , to prevent the return of gas, whereby the double-seated valve is only required to perform the office of mixing the gas and air, as stated. When the supplemental valve k is not used, then the prevention of the return of gases from the passage m is effected by the upper valve, d' , and the lower valve, d , is thereby relieved of back-pressure from the pump, because this gas-controlling valve operates within a chamber which is always open to the air. By this construction no leakage of gases from back-pressure can reach the gas-supply pipe, for if there should be leakage from any imperfection of the valves and their seats such leakage will flow into the chamber f and pass out into the air through the openings f' in the bottom of said chamber, so that the gas-supply cannot become fouled or diluted.

As the size of the openings e' and f' in the bottom of the chamber f control the proportional flow of the constituents, the form of the valve-seats should be such as to lift quickly and completely open the full capacity of the inlet-openings. I may, however, use a double-seated valve, as shown in Figs. 5 and 6, wherein the upper and lower seats are made of different inclinations or tapers, so that the openings b and c will bear a definite proportion to each other in all positions of the valve.

In Fig. 6 the smaller valve is placed above the larger one, and the smaller valve-seat has a much sharper inclination or taper than the lower valve-seat, the inclinations being such that the areas of the openings or valve-ports will always bear a definite proportion to each other whatever be the lift of the valve, and the flow of each constituent will be proportional at all times. Referring to the construction shown in Fig. 6, the valves and their seats are formed with straight tapers; but when the mixing device is required to furnish a mixture at various rates of flow it will be best to form the inclinations or tapers of the seats by actual test of a shape which will give the exact amount of each constituent to form the required mixture, and this may require a form of seat having an irregular outline. Generally the forms shown will give a combustible mixture of sufficiently uniform proportions for all practicable purposes.

In Fig. 5 I have shown my mixing device as constructed for use with an engine using a fuel-vapor, as set forth in patents granted to

me December 4, 1883, No. 289,693, and February 17, 1885, No. 312,449, wherein a charge of air from the compressor is divided into two streams, one of which passes through a volatile liquid fuel, where it becomes saturated with fuel-vapor, and then returns and passes into the engine, together with the remaining portion of the air. When the mixing device is used in this way, its action is exactly the reverse of that before described and the mixing is effected by dividing the air-current into two definite portions, one of which is saturated with the vapor and then returns mixing with the other portions of the divided air-currents.

When so operating, the pipe *n* connects with the compressor, so that the air passes through the openings *f'* into the chamber *f*, from whence a portion passes out through the port *e'* to the pipe *e*, which connects with a fuel-evaporating reservoir, and, passing through the latter, becomes charged with the fuel, and is caused to unite with the other portion of the air, passing out at *m* mixed and supplied to the engine as a complete combustible mixture.

I have shown and described a double-seated lifting-valve known as a "puppet-valve;" but I may use other forms of valves to carry out my invention, so long as the valve has two independent seats of unequal capacity and adapted to control two separate supply-passages to open and to close them proportionally.

The engine shown in Fig. 1 is given to illustrate the action of the pump, in which the compression is effected by the forward stroke of the piston within a closure communicating with the mixing device and containing the crank-connections; but such engine forms the subject of separate and distinct applications for patents filed by me of even date herewith.

I claim—

1. The combination, in a fuel-mixing device, of a double-seated valve and a case having corresponding valve-seats and supply-passages, with the adjustable plug *g* and the adjustable cup *n*, substantially as herein set forth.

2. The fuel-mixing device herein described, consisting of the case *a*, having a bottom plate, *a'*, provided with the passages *e*, *e'*, and *f'*, and a central valve-seat, a chamber formed by said bottom plate and an upper valve-seat, the passage *m*, and a double-seated lift-valve operating in the passage *m* and in said chamber, and constructed substantially as herein set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS HALLOCK NASH.

Witnesses:

A. E. H. JOHNSON,
BESSIE B. JOHNSON.