

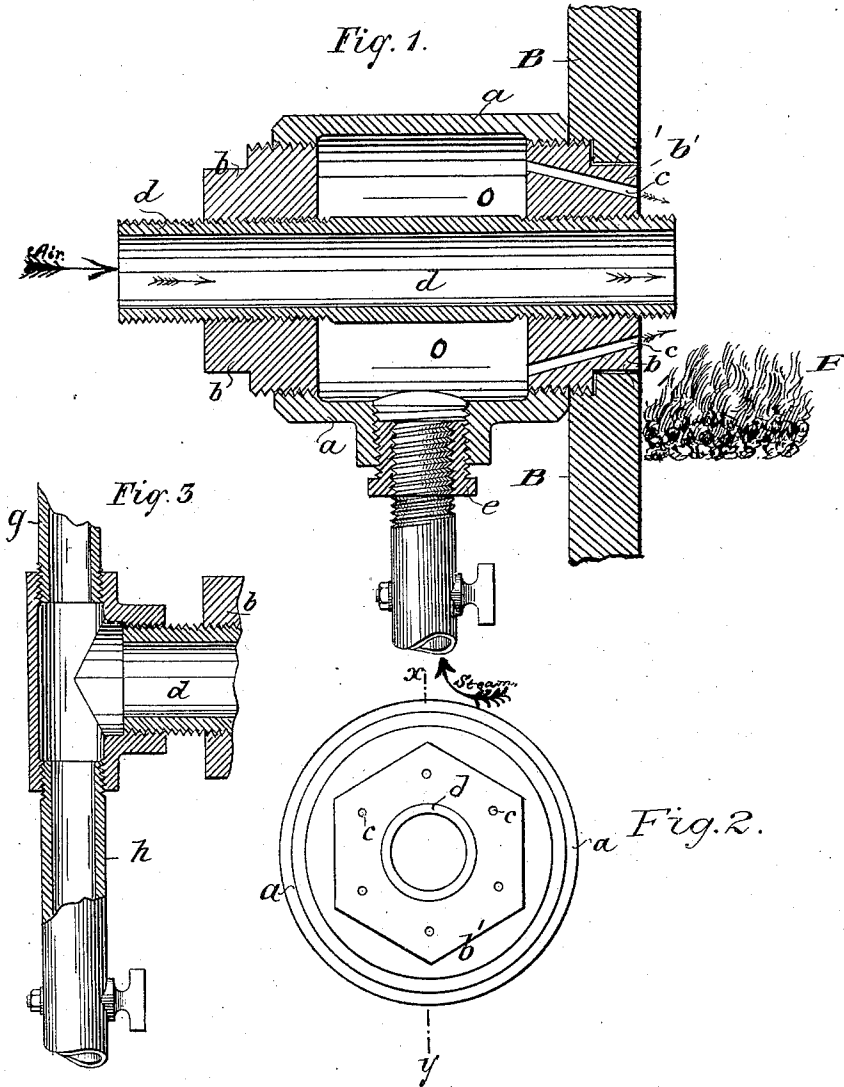
(No Model.)

A. C. LEWIS.

DEVICE FOR COMMINGLING AND COMBINING GASES.

No. 306,500.

Patented Oct. 14, 1884.



Witnesses:

*J. G. Bull*  
*W. H. Broadus*

Inventor.

*Albert C. Lewis*

# UNITED STATES PATENT OFFICE.

ALBERT C. LEWIS, OF BROOKLYN, NEW YORK.

## DEVICE FOR COMMINGLING AND COMBINING GASES.

SPECIFICATION forming part of Letters Patent No. 306,500, dated October 14, 1884.

Application filed December 26, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, ALBERT C. LEWIS, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Devices for Combining Gases and Vapors in Fire-Chambers, as and for the purposes hereinafter fully set forth, of which the following is a description in such full, clear, concise, and exact terms as to enable any one skilled in the art to which my invention belongs to make and use the same, reference being had to the accompanying drawings, making part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of said drawings represents a longitudinal section through said device, taken on the line  $x y$  of Fig. 2, which is a front view of the same.

The object of my invention is to insure a more perfect consumption of the gases developed by the combustion of fuel in fire-chambers. This object I accomplish by introducing into the fire-chamber, above the fire-surface, a combination of steam and air, uniting, heating, and intermingling with each other and with the gases of the fuel upon entering the fire-chamber, thus admitting to the fire an additional supply of oxygen, hydrogen, and nitrogen gases duly heated and intermingled, ready to be united with the gases of combustion and perfect their consumption, the union between the combined steam and air and the gases of combustion being made at the fire-surface to insure the best results.

A practical means of practicing my improvement is illustrated by the drawings, in which  $a a$  is a steam-cylinder tapped to receive the leading-in pipe  $e$ , and fitted with the heads  $b$  and  $b'$ . Through the heads of this cylinder a continuous air-pipe,  $d$ , passes, the external end of which may be fitted with branch pipes, as shown by Fig. 3, and should be fitted with any of the well-known cocks or valves to regulate the supply of air, as should also the steam-pipe  $e$  to regulate the supply of steam. The head  $b'$  of the steam-chamber  $o$  is perforated with a number of holes,  $c$ , or steam-channels converging upon the internal end of the air-pipe  $d$ , substantially as shown. This de-

vice, which I will call "a steam and air injector," having been made substantially as shown and described, is now fitted in the walls B of the fire-chamber, its delivering end being above and over the surface F of the fire where the heat of combustion is most intense.

The operation is follows: The supply-cock of the air-pipe  $d$  being opened to admit the necessary supply of air, the steam is turned into the chamber  $o$  and is forced out through the converging channels  $c$  upon the internal end of the air-pipe  $d$ , by which means the air is drawn into the fire-chamber with a velocity and force due to the pressure of the steam in the chamber. The steam and air coming together at the end of the pipe  $d$  intermingle there inside of the fire-chamber upon the surface of the fire, where their constituent elements are instantly heated, intermingled, and combined with each other and with the gases of combustion, thus increasing the intensity of the heat and insuring a much more complete consumption of the fuel-gases. In the use of this invention a practical engineer will understand, of course, that one of the essentials of its success is a judicious regulation of the amount of air and steam supplied. If the steam and air be not supplied in their proper relative proportions, or if there be too little or too much of both, satisfactory results will not be obtained. If the relative proportions are wrong, or if the supply of steam and air be scanty, the consumption of the gases will not be perfect, or if the supply of steam or air be in excess the fire will be dampened, and in case of great excess the fire will be extinguished; but this matter of proper proportion and quantity of supply can only be determined by actual experience with fire-chambers of given dimensions using a given variety of fuel; the supply of steam and air necessary depending very largely upon the relative proportion of hydrogen and carbon contained in the fuel being consumed, and also upon the amount of grate-surface in the fire-chamber. It is impossible, therefore, to give any rule for the proportion or supply of the combined steam and air—that must be left to the constructing and operating engineer in each case; but the importance and necessity of having some effectual means of

regulating this proportion and supply will be plainly apparent from what I have above stated, and all that is necessary to that end are suitable valves or cocks, of which there is an endless variety for the engineer to select from.

After a little experience with the injector an engineer, knowing the amount of grate-surface and the kind of fuel to be used in the fire-chamber and the pressure of steam to be employed, can construct the injector and proportion its steam and air passages so as to be self-regulating; but in most cases the exigencies are such as to make this impossible, and resort must be had to adjustable cocks or valves.

In constructing the injector care should be taken to make the steam-passages converge and concentrate around the end of the air-passage, by which the steam is made to form a vortex around the end of the pipe for the purpose of drawing in and insuring a plentiful supply of air and a perfect intermingling of the two elements. To insure the best results there should be fitted in the walls of the fire-chamber a number of these injectors, delivering into the chamber immediately above the surface of the fire, by which a more perfect distribution of the combined gases in the chamber is obtained.

The steam used in the injector may or may not be superheated, depending upon the pressure and temperature of the steam used, the kind of fuel under consumption, the condition of the atmosphere, and many other circumstances known to men skilled in this department of science.

In concluding this specification, I desire to say that the introduction of steam and air under the grate-bars of a fire-chamber for the purpose of perfecting or improving the combustion in the furnace is well known to me, and in some cases it improves the combustion, but in most cases it is of no value. The steam and air in such cases are only partly intermingled in the ash-pit of the fire-chamber, and instead of being instantly heated and combined with the intense heat of the fire-surface,

they strike the bottom of the fire first, where the temperature is comparatively low, and, uniting with the carbon of the fuel at a comparatively low temperature, they form carbonic-acid gas, which, instead of aiding the combustion, has a tendency to dampen the fire.

I am also well aware that a great variety of hydrocarbon injectors and burners have been combined with fire-chambers to supply hydrocarbon as well as steam and air to the fuel of the furnace—as, for example, in the patents to S. C. Salisbury, dated, respectively, June 24, and July 1, 1879. I am also familiar with the steam-blower shown and described in the patent to P. H. Grimm, dated July 3, 1883. But none of these patents, plans, or inventions above referred to describe or even suggest the essential feature of my invention. They do not embrace the same thoughts or accomplish the same ends.

The novel and essential features of my invention, and what I desire to secure by Letters Patent, are included in the following claim, viz:

The means substantially herein described of perfecting in the fire-chamber of furnaces the consumption of fuel-gases, which means consist of an injector combined in the wall B of the fire-chamber immediately above the surface of the fire F, and susceptible of regulating the relative proportions and combined quantity of steam and air into the fire-chamber, and of concentrating, intermingling, and combining them with each other and with the gases of combustion as they enter the chamber at the surface of the fire, said injector consisting, substantially, of an air-pipe, *d*, combined in a chamber, *o*, the inner end, *b'*, of which is fitted in the wall B of the fire-chamber, and provided with steam-channels *c*, converging upon the end of the air-pipe, substantially as described.

ALBERT C. LEWIS.

Witnesses:

WM. H. BROADNAX,  
J. EDGAR BULL.