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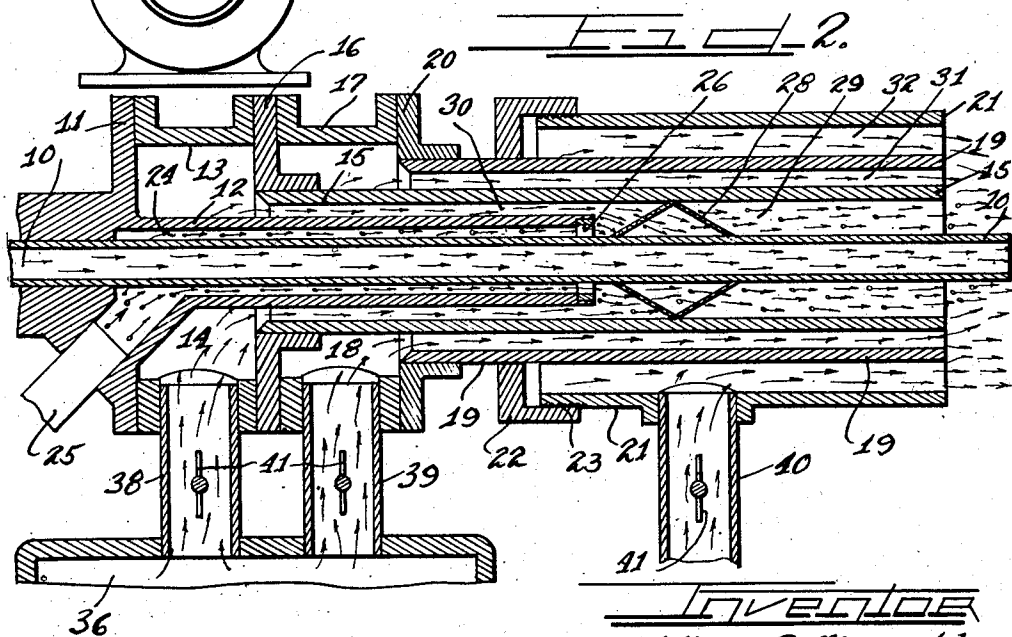
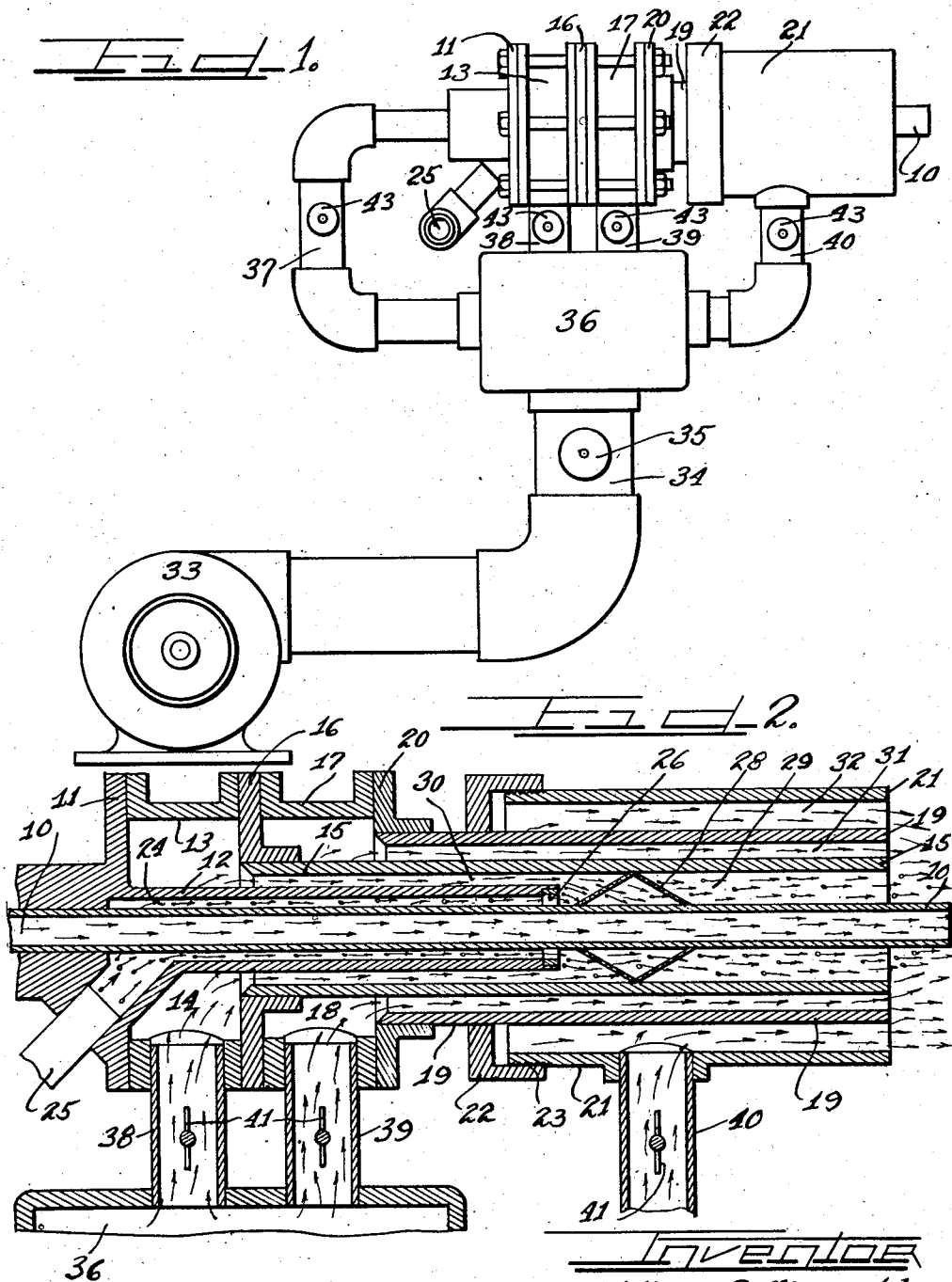
W. B. MANGOLD

1,995,934

GAS BURNER

Filed Sept. 18, 1933

2 Sheets-Sheet 1



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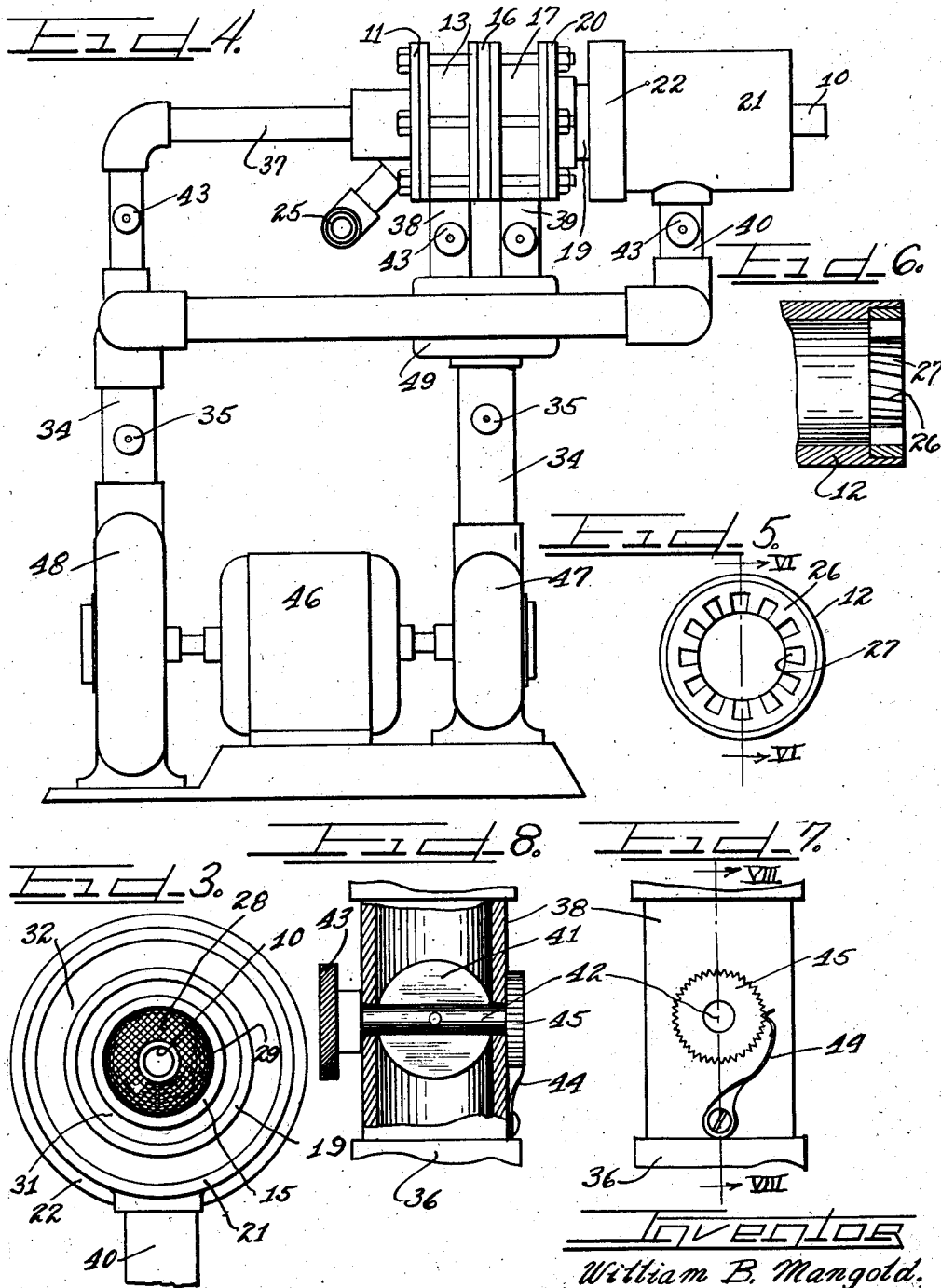
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UNITED STATES PATENT OFFICE

1,995,934

GAS BURNER

William B. Mangold, Chicago, Ill.; Mildred P. Mangold, administratrix of said William B. Mangold, deceased, assignor to The Trust Company of Chicago, as trustee

Application September 18, 1933, Serial No. 689,806

11 Claims. (Cl. 158—110)

This invention relates to an improved gas burner for use in boilers, furnaces, ovens and the like, where it is desired to use an economical and efficient combustion apparatus utilizing natural or artificial gas.

The burner of this invention is particularly adapted for use, in combination with automatic control systems, in domestic and building heating plants and in process and baking ovens subject to automatic control, since when once installed and adjusted, it can be operated intermittently, without danger of flarebacks or explosions upon relighting. It is accordingly an object of this invention to provide an improved gas burner for the purposes described that can be intermittently operated by an automatic on and off control.

It is another object of this invention to provide a gas burner, providing a gas and air mixture that is projected from and burns externally of the apparatus, whereby complete combustion can be obtained without cooling the flame by adjacent metal surfaces of the burner, or the provision of excess air beyond that needed for combustion, since excess air tends to reduce the boiler or furnace efficiency due to the heat carried away thereby in the stack or chimney.

It is also an object of this invention to provide an improved combustion system for a gas burner wherein a rich mixture of gas and air is projected as an annular expanding cylinder with secondary air supplies both inside and outside the burning mixture. With this arrangement, a true Bunsen or colorless flame results differing therefrom, however, in that the characteristic inner cone of the Bunsen flame is in this case a cone of air supplying further oxygen to the interior of the hollow ring of burning gas beyond the point of flame propagation. The resulting colorless flame projects some distance from the burner without any tendency to deposit soot upon relatively cool surfaces in the neighborhood thereof or in the flues and stack of the boiler or oven in which it is installed.

It is a further object of this invention to provide an improved gas burner having separately controllable air supplies permitting accurate adjustment of the primary mixture of gas and air and of the secondary air supplied to the burning mixture whereby complete control of the combustion process may be had unaffected by possible variations in the gas supply pressure.

It is still another object of this invention to provide an improved gas burner with multiple air supply connections under controllable pres-

ures adjustable to produce air velocities in proportion to the rate of flame propagation at the burner nozzle.

It is a further object of this invention to provide an improved and simplified high efficiency gas burner that can be economically manufactured and accurately adjusted to the varying requirements of different types of gas available, such as natural and artificial gas and mixtures thereof.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a side elevation of a gas burner system embodying the features of this invention.

Figure 2 is a fragmentary enlarged longitudinal section through the gas burner of this invention.

Figure 3 is an end view from the right of Figure 2.

Figure 4 is an elevation similar to Figure 1 but disclosing the use of separate blowers for the supply of air to the different passages in the burner.

Figure 5 is an end view of the nozzle outlet from the gas supply chamber.

Figure 6 is a section on the line VI—VI of Figure 5.

Figure 7 is a fragmentary elevation of one of the air supply pipes showing the damper control thereof.

Figure 8 is a section on the line VIII—VIII of Figure 7.

As shown by the drawings:

The present invention is illustrated as a complete burner unit intended to be used with automatic temperature and operating controls, although the latter have not been illustrated in connection with the burner.

In describing the burner structure, it will be convenient to refer first to Figure 2, wherein a series of concentric passages are provided by spaced tubes. Starting from the left in this figure, a central tube 10 is supported in an end closure 11 which has a spaced tubular extension 12 surrounding the tube 10. A housing 13 provides an air chamber 14 having an outlet through a second spaced tube 15 supported by a diaphragm 16 between the housing 13 and a second housing 17 forming an air chamber 18. The chamber 18 has an outlet through a third spaced tube 19,

supported by an end closure 20. A fourth tube 21 envelopes the tube 19 and has a collar 22 threaded at 23 on the rear of the tube 21 and secured to the tube 19 to form a closure, the arrangement preferably being such that the tube 21 can be rigidly mounted in an orifice leading to the combustion chamber or fire box of a boiler or oven, and the balance of the burner applied or removed as a unit by screwing the collar 22 on or off the threads 23 of the tube 21.

The tubes 15, 19 and 21 preferably terminate in the same plane and the central tube 10 projects somewhat beyond this plane in order to give stability to the ignition zone surrounding the same. The tube 12 terminates about halfway of the tube 15 and the space 24 between the tubes 10 and 12 is supplied with gas through a connection 25 leading through the end closure 11. The tube 12 terminates in a slotted nozzle 26 shown in Figures 5 and 6, the slots 27 therein being preferably inclined as shown to set up a spiral flow in the gas. A double conical screen 28 is positioned in the space 29 between the tubes 10 and 15 outside the nozzle to facilitate mixture of air from the chamber 14 and gas leaving the nozzle 26. The screen serves primarily as a mixing device, since the burner is inherently free from danger of flare-backs for reasons to be brought out hereinafter, but would help to prevent such flare-backs should they occur. For convenience in what follows, the chamber 14 and the space 30 between the tubes 12 and 15 will be referred to as the primary air supply and the space 29 as the mixing chamber for the gas and primary air supply; while the central tube 10, the space 31 between the tubes 15 and 19 and the space 32 between the tubes 19 and 21 as the secondary air supplies.

In the form of Figure 1, a single blower 33 supplies air through a connection 34, containing a valve indicated by its control handle 35, to an air manifold 36, from which connections 37, 38, 39 and 40 lead to the tube 10, air chambers 14 and 18 and tube 21, respectively, each connection containing a butterfly valve 41 on a shaft 42 having a control knob 43 on one end and a spring ratchet 44 and wheel 45 on the other end, as shown in Figures 7 and 8. The valve indicated by its handle 35 in the connection 34 is of the same construction; hence is not shown in Figure 1.

The structure of Figure 4 differs from that of Figure 1 in that a motor 46 drives two blowers 47 and 48, the smaller blower 47 supplying the air chambers 14 and 18 through a manifold 49, while the larger blower 48 supplies the tubes 10 and 21. The larger blower supplies increased pressure and volume which is desirable when handling gases of high heat value, such as natural gas and mixtures thereof with other gases, since a greater pressure and volume of air is required for proper combustion, and this greater volume should be supplied through the secondary air supplies for maximum combustion efficiency as well as stability of flame propagation.

In the operation of this burner, the gas supply is, of course, under the control of a valve (not shown) which is adjusted, along with the valve in the connection 38, to provide the desired volume of rich mixture of gas and air in the mixing chamber 29 according to the duty required of the burner. It is to be understood that this duty may vary over wide limits in a given burner due to varying installation demands. After the desired volume of mixture has been determined,

the air supplies through the central tube 10 and tube 19 are then adjusted by the valves in the connections 37 and 38 to provide a velocity there-through approximating the rate of flame propagation in the mixture. Then the air supply through the connection 40 is arranged to give a colorless flame indicative of complete and efficient combustion. It is to be noted at this point that by analysis of the products of combustion, the burner can be adjusted very accurately to eliminate carbon monoxide while reducing the amount of excess air, indicated by the presence of unconsumed oxygen. With the burner properly adjusted, the main air valve operated by the knob 35 is adjusted to cut down the pressure of the air supplied to the various connections until substantial balance is obtained between the inlet to the manifold and the outlet therefrom. This arrangement provides a balanced pressure effect that compensates for wide fluctuations in the pressure of the gas supply so that efficient combustion is maintained in spite thereof. Also, by so adjusting the air supply, the possibility of backfiring is eliminated, as the burner controls cut off the gas and current supply to the blower motor at the same time and the residual air pressure serves to evacuate unburned gas from the burner after the gas supply has been cut off.

The air supplied through the connection 40 to the tube 21 is not required with some types of gas, or at low combustion rates. Under these conditions, the tube 21 can be omitted, as sufficient air can be supplied through the tube 19 without requiring a velocity exceeding that of the rate of flame propagation.

While the burner of this invention can readily be adjusted for efficient combustion over a wide range of operating conditions, it is not the primary intention to so control the burner in service, but to operate it intermittently at a fixed adjustment most satisfactory for each particular installation.

In adjusting the burner for high rates of combustion where a long horizontal flame is desired, the air supply through the central tube 10 can be increased in velocity to a degree exceeding the rate of flame propagation, since the tube 10 projects beyond the ignition zone and therefore will not disturb the flame stream.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. A gas burner comprising a casing having a plurality of concentric air passages, an intermediate gas supply passage arranged to discharge into a mixing chamber in one of said air passages subject to suction produced by the flow of air in said air passage, means for supplying air under pressure to each of said concentric air passages, and means for individually controlling the supply of air to each of said air passages.

2. A gas burner comprising a casing having a plurality of concentric air passages, an intermediate gas supply passage arranged to discharge into a mixing chamber in one of said air passages subject to suction produced by the flow of air in said air passage, a mixing screen in said last mentioned air passage, means for supplying air under pressure to each of said concentric air passages, and means for individually controlling

the supply of air to each of said air passages.

3. A gas burner comprising a casing having a plurality of concentric air passages, an intermediate gas supply passage having a turbulence inducing outlet arranged to discharge into a mixing chamber in one of said air passages, the outlet being subject to suction induced by air flow therearound, means for supplying air under pressure to each of said concentric air passages, and means for individually controlling the supply of air to each of said air passages.

4. A gas burner comprising a casing having a plurality of concentric air passages, an intermediate gas supply passage having a turbulence inducing outlet arranged to discharge into a mixing chamber in one of said air passages, a mixing screen in said last mentioned air passage, means for supplying air under pressure to each of said concentric air passages, and means for individually controlling the supply of air to each of said air passages.

5. A gas burner comprising a casing having a central tube and a series of concentric tubes arranged to provide a plurality of annular passages about said central tube, means for introducing gas into the tube outside the central tube, said means being subject to suction induced by air flow in said passage, means for supplying air under pressure to all of said tubes, and means for controlling the supply of air to each of said tubes.

6. A gas burner comprising a casing forming an air chamber, an end closure having a tube extending through said air chamber and a gas connection through said end closure to said tube, a central tube extending axially through said first mentioned tube, a restricted gas outlet between the end of the first tube and the perimeter of the central tube, a diaphragm forming the other end closure for said casing, a second tube enveloping the gas tube and the central tube and providing an outlet from the air chamber for air to be mixed with gas from the first tube, a second casing abutting the diaphragm and forming a second air chamber, a closure for the free end thereof, a third tube enveloping the second tube and providing an outlet from the second air chamber, and means for supplying air to the several tubes.

7. A gas burner comprising a casing forming an air chamber, an end closure having a tube extending through said air chamber and a gas connection through said end closure to said tube, a central tube extending axially through said first mentioned tube, a restricted gas outlet between the end of the first tube and the perimeter of the central tube, a diaphragm forming the other end closure for said casing, a second tube enveloping the gas tube and the central tube and providing an outlet from the air chamber for air to be mixed with gas from the first tube, a second casing abutting the diaphragm and forming a second air chamber, a closure for the free end thereof, a third tube enveloping the second tube and providing an outlet from the second air chamber, means for supplying air to the several tubes, and means for separately regulating the air supply to the tubes and air chambers.

8. A gas burner comprising a casing forming an air chamber, an end closure having a tube extending through said air chamber and a gas connection through said end closure to said tube, a central tube extending axially through said first mentioned tube, a restricted gas outlet between the end of the first tube and the perimeter

of the central tube, a diaphragm forming the other end closure for said casing, a second tube enveloping the gas tube and the central tube and providing an outlet from the air chamber for air to be mixed with gas from the first tube, a second casing abutting the diaphragm and forming a second air chamber, a closure for the free end thereof, a third tube enveloping the second tube and providing an outlet from the second air chamber, a fourth tube enveloping the third tube, and means for supplying air to the several tubes.

9. A gas burner comprising a casing forming an air chamber, an end closure having a tube extending through said air chamber and a gas connection through said end closure to said tube, a central tube extending axially through said first mentioned tube, a restricted gas outlet between the end of the first tube and the perimeter of the central tube, a diaphragm forming the other end closure for said casing, a second tube enveloping the gas tube and the central tube and providing an outlet from the air chamber for air to be mixed with gas from the first tube, a second casing abutting the diaphragm and forming a second air chamber, a closure for the free end thereof, a third tube enveloping the second tube and providing an outlet from the second air chamber, a fourth tube enveloping the third tube, means for supplying air to the several tubes, and means for separately regulating the air supply to the tubes and air chambers.

10. A gas burner comprising a casing forming an air chamber, an end closure having a tube extending through said air chamber and a gas connection through said end closure to said tube, a central tube extending axially through said first mentioned tube, a restricted gas outlet between the end of the first tube and the perimeter of the central tube, a diaphragm forming the other end closure for said casing, a second tube enveloping the gas tube and the central tube and providing an outlet from the air chamber for air to be mixed with the gas from the first tube, a second casing abutting the diaphragm and forming a second air chamber, a closure for the free end thereof, a third tube enveloping the second tube and providing an outlet from the second air chamber, blower means for supplying air to the several tubes, means for regulating the blower pressure, and means for regulating the separate supplies to the several tubes.

11. A gas burner comprising a casing forming an air chamber, an end closure having a tube extending through said air chamber and a gas connection through said end closure to said tube, a central tube extending axially through said first mentioned tube, a restricted gas outlet between the end of the first tube and the perimeter of the central tube, a diaphragm forming the other end closure for said casing, a second tube enveloping the gas tube and the central tube and providing an outlet from the air chamber for air to be mixed with gas from the first tube, a second casing abutting the diaphragm and forming a second air chamber, a closure for the free end thereof, a third tube enveloping the second tube and providing an outlet from the second air chamber, a fourth tube enveloping the third tube, blower means for supplying air to the several tubes, means for regulating the blower pressure and means for regulating the separate supplies to the several tubes.