Feb. 27, 1934. G. H. IRWIN 1,948,663

GAS BURNER STRUCTURE

Filed Jan. 23, 1930 3 Sheets-Sheet 1

Fig. 1

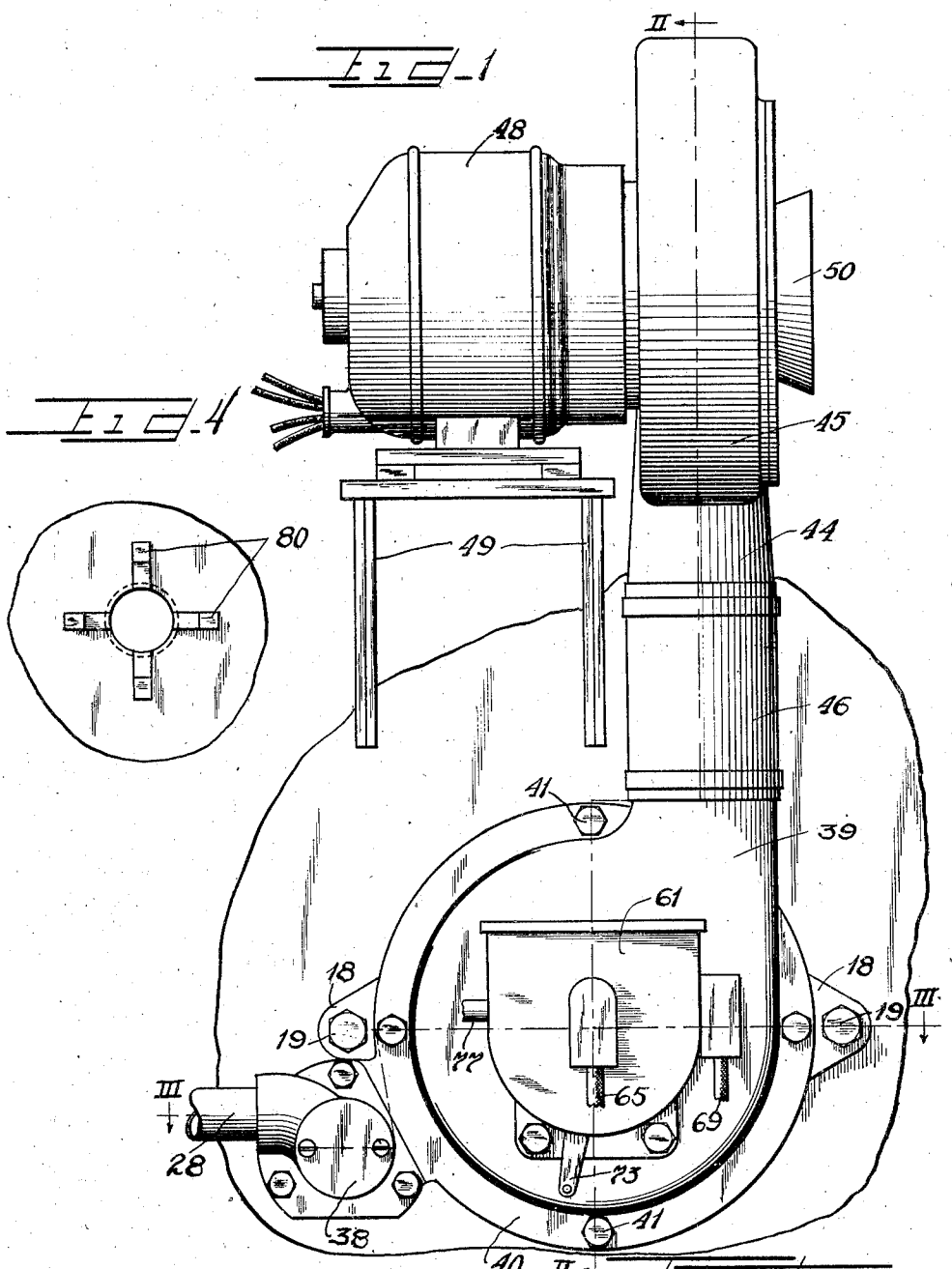


Fig. 4

Inventor

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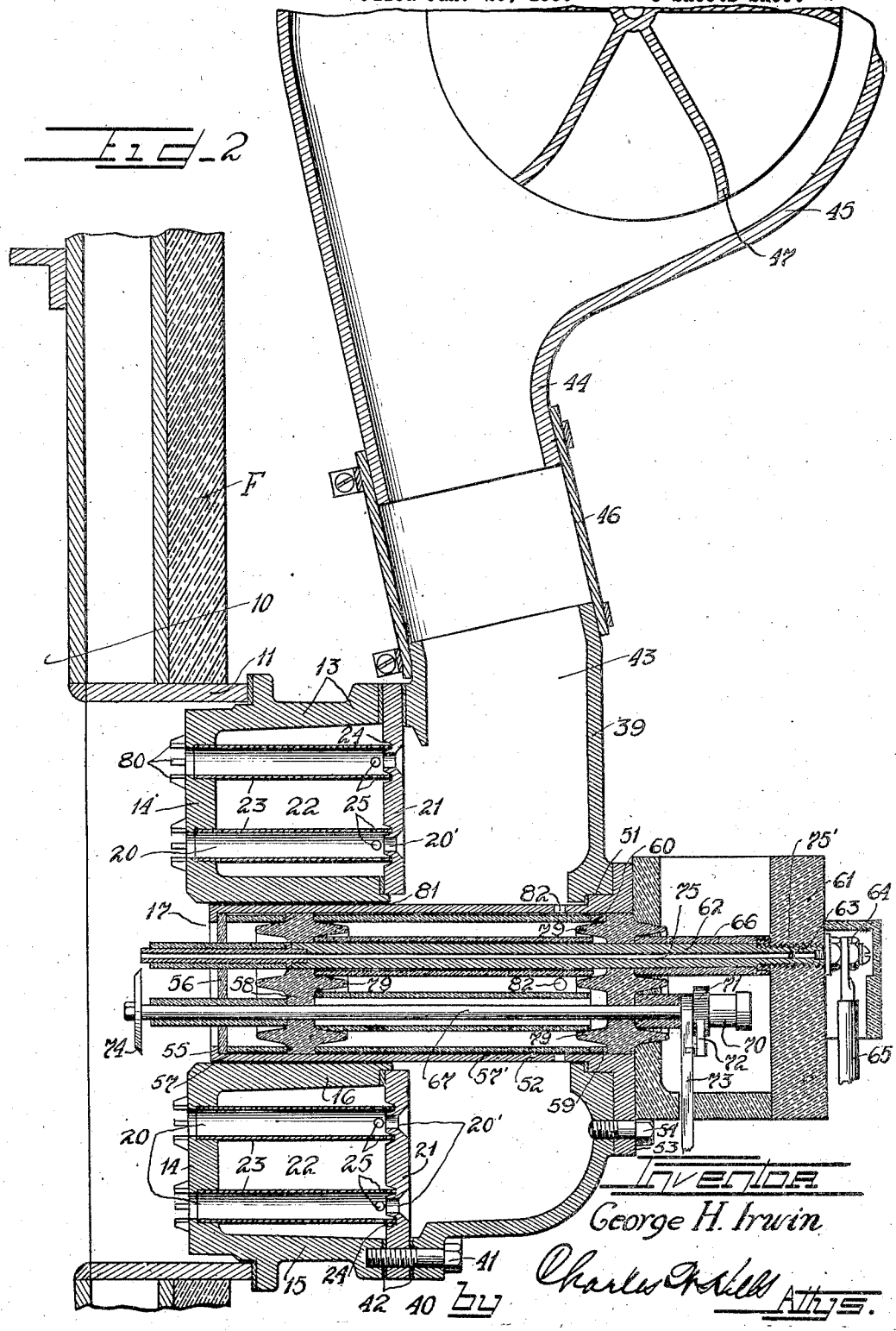
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GAS BURNER STRUCTURE

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Fig. 2



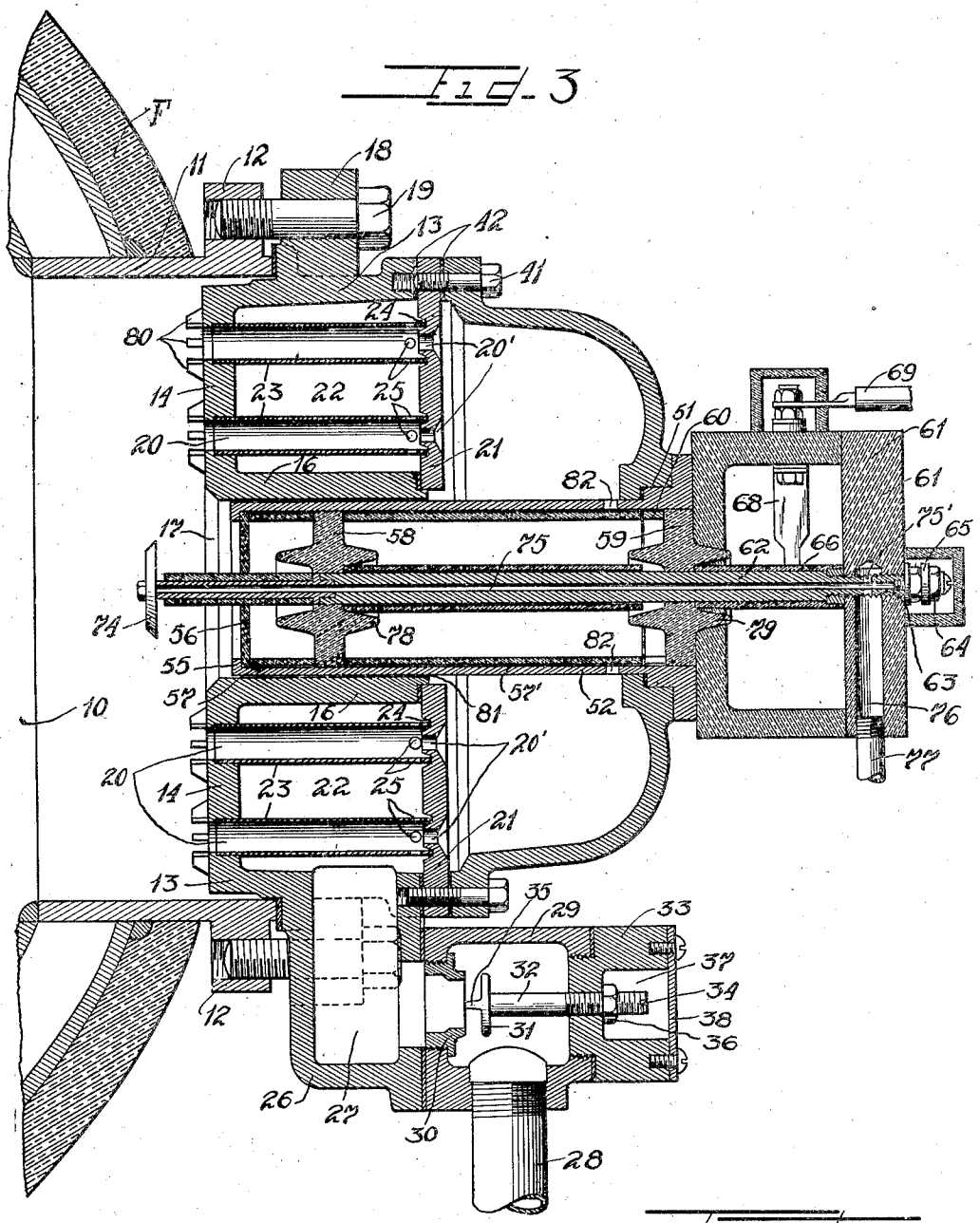
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GAS BURNER STRUCTURE

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Fig. 3



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UNITED STATES PATENT OFFICE

1,948,663

GAS BURNER STRUCTURE

George H. Irwin, Chicago, Ill.

Application January 23, 1930. Serial No. 422,745

3 Claims. (Cl. 158—108)

My invention relates to gas burner structure for burning artificial or natural gas, and the general object of the invention is to provide a burner which is highly economical in gas consumption, and which will entirely eliminate the back-firing or back-flashing of the flame so prevalent in many types of burners.

More in detail, an important object of the invention is to provide a burner through which air under pressure is blown in fixed paths into which gas is drawn by the air flow to become thoroughly mixed with the air before delivery of the combustion mixture into the fire box, together with improved means for igniting the combustion mixture at the outlets of the paths.

A further object of the invention is to provide a constant volume of air under a fixed pressure to the burner and to eliminate air regulating means at the intake of the air blower, so that a constant, reliable and dependable source of air supply is maintained to flow through the fixed paths in the burner and take on the required proportion of gas, thereby insuring a constant pressure velocity and velocity pressure of the combustion mixture through the paths and from the ejection ends thereof into the furnace.

Another object of the invention is to provide a burner which has a very large combustion mixture capacity with a limited burning area, and through which the entire amount of air required for combustion and for carrying off the products of combustion may be admitted to the combustion area without the admission of any secondary air from any other source, thereby permitting efficient use of closed furnaces or fire boxes.

A further object is to provide a burner in which the gas is preheated and, by its inspiration into the fixed paths of air under high velocity and pressure, is subjected to vacuum effect to cause expansion thereof and breaking down of its molecular structure before mixture thereof with the air.

A still further object of the invention is to provide a burner having a gas chamber in which the gas is preheated, and the mixing tubes extending through the chamber and connected at their inlet ends therewith, together with means for forcing air under high velocity and pressure through the tubes to create vacuum effect in said chamber and expansion of the heated gas before inspiration thereof into the tubes whereby the molecular structure of the gas will be broken down and it will more readily and more thoroughly mix with the air before delivery of the mixture from the tubes.

A still further object of the invention is to provide a burner in which combustion delivering tubes are arranged in concentric circular rows surrounding an ignition means in the form of a gas pilot flame and another ignition means in the form of an electric arc producing device, so that should one of the ignition means fail the other will function to ignite the combustion mixture.

Another object is to provide improved means for regulating the gas supply into the gas chamber of the burner, such means being in the form of a baffle valve which may be adjusted to admit gas flow to the full capacity of the burner but which is prevented from being adjusted to shut off the gas flow below a certain fixed volume to thereby prevent a mixture which would be too lean to ignite in the combustion chamber.

A still further object is to provide means at the end of the mixture tubes for breaking down the noises of combustion and at the same time serving to transfer heat from the flame back to the burner walls and the mixing tubes supported thereby to thus rapidly preheat the gas in the gas chamber before it is drawn into the mixing tubes by the air streams.

The above enumerated features and other features of my invention are all incorporated in the structure disclosed in the drawings, in which—

Figure 1 is a front elevation of the burner structure and the air blower connected therewith;

Figure 2 is a section on plane II—II of Figure 1;

Figure 3 is a section on plane III—III of Figure 1;

Figure 4 is a fragmentary view of the inner end of the burner, showing the heat conveying projections around the mixture tube outlets.

I have shown my improved burner structure B applied to a furnace or boiler structure F which may be of the construction and arrangement disclosed in my co-pending application Serial No. 226,563, filed October 17, 1927, the closed firebox 10 having the inlet frame 11 provided with lugs 12 for supporting the burner structure B.

The burner structure comprises a body 13 in the form of annular frame having the inner wall 14, the outer cylindrical wall 15, and the inner cylindrical wall 16 which surrounds the axial passageway 17. The frame 13 has lugs 18 for registering with the lugs 12 which are threaded, so that the burner structure may be detachably secured to the furnace by means of bolts 19.

The wall 14 of the burner body has concentric circular rows of combustion mixture outlet ports

20 which are in alignment with air inlet ports 20 through a plate 21 which is secured against the inner ends of the walls 15 and 16 and, with these walls and the wall 14, define a gas chamber 22.

The inner ends of the outlet ports 20 in the wall 14 are counter-bored to receive the outer ends of mixing tubes 23 which at their outer ends are received in annular pockets or grooves 24 around the respective air inlet ports 20 in the plate 21, the tubes being thus held accurately in alignment when the plate 21 is secured to the burner body 13. Just within the plate 21, the tubes have gas inlet ports 25 communicating with the gas chamber 22. The outer ends of the air inlet ports 20 are flared, as shown, so that air may more readily flow thru the ports and into the tubes.

At one side the burner body 13 has the extension 26 forming an inlet passage 27 for gas flow into the gas chamber 22, this inlet extending tangentially relative to the chamber for the better distribution of gas through the chamber. Between the gas inlet passage 27 and a gas supply pipe 28 is interposed a valve frame 29 which may be supported on the extension 26. A bushing 30 is removably threaded in the base of the valve frame 29 and affords communication between the interior of the frame and the inlet passage 27. A baffle valve disc 31 cooperates with the bushing to control the volume of gas flowing from the supply pipe 28 to the inlet passage 27, this valve disc being supported at the end of a stem 32 which has threaded engagement at its outer end in the closure cap or plug 33 for the frame 29. The stem at its outer end has the screw-driver slot 34 by means of which it may be readily turned to adjust the valve disc relative to the end of the bushing, a stop lug or projection 35 on the inner side of the valve disc being adapted to abut against the end of the bushing to limit the adjustment of the valve disc toward the bushing so that it will be impossible to shut off the flow from the supply pipes to the burner below a certain fixed volume which would give the minimum gas requirement for the burner thereby preventing a mixture which would be too lean to ignite or burn in the furnace.

After adjustment of the baffle valve it may be locked in adjusted position by a lock nut 36, and preferably the outer end of the valve stem is within a recess 37 in the plug 33 so that a plate 38 may be secured over the outer end of the plug to enclose the valve against tampering by unskilled and unauthorized persons.

A cap frame 39 has the flanged periphery 40 for seating the frame against the peripheral section of the plate 22, and bolts 41 extending through the flanged periphery and the peripheral section of the plate 22 thread into the wall 15 of the burner body to hold the plate and the cap frame in proper position, suitable gaskets 42 being interposed to seal the connection. The frame 39 has a tangential inlet 43 which is connected with the outlet 44 of a blower structure 45, the connection being preferably in the form of a length 46 of hose of some fabric such as rubber which will tend to absorb the vibrations of the blower and will prevent noises of the fan structure and its driving motor from being communicated to the burner structure and the furnace or boiler structure. The blower propeller 47 is driven by a suitable electric motor 48 which may be mounted on a suitable support 49. The blower structure has the air inlet 50 concentric with the propeller 47, and this air inlet is preferably devoid of any air flow adjusting means in order that the blower may deliver a constant, reliable and dependable volume of air to the burner, dependent only upon the speed of the motor.

The outer wall of the cap frame 39 has the opening 51 in axial registration with the passageway 17 through the body 13 of the burner. The opening and the passageway serve to receive a suitable ignition device which may be like that disclosed in my co-pending application, Serial No. 384,442, filed August 8, 1929. The body frame of this ignition device is in the form of a tubular metallic shell 52 having at its outer end a flange 53 by means of which it may be secured to the cap frame 39 by bolts 54. At its inner end the shell 52 has the annular flange 55 forming a seat for the end wall or disc 56, and this wall may be of heat refractory and electrical insulating material. The shell 52 is lined by bushing sections 57 and 57' which may also be of heat refractory and electrical insulating material. Between the outer end of the bushing sections 57 and the outer end of the section 57' is interposed a supporting wall 58 of heat refractory and electrical insulating material, and a similar wall 59 is inserted between the outer end of the shell 52 and the outer end of the bushing section 57', a yielding washer such as a spring 60 being preferably interposed. A rectangular frame 61, preferably of insulating material, is secured to the outer end of the shell 52 and abuts against the supporting wall 59, the pressure being transmitted through the spring washer 60 to the bushing sections so that these bushing sections and supporting walls will be held against movement, the spring washer permitting relative expansion and contraction between the bushing sections and the shell 52 during temperature changes.

Supported in the walls 58 and 59 is a metallic rod 62 whose outer end 62' may be of some heat resistant metal such as nichrome. This end extends outwardly through the end wall 56, while the outer end of the rod 62 extends through the inner wall of the frame 61 and its threaded end 63 is received by the outer wall of the frame 61, this threaded end being of reduced diameter and receiving the nuts 64 outside of the frame wall so that the rod is securely clamped to the wall. The nuts 64 serve also to connect a current supply lead 65 with the rod, the rod forming one of the electrodes of the electrical ignition part of the ignition device. To further insulate the rod and its end 62', sleeves 66 of heat and electrical resistant material may be applied thereto.

The walls 58 and 59 also support a solid electrode rod 67 which at its inner end extends through the end wall 56 and terminates adjacent the inner end of the rod end 62'. At its outer end the rod 67 extends into the frame 61 where it is engaged by a contact 68 extending through a side wall of the frame 61 for connection with the current supply lead 69. The rod 67 is rotational, and the contact 69 may be in the form of a contract spring engaging a contract disc 70 secured to the rod. The rod also carries a ratchet wheel 71 engaged by a pawl 72 on the lever 73 which is pivoted on the rod adjacent to the ratchet wheel this lever extending to the exterior of the frame 61 to be manually, electrically or otherwise operated. The arrangement may be the same as disclosed in my co-pending application Serial No. 384,442 hereinbefore referred to.

At its inner end the rod supports the terminal disc 74 whose circular contact edge is adjacent

to the inner end of the rod section 62', so that, when the electrode rods are connected in a high tension ignition circuit, ignition sparks or arcs will flow between the end 62' and the disc 74.

The electrode rod 62 and its end 62' have a bore 75 extending therethrough for the passage of gas or a pilot flame, the outer end of the bore communicating through a port 75' with the gas passage 76 through the outer wall of the frame 61 and connected with a gas supply pipe 77. The gas issuing from the electrode bore will be ignited by the sparks to form the pilot flame which will then serve to ignite the combustion mixture tubes of the burner structure. If the pilot flame becomes extinguished at any time the combustion mixture issuing from the mixing tubes will be ignited directly by the sparks. The purpose of the rotational electrode rod 67 and its terminal disc 74 is to prevent accumulation of carbon, dirt or any foreign substances which might clog the sparking gap and interfere with the formation of a proper current flow and ignition sparking. The electrode may be manually rotated at desired times or it may be automatically rotated continuously or intermittently.

To insulate the electrode rod 67 it may be surrounded by insulating bushings 78 and to prevent creepage of current between the electrodes along the walls 58 and 59, these walls may be provided with fins 79 surrounding the electrodes.

As shown, a plurality of projections or tips 80 on the outer wall 14 of the burner structure surround the outlet port 20 of each combustion mixture tube, such tips tending to break down the noises of combustion and serving also to transmit the heat from the flames back to the burner body for the purpose of heating the gas in the chamber 22.

The operation of the structure is as follows:

The gas for the pilot flame delivered by the supply pipe 77 flows through the bore 75 of electrode 62 at whose inner end it is ignited by the spark flow between the ends of the electrodes. The gas supply for the burner from the pipe 28 flows into the gas chamber of the burner through the restricted passageway established by the baffle valve 31, the gas chamber being otherwise closed to the inlet of gas. The blower being started, air is blown under pressure and velocity through the mixing tubes. The setting of the baffle valve 31 is such that the volume of gas flow into the gas chamber is less per unit of time than the volume of air blown through the mixing tubes per unit of time. The tubes 23 are comparatively long and of comparatively large and uniform diameter throughout so that there will be substantially no obstruction or resistance to the air flow therethrough. The air under pressure flows from the air chamber 43 through the restricted inlets 20' under considerable velocity into the tubes 23 where it expands and becomes attenuated and this results in the creation of suction or vacuum effect at the gas inlet ports 25 which are more or less restricted, and gas is entrained into the tubes under considerable velocity and is subjected to the suction or vacuum effect. As the volume of gas flowing into the gas chamber is restricted by the baffle valve 31, the rapid entrainment of gas into the tubes by the air blast will cause the gas in the gas chamber to be more or less attenuated, and such attenuation of the gas together with the heating thereof by the burner outer wall, will tend to weaken the molecular structure of the gas so that it will more readily and thoroughly mix with the air to form perfect combustion mixture in the tubes 23, the combustion mixture then burning at the surface of the burner with a blue hot flame.

The hot blue flame which starts substantially at the outlet end of the mixing tubes 23 soon heats the outer wall 14 and the walls 15 and 16 of the gas chamber and the gas becomes highly heated and then the powerful entrainment pull of the air blast against the resistance of the gas inlet flow restricting baffle valve 31, will cause this heated and expanded gas to be subjected to suction or attenuation before it reaches the air in the tubes, and this hot attenuated gas will then readily and thoroughly mix with the expanding air in the tubes and the resulting combustion mixture gradually slows down for projection at the proper velocity from the tubes and to begin its combustion with a blue flame at the forward end of the tubes or the surface of the burner. No additional or secondary air supply will be necessary so that the combustion can take place in a closed fire box. The combustion mixture issues in streams from the ports 20 and is immediately ignited by the pilot flame. The shell 52 of the ignition device may have a loose fit in the passage 17 of the burner to leave small passage space 81 through which sufficient air may escape from within the cap frame 39 to supply the gas for the pilot flame. Should the pilot flame at any time fail or become extinguished, the combustion mixture issuing from the mixing tubes will be ignited directly by the spark flame between the disc 74 and the adjacent end of the electrode 62'. The flow of air around the ignition device will tend to keep it cool, and through openings 82 some of the air may enter the interior of the ignition device to assist in the cooling thereof.

The terminal disc 74 also becomes heated, but it is preferably of some heat refractory metal, such as nichrome. The heating of the disc will serve to burn off any accumulation which might form thereon and will keep the disc clean and bright for the proper flow of ignition current.

The pilot flame electrode is preferably above the disc electrode, so that the pilot flame will be deflected upwardly and any soot which might be formed therein will be carried upwardly and away from the disc by the draft of the furnace or boiler. The rotation of the disc continuously or at intervals will always assure the presentation of a clean surface to the pilot electrode and the rotational movement will also tend to break up and discharge any accumulation of carbon, soot, dust or other foreign matter between the electrode ends.

The area of the air intake for the blower being fixed, the volume and pressure of the delivered air will depend only upon the speed at which the blower is driven by the motor, and, with the adjustable baffle valve 31 for accurately determining the volume of gas flow to the burner, a uniform and efficient combustion mixture is generated by the burner and delivered to the furnace firebox without the need of any additional air inlet to the firebox.

The burner structure is of simple and economical construction and its parts can be very readily assembled, dismantled or replaced.

It is to be understood that changes and modifications can be made without departing from the scope of my invention, and I do not, therefore, desire to be limited except as necessitated by the prior art.

I claim as follows:

1. In a gas burner, the combination of an annular frame forming a central passage and a surrounding gas chamber, means for feeding gas into said chamber, concentric circular rows of tubes extending through said frame and chamber parallel with the axis thereof, said tubes adjacent their entrance ends having restricted gas inlets communicating with said chamber, means forming an air chamber surrounding the entrance ends of said tubes, means for forcing air under pressure into said air chamber to flow through said tubes, the air flow past said inlets entraining gas therethrough into the tubes to mix with the air to produce combustion mixture, an ignition device comprising a body extending through said air chamber and said central passage, electrodes extending through said ignition device body with their inner ends terminating adjacent to each other near the outlets of said tubes, an ignition circuit connected with said electrodes, one of said electrodes having a bore therethrough, and means for delivering gas through said bore to be ignited by the current flow between the ends of the electrodes to produce a pilot flame for igniting the combustion mixture issuing from said tubes.

2. In a gas burner, the combination of an annular frame forming a central passage and a surrounding gas chamber, means for feeding gas into said chamber, concentric circular rows of tubes extending through said frame and chamber parallel with the axis thereof, said tubes adjacent their entrance ends having restricted gas inlets communicating with said chamber, means forming an air chamber surrounding the entrance ends of said tubes, means for forcing air under pressure into said air chamber to flow through said tubes, the air flow past said inlets entraining gas therethrough into the tubes to mix with the air to produce combustion mixture, an electrical ignition device comprising a body extending through said air chamber and said central passage whereby to be cooled by the air flowing through said air chamber, and electrodes extending through said body and terminating adjacent to the discharge ends of said tubes for igniting the combustion mixture issuing from said tubes.

3. In a gas burner, the combination of an annular frame forming a cylindrical central passage and a surrounding gas chamber, means for feeding gases to said chamber, concentric circular rows of tubes extending through said frame and chamber parallel with the axis thereof, said tubes adjacent their entrance ends having restricted gas inlets communicating with said chamber, means forming an air chamber surrounding the entrance ends of said tubes, means for forcing air under pressure into said air chamber to flow through said tubes, the air flow past said inlets entraining gas therethrough into the tubes to mix with the air to produce combustion mixtures, an ignition device comprising a cylindrical body extending through said air chamber and said central passage and being of less diameter than said central passage whereby the air flow around said body will keep it cool, and electrodes extending through said body and terminating adjacent to the discharge ends of said tubes for igniting the combustion mixture issuing from said tubes.

GEORGE H. IRWIN.