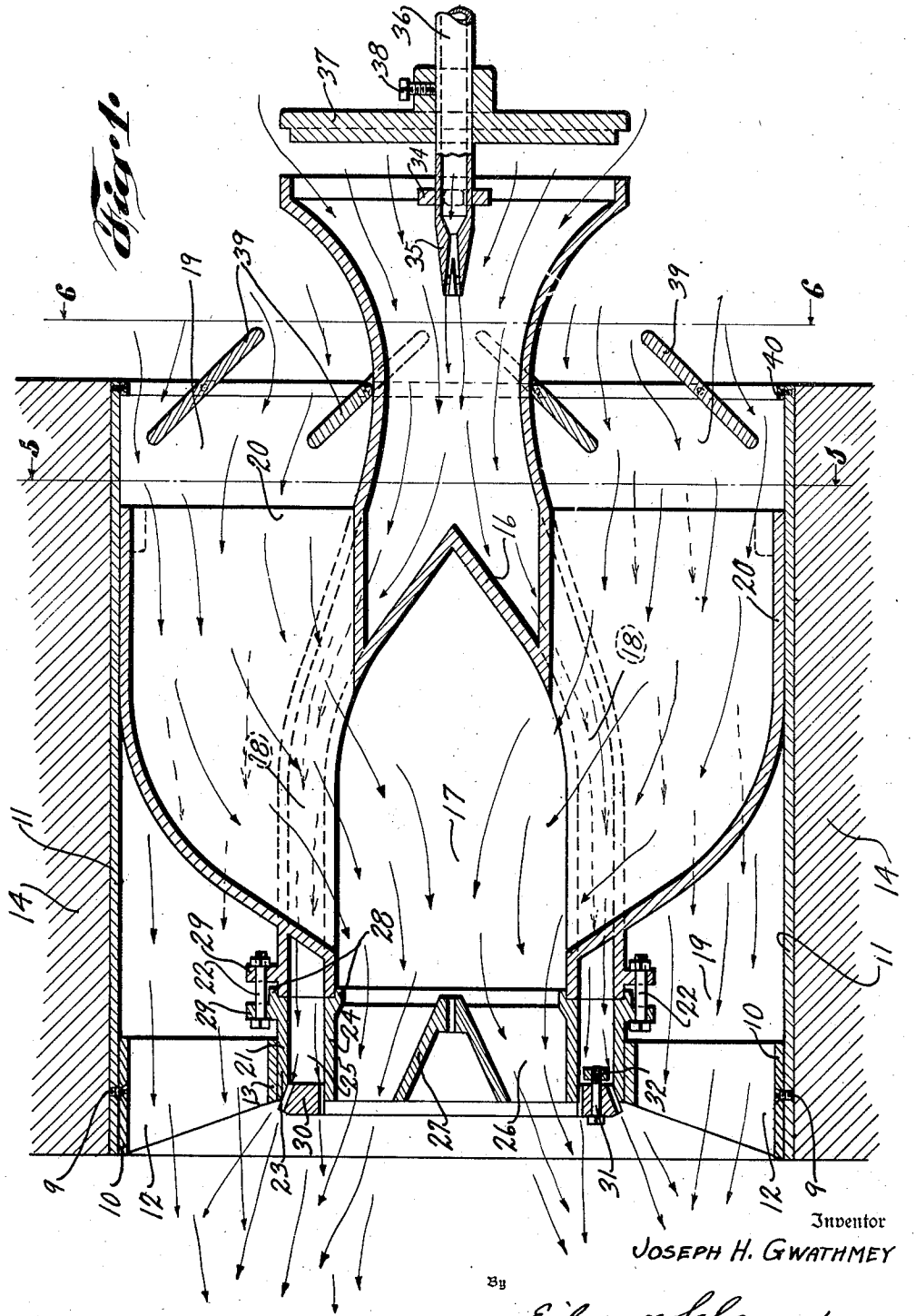
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GAS BURNER

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Fig. 1.



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Fig. 2.

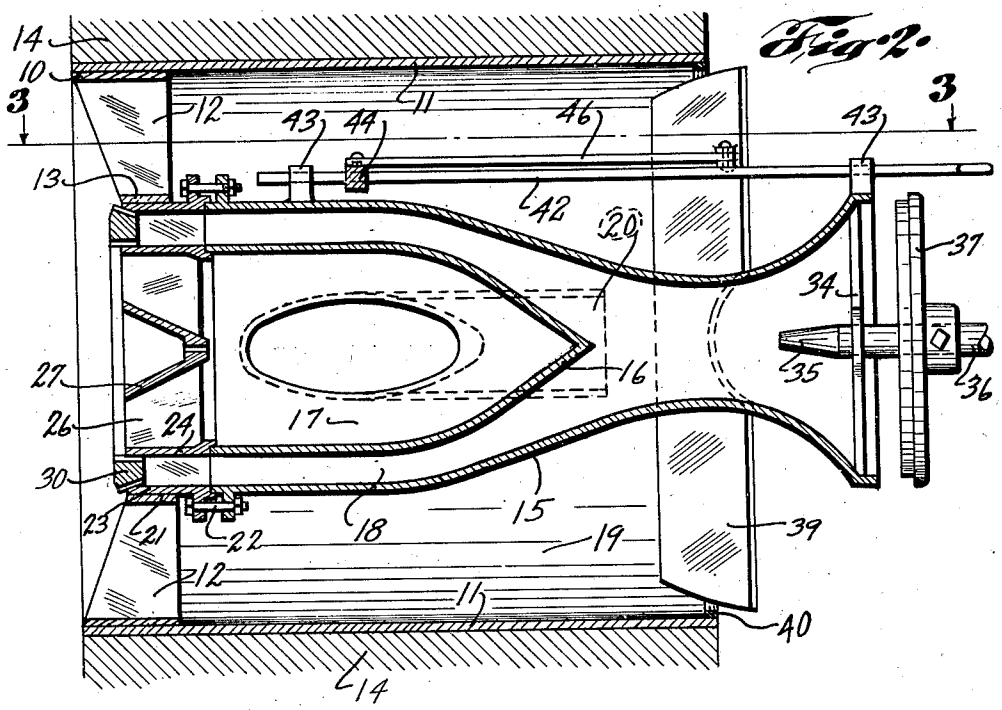
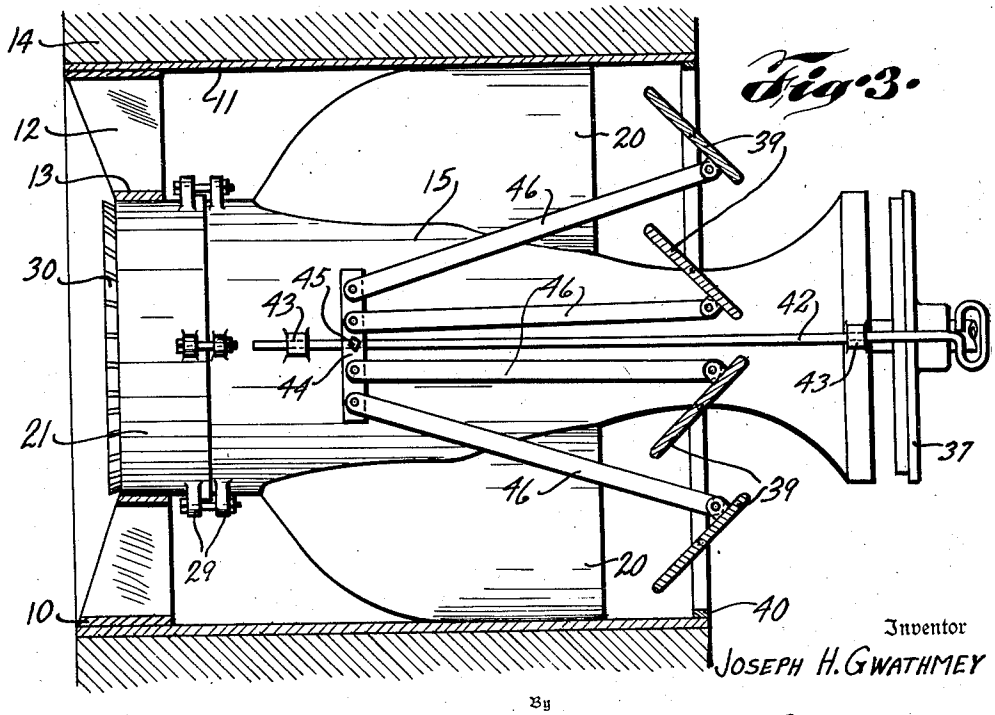


Fig. 3.



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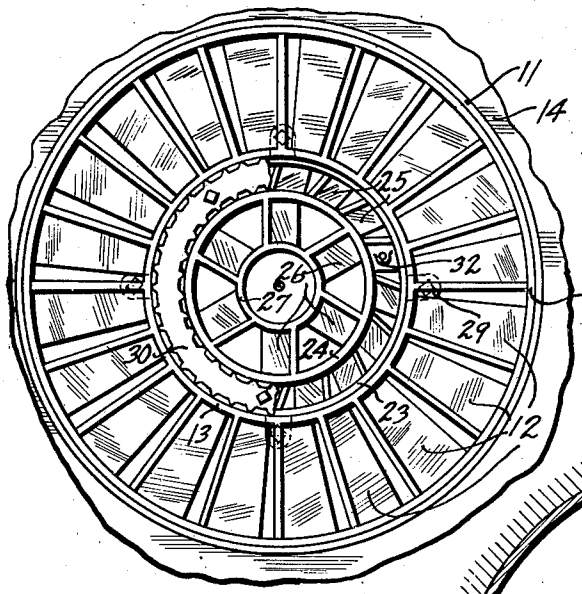


Fig. 4.



Fig. 7.

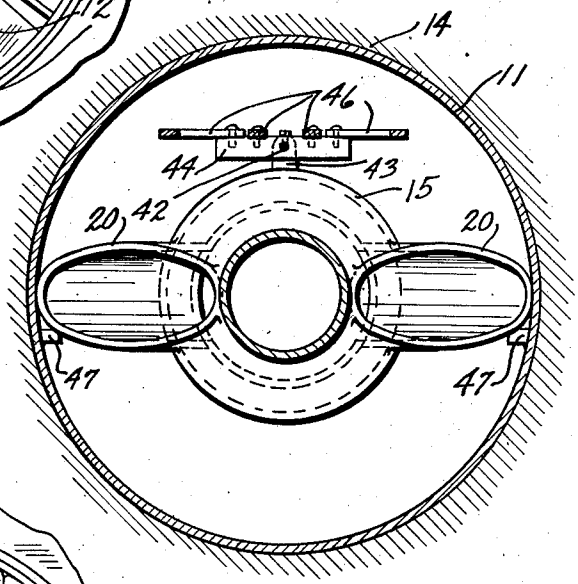


Fig. 5.

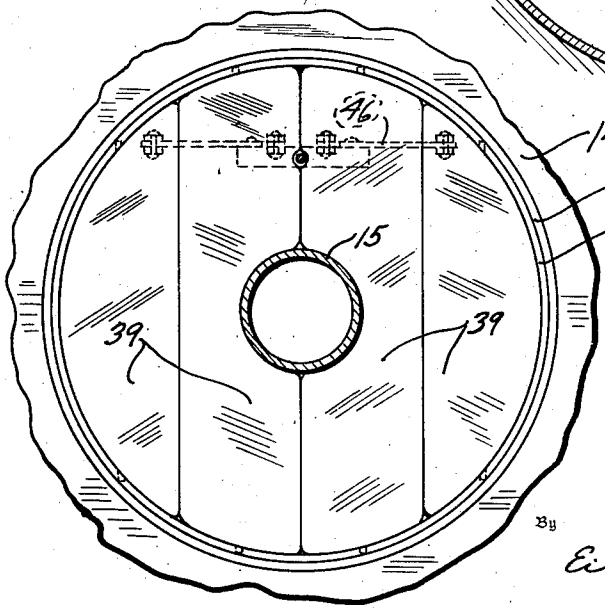


Fig. 6.

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UNITED STATES PATENT OFFICE

1,954,873

GAS BURNER

Joseph H. Gwathmey, Harrisonville, Mo.

Application February 23, 1932, Serial No. 594,466

16 Claims. (Cl. 158—110)

My invention relates to improvements in gas burners, and particularly in burners of types adapted primarily for use in industrial furnaces and boilers.

The device of my invention is designed to receive gas under a substantial pressure, and an object is to provide improved means for effectively and thoroughly mixing the fuel with air, and for controlling the mixture so as to burn the fuel with the greatest possible economy. This measure is accomplished by producing a hollow, whirling, conical flame which surrounds, and is itself surrounded by streams of air which are caused to whirl in a direction opposite to that of the burning fuel gas. By this expedient an abundant supply of oxygen is brought to all parts of the flame, thereby insuring complete combustion of the fuel.

Another object is to provide a single inlet opening, and a single control means for both the inner and outer streams of air.

Yet another object of my invention resides in an improved burner construction which permits certain parts thereof to be readily detached and removed from the boiler or furnace, for cleaning purposes.

Since the portion of the burner adjacent to the flame may, over a long period of use, become damaged as by heat corrosion, it is an object of the present invention to provide a burner with a separable orifice member which may be readily removed and replaced when necessary, and which provides for interchangeability of orifice members to meet differing fuel characteristics, such as varying fuel pressures, heat content, etc.

Other objects and advantages will appear from the detailed description which follows, and from the accompanying drawings, Fig. 1 of which is a horizontal sectional view taken longitudinally through the burner; Fig. 2 is a vertical section taken through the longitudinal axis of the burner; Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2; Fig. 4 is a front view of the burner; Figs. 5 and 6 are sectional views taken respectively along the lines 5—5 and 6—6 of Fig. 1; and Fig. 7 is a fragmentary plan view of an orifice ring which is detachably secured to and forms part of the burner head.

Referring now by characters of reference to the drawings, particularly Figs. 1, 2 and 3, a tubular housing or sleeve 11 is provided near one end with a series of radially disposed vanes 12, which extend radially between a pair of concentrically disposed annular portions 10 and 13. This vane assembly, consisting of vanes 12 and ring portions 10 and 13, by preference, is separable from the sleeve 11. Screws 9, extending through the ring portion 10 for threaded engagement with the sleeve, serve to secure the vane assembly to the sleeve. The annular portion 13 is adapted snugly to accommodate the forward or head end of an inner burner unit, comprising body and head castings to be hereinafter described. The vanes 12 are sloped or pitched, as best appears in Fig. 4, to impart a rotary or whirling motion to a stream of air which normally flows out of the burner between the sleeve 11 and the portion 13. The sleeve or housing 11 is adapted to be positioned within and through the wall of a furnace or boiler, which is indicated at 14, Fig. 1, the vaned end of the sleeve being disposed towards the inner surface of the furnace wall. By preference, the sleeve is arranged for permanent or semi-permanent installation in the furnace wall. The other parts of the burner, hereinafter described, are detachably mounted within, so as to be readily disengaged from, the sleeve so as to facilitate their removal from the furnace.

Considering now the inner unit hereinabove referred to, this unit consists, in part, of a central body 15 of Venturi form, the discharge end of which is divided, as by an annular partition or shell 16, into two concentric chambers or passages 17 and 18. The outermost end of the shell 16 is closed, converging to a point located at the discharge end of the Venturi passage in the body 15.

It may thus be observed that three separate, and substantially concentric passageways are formed within the sleeve or housing member 11. These passages, numbered 17, 18 and 19, will be hereinafter termed inner, intermediate and outer passages, respectively.

As will be hereinafter more fully explained, a mixture of gas and air is delivered to the head member through the intermediate passage 18. Combustion of the mixture takes place in an atmosphere of air which is largely supplied through the inner and outer passages 17 and 19. Thus a portion of the air drawn into the mouth of the tubular casing 11, and into the outer passage 19 is conducted to the inner passage 17 through a pair of pipes 20, disposed at opposite sides of the burner body. The forward, or receiving ends of the pipes 20, have a trend substantially parallel to the longitudinal axis of the burner, the open ends of the pipes being disposed to receive a portion of the air flowing into the passage 19.

The air received by the pipes 20 is directed inwardly, flowing substantially transversely through the intermediate or fuel passage 18, to the inner passage 17.

The burner head, consisting preferably of an annular casting 21, is adapted to fit the forward end of the Venturi body 15 and is detachably secured thereto as by means of threaded elements or bolts 22. Extending between concentric ring portions 23 and 24 of the head member, which rings are arranged to form continuations, respectively, of the Venturi tube 15 and the inner shell 16, are a series of radially disposed vanes 25. These vanes are set obliquely, or sloped to cause the fuel gas to be emitted from the burner head in a whirling stream. The direction of rotation of this stream is opposite to that of the air stream discharged from the outer passage 19, since the vanes 25 are sloped oppositely to the vanes 12. Similarly, a series of vanes 26 are provided for whirling the inner air stream, the vanes 26 extending radially between an outwardly divergent, conical hub portion 27 and the ring 24. The vanes 26 are pitched to cause the inner stream to be rotated in a counter-direction as compared with the fuel gas which flows out of the burner from the intermediate passage 18. Annular flanges 28 on the head member 21 are adapted to embrace the frontal margins of the body member, and these members are secured together as has been previously mentioned, by the bolts 22 which extend through apertures in laterally projecting lugs 29, formed on the head and body castings.

An orifice ring 30, arranged for disposal partially within the annular space between the ring portions 23 and 24 of the burner head, is adapted for attachment to that member by means of bolts 31 extending through the orifice ring and engaging ear portions 32 formed on certain of the vanes 25. The outer and inner side surfaces of the orifice ring are ridged, so that spaces between adjacent ridges 33, form ports for the exit of the fuel gas from the passage between the ring portions 23 and 24. The ridges 33 are preferably inclined with respect to the axis of the orifice ring, in the same direction as vanes 25. The provision of the member 30 greatly improves the operation of the burner, since by breaking up the stream of fuel gas into a plurality of individual streams, resulting, in the present example, from the spaced ports formed between the ridges 33, a more thorough intermixing of the fuel gas with the surrounding air is accomplished. As best appears from Fig. 1, the orifice ring is formed with a sloping outer side, which causes the streams of gas to be discharged outwardly from the burner head and into the air stream issuing from the passage 19. The air stream from the inner passage 17 is directed, by the conical hub portion 27, outwardly towards the stream of gas. The tendency for the gas to intermix with the secondary air is greatly increased by reason of their oppositely whirling movements.

Extending across the mouth of the venturi is a bracket 34 which is apertured to receive and arranged to support a gas nozzle 35. As best appears in Fig. 1, the nozzle orifice faces the tapered end portion of the shell 16. The nozzle, preferably designed to discharge the gas from the orifice in a hollow, funnel-shaped stream, directs the gas into the annular passage 18 without undue impingement against, or direct impact upon the wall of the shell 16. In accordance with well known principles, due to the velocity of the gas, air will be injected into the mouth of the venturi, and thereafter become intermixed with the gas as it flows through the burner. The relative proportions of gas and primary air may be regulated by a valve (not shown) in the gas supply pipe 36, and by an adjustable closure plate 37. This plate, in the present example, is carried by the pipe 36 and arranged for axial adjusting movement relative to the Venturi mouth, a set screw 38 serving to secure the plate in adjusted position.

For controlling the supply of secondary air, which is drawn into the mouth of the casing or sleeve 11 and which thereafter becomes divided into inner and outer streams heretofore mentioned, an assembly of segmental shuttter plates 39 is provided at the mouth of the sleeve, each thereof being mounted for pivotal movement on a ring frame 40, disposed internally of the sleeve. This closure assembly is secured to the sleeve by screws which extend through the ring frame 40 into the sleeve. Conjoint movement of the shutters and control of the secondary air streams is obtained by the provision of an actuating rod 42 (Figs. 2 and 3) disposed for sliding movement parallel to the axis of the Venturi tube body 15. The rod 42 is carried between a pair of spaced eye lugs 43 formed on the Venturi body. A crosshead 44, mounted on the control rod 42 and adjustably positioned thereto as by a set screw 45, is connected to each of the shutters 39 by individual link members 46 as best appears in Fig. 3. Obviously, longitudinal movement of the control rod causes the shutters to be turned on their individual axes, thereby increasing or decreasing the area of intake opening in the housing. The control rod is limited in its inward movement, by the abutment of the cross head 44 against the innermost eye lug 43, which is arranged to occur when the shutter assembly is in closed position.

An important advantage of the present invention resides in the ease with which the burner may be installed, and in the ease with which those portions of the burner requiring periodic attention may be removed and replaced in the furnace or boiler. As has been previously stated, the sleeve or housing member 11 is designed to constitute a permanent part of the furnace and by preference, is bricked in place when the furnace is built. The removable portions of the burner, which include the body and head castings 15 and 21, respectively, and the segmental shutter assembly, may be readily disengaged and withdrawn from the sleeve 11. The inner unit, consisting of the body and head castings, is preferably supported at three points. At the discharge or head end, the unit is supported by the annular portion 13 which preferably forms an integral part of the housing. A pair of oppositely disposed, internal lugs 47 on the sleeve 11 are arranged for seating or supporting engagement by the laterally projecting pipe arms 20. No threaded connection need be employed for securing the position of the inner unit.

Although designed for a long period of service, the part of the burner most susceptible to damage by heat corrosion is the orifice ring. This member is made separable from the burner head, to permit of its replacement in case of cracking or corrosion.

Summarizing, for purposes of completeness, the operation of my improved burner, gas, preferably under substantial pressure, is delivered to the nozzle 35 and discharged therefrom in a funnel-

like stream into the mouth of the venturi. Primary air, drawn by injector action of the venturi into the burner through the opening between the Venturi mouth and the closure plate 37, becomes intermixed with the gas during its passage through the Venturi throat and the annular intermediate passage 18. This mixture, due to the vanes 25 and the pitched orifices, issues from the burner head in a highly divided stream having whirling as well as forward motion. The forward motion of the fuel mixture, in addition to the draft, normally present in the furnace, causes secondary air to be drawn into the mouth of the housing or sleeve 11, through the adjustable shutter plates 39. A portion of this air is collected and delivered through the pipes 20 to the inner passage 17. Both inner and outer air streams issue from the burner head with a rotary motion, the direction of which is opposed to that of the fuel gas, causing a thorough intermixing of air and fuel which results in perfect combustion.

While my invention has been described with reference to a particular, presently preferred embodiment, I fully understand that various changes may be made in the burner herein shown and described without departing from the spirit and full intended scope of my invention.

I claim:

1. A gas burner comprising a tubular body having annular partitions forming inner, intermediate, and outer coaxial passageways therethrough, and means disposed near one end of said body member for discharging fluids conducted through adjacent passageways, in oppositely whirling streams.

2. A gas burner comprising a tubular body having annular partitions forming inner, intermediate and outer coaxial passageways therethrough, means disposed near one end of said body member for discharging fluid conducted through adjacent passageways, in oppositely whirling streams, said means adapted to direct one of the streams discharged within the outer stream, divergently into said outer stream.

3. A gas burner structure having inner and outer air passages therein, a fuel passage therebetween and a pair of laterally disposed pipes extending substantially transversely through the fuel passage, connecting said inner and outer air passages, said pipes adapted to conduct air from said outer passage, through the fuel passage and into said inner passage.

4. A burner including a tubular housing, means dividing the space within the housing into inner, intermediate and outer concentric passageways, said means being removably associated with the housing, and a pipe extending through the intermediate passageway connecting said inner and outer passageways.

5. A gas burner structure including an axial fuel passage and an outer air passage at one end of the structure, an axial air passage and a fuel passage exteriorly thereof near the opposite end of the structure and communicating with said axial fuel passage, and a conduit within the burner structure connecting said air passages.

6. A gas burner including an outer tube, an inner tube of lesser diameter than the outer tube extending longitudinally therethrough, a detachable tubular head member on said inner tube, and fluid-whirling means located internally and externally of said head member.

7. In a gas burner structure, an outside casing adapted to be permanently installed in a furnace, a burner body detachably disposed within the casing structure, a plurality of separate fuel and air passages through said body, a support for said body carried by and within the casing and fluid-spiralling vanes constituting a portion of said support.

8. In a gas burner, an outside, tubular casing arranged to be installed in the wall of a furnace or the like, a burner body detachably suppported within the casing, the body including a detachable burner head portion and a plurality of air and fuel passages, the body coacting with the casing, when installed therein, to form a passage exterior of the body and interior of the casing.

9. In a gas burner, a tubular housing structure, a chambered body casting removably disposed within the housing structure, forming a gas passage and a plurality of separate air passages therethrough, means for discharging gas and air conducted through said passages in separate coaxial streams, and means for deflecting a plurality of said streams, upon issuance from the structure, into the line of flow of another of said streams.

10. In a gas burner, a housing structure, chambered internally to provide passages for conducting a fuel stream and a plurality of air streams, separately, through the said structure, means in said passages for whirling each of said streams as they issue into a combustion zone located forwardly of said structure, and means for directing a plurality of said streams into said zone of combustion, divergently into the line of flow of another of said streams.

11. In a gas burner, a tubular housing, a removable inner tube spaced from the walls of said housing and forming therewith three separate passages therethrough, and a plurality of coacting closures adapted to control the fluid flow through two of said passages.

12. In a gas burner, a tubular housing or casing adapted to be permanently installed in a furnace wall, and open at its opposite ends; a plurality of inwardly and radially extended vanes carried by said housing near the discharge end of the burner, the vanes terminating inwardly in an annular collar; a burner body detachably disposed within said housing and having a detachable, annular head portion slidably supported within said collar, said body including an axial Venturi passage at its inlet end; a slidable closure and a gas inlet nozzle at the inlet end of the venturi; a hollow streamline structure disposed in the body between the constricted portion of the venturi and the discharge end of the body, said streamline member forming an axial air passage near the discharge end of the burner body and provided with laterally extended supply branches opening at their intake ends into said housing; an air-diverging structure disposed axially of said streamline member at the discharge end of the burner; an annular member having burner ports therein and detachably carried by said burner head; two sets of vanes in the burner head, one disposed across the inner air passage and the other disposed adjacent said annular port member and adapted for imparting a whirling motion, in opposite directions, to the streams of fluid issuing from said burner body, said burner body being spaced from the inside surface of said housing so as to form an outer, substantially annular air passage through the housing, and means for concurrently controlling the movement of air through said outer and inner air passages, said means including a shut-

ter structure detachably carried by said housing near its inlet end, and a device for concurrently actuating the elements of said shutter structure.

13. In a gas burner, a tubular concentrically chambered body, a removable discharge head mounted at one end of said body portion comprising an outer ring forming a continuation of the outer wall of said body, a conical hub portion, and a ring disposed intermediately of said hub and outer ring, a series of radially disposed vanes connecting said outer and intermediate rings, and a series of radially disposed vanes connecting said hub portion and intermediate ring.

14. In a gas burner, a tubular body, an annular discharge head removably connected to said body forming a continuation thereof, said discharge head having a conical hub and an intermediate ring portion dividing the space within the discharge head into separate concentric passages, series of radially disposed vanes in said passages arranged to cause the fluids discharged therefrom to be whirled in relatively opposite directions.

15. In a gas burner, in combination with a tubular body portion, a head casting mounted at the discharge end of said body portion including concentric tubes forming an annular passage therebetween, a series of radially disposed vanes connecting said tubes, uniformly tilted to impart whirling motion to fluid conducted through said passage, a removable ring member on said head casting having ports adapted to discharge said fluid in relatively divergent streams.

16. A gas burner structure including a tubular body providing a fuel passage and having a Venturi throat portion near its inlet end, a burner head at the discharge end of said body, a hollow member of substantially streamline form disposed in the fuel passage between the Venturi throat portion of said body and said burner head, providing an air passage internally of said fuel passage, and a pipe for conducting air to said internal passage.

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