J. KNUDSEN.

GAS BURNER.

APPLICATION FILED DEC. 11, 1920.

1,407,871. Patented Feb. 28, 1922.

Fig. 1

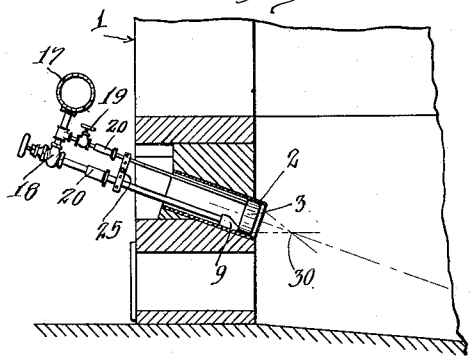


Fig. 3

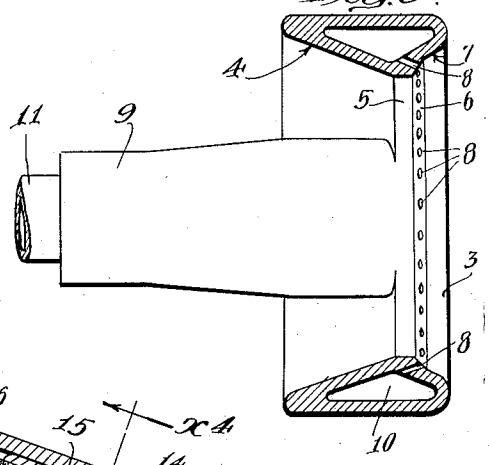


Fig. 2

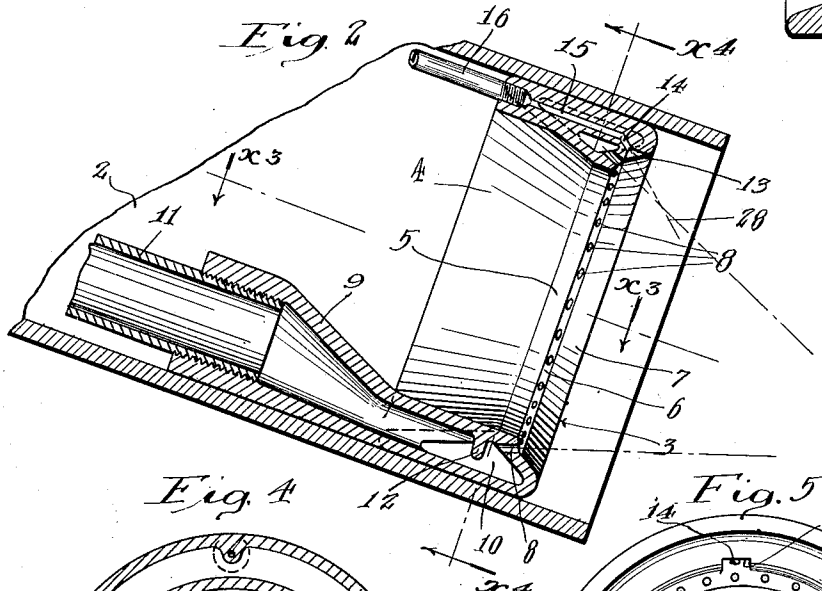


Fig. 4

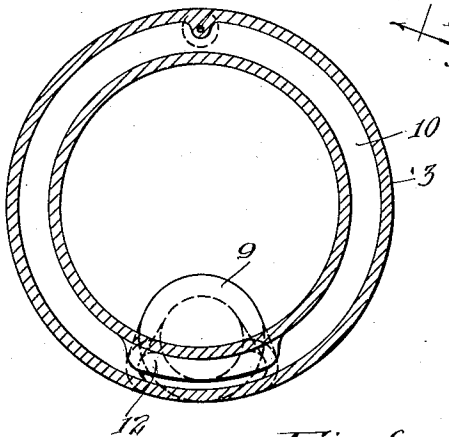


Fig. 5

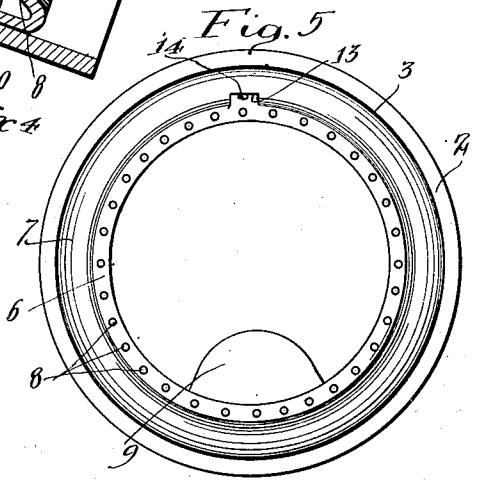
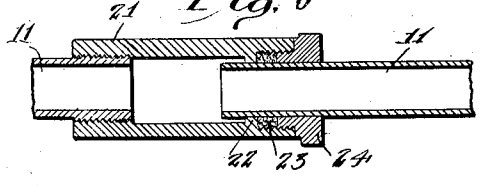


Fig. 6



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UNITED STATES PATENT OFFICE.

JOHN KNUDSEN, OF BREA, CALIFORNIA.

GAS BURNER.

1,407,871. Specification of Letters Patent. Patented Feb. 28, 1922.

Application filed December 11, 1920. Serial No. 429,906.

To all whom it may concern:

Be it known that I, JOHN KNUDSEN, a citizen of the United States, and a resident of Brea, in the county of Orange and State of California, have invented certain new and useful Improvements in Gas Burners, of which the following is a specification.

This invention relates to gas burners and is particularly directed to burners especially adaptable for firing furnaces, the main object of the invention being to provide a burner of the air induction type in which the gas and air requisite for proper combustion are discharged from the burner and directed to an apex point of mixture within the furnace and exterior of the burner.

Another object is to provide a burner forming an air passage of general Venturi-tube contour and having provisions for directing a flow of gas from the periphery of the burner longitudinally to its axis in hollow cone formation with the base of the cone inwardly of the throat of the venturi and the apex within the furnace exterior of the discharge end of the burner, whereby the cone of flowing gas creates a suction inducing air through the venturi and into the gas cone, entraining the air in a direction coincident to the gas flow and in proportions variable with variations in the gas pressure.

Another object is to provide means for varying the longitudinal position of the apex point of mixture to vary the suction on the induced air.

Another object is to position the gas discharge orifices so that the gas flows in a direction approximately coincident to that of the air.

Another object is to provide a burner discharging an annular cone shaped column of gas effecting an induction of a solid column of air into the cone, the burner being formed to compel all the induced air to flow into and through the gas cone.

Another object is to provide a burner in which combustion takes place at the immediate point of the breaking up and mixing of the air and gas, this point being within the furnace and beyond the discharge end of the burner.

A further object is to provide a pilot flame immediately adjacent the gas discharge and positioned away from the draft action of the air current.

Various other objects and advantages will be more fully apparent from the following description of the accompanying drawings, which form a part of this disclosure, and which illustrate a preferred form of embodiment of the invention.

Of the drawings,

Figure 1 is a vertical section through a portion of a furnace with the burner of the present invention installed therein;

Figure 2 is an enlarged longitudinal section through the inner portion of the burner;

Figure 3 is a longitudinal section through the gas ring, taken on line x^3—x^3 of Figure 2;

Figure 4 is a transverse section through the gas ring, taken on line x^4—x^4 of Figure 2;

Figure 5 is an elevation of the inner end of the burner; and

Figure 6 is a longitudinal section through the slip-joint connection of the gas feed pipe.

Various types of gas burners for firing furnaces have previously been designed with the object of promoting perfect combustion and generally these have provided for the breaking up and mixing of the air and gas within the burner and then injecting the mixture into the furnace. The breaking up of the air and gas by collision causes a violent agitation which is nullified by the flow of the mixture through the furnace.

Taking advantage of the fact that the most perfect combustion is had at the point of greatest mixture agitation, I have changed the functional theory of the previous burners and confined the functions of the burner of the present invention to the proportioning of the proper relative feeding of air and gas and to the directing of these to a common point of collision or mixture exterior of the burner whereby the point of combustion is immediately at the point of greatest mixture agitation. Therefore, it will be evident that the burner of the present invention is a radical departure from the general type of fuel mixing burners and that its distinguishing feature is that it is in effect a fuel feeding device which ejects the fuel to a mixing point exterior of the burner and within the furnace, as distinguished from those devices in which the mixing of the fuel takes place within the burner.

With reference to Figure 1 of the drawings, the burner is positioned in the front

wall 1 of the furnace in an angled plane pointing downwardly towards the floor of the fire box.

In construction, the burner comprises a burner tube 2 embedded in the front wall 1 and a gas ring 3 longitudinally slidable therein with the exterior periphery of the ring 3 closely fitting the inner periphery of the tube 2 so that no appreciable amount of air may flow between the ring and tube.

The gas ring 3 is preferably an integral hollow annular casting having a cross sectional contour of Venturi-tube formation providing a converging diverging passage, the inner peripheral wall of the gas ring 3 being gradually tapered, as at 4, to converge longitudinally from the intake end of the ring to a throat portion 5, then relatively abruptly tapered, as at 6, to diverge longitudinally away from the throat a short distance, and then more gradually tapered, as at 7, to diverge to the outlet end of the ring. At the portion 6, the ring is bored to provide an annularly disposed series of fuel ports 8 angularly disposed in a circular converging plane approximately parallel to the converging plane of the wall portion 4 and adapted to direct a cone-shaped column of fuel to an apex point of collision beyond the discharge end of the burner tube 2.

At one side the gas ring 3 has a gas inlet nipple 9 communicating with the annular gas chamber 10 of the gas ring and having a screw-threaded outer end to receive the main gas supply pipe 11. The nipple 9 is designed to provide a uniform cross-sectional area for gas admittance to the ring without appreciably disturbing the smooth flow of air through the burner. This is accomplished by gradually flattening and widening the intake nipple from the circular outer end to its juncture with the gas ring 3. A deflecting web 12 extends across the outlet end of the nipple 9 circumferentially of the gas ring and part way across said outlet end radially of the gas ring and serves to provide an equal distribution of the gas around the ring.

At the opposite side of the ring 3 the wall portion 7 is recessed, as at 13, and a pilot gas port 14 terminating in said recess directs a pilot flame in a plane (indicated at 28) intersecting the flow of gas from the adjacent fuel port 8, as indicated in Figure 2. The pilot gas port 14 communicates with a duct 15 extending through a fillet in the gas chamber 10 and receiving fuel from a pilot supply pipe 16.

The gas supply pipe 11 and the pilot supply pipe 16 both extend rearwardly out of the burner tube 2 and communicate with the gas main 17 through individual control valves 18 and 19.

For the purpose of permitting a longitudinal adjustment of the gas ring within the burner tube, I provide slip-joints 20 connecting each of the supply pipes 11 and 16 to their respective stationary pipe lines. The preferred construction of these joints is illustrated in Figure 6 and consists of a stationary sleeve 21 connected to the pipe line and telescopically engaging over the free end of the pipe 11 or 16, as the case may be, and provided with an annular shoulder 22 as a seat for a suitable packing ring 23 which is engaged and compressed by a packing bushing 24 screw-threaded in the end of the sleeve, the pipe projecting through the bushing and packing and communicating with the interior of the sleeve.

The outer ends of the pipes 11 and 16 are joined by a cross bar 25 serving as a handhold for adjusting the ring.

Having described the mechanical construction of the burner, I will now explain its mode of operation and the effects of such changes as are within the scope of the present invention.

The gas under pressure is ejected through the fuel ports 8 of the gas ring or distributor 3, each jet being directed to an apex point (indicated at 30 in Figure 1) on the extended longitudinal axis of the burner, the several jets forming elements of the side or sides of a cone or pyramid, depending on whether the distributor is of circular, square or rectangular type, it being within the scope of the invention to form the gas distributor of such shapes as may be most desirable. The ejecting of the gas from the peripheral portion of the gas ring to an apex point of collision produces a suction on the column of free air in the burner tube 2 inducing a flow of air through the gas ring and such flow of air will vary directly as the pressure of the gas is varied, thereby producing an automatic regulation of the air supply directly influenced by the velocity of the ejected gas. The gradually converging wall of the intake end of the venturi contoured gas ring tends to direct the air column to a more or less cone formation as it passes the throat of the ring, so that the air is entrained with the gas rather than wiping directly across the mouths of the gas jet orifices or ports, and by providing the abruptly diverging wall adjacent the throat and boring the gas ports in said wall, the ports are in a protected position diametrically beyond the throat and removed from the direct path of the air column.

It will be understood that all the induced air must flow into and through the gas cone and considering the fact that the air and gas flow in approximately the same direction it will be evident that what mixing takes place within the burner is of minor proportion. Also, it will be evident that the general direction of fuel discharge is longitudinally of the burner and to an apex point exterior

of the burner, carrying the mixing of the fuel and air to the point of combustion within the furnace.

In general practice, the burner is installed in a furnace with the gas ring positioned, as near as is possible, at a point in the burner tube where it will give the most efficient service, but as this point varies slightly with different furnaces, it is desirable to be able to adjust the ring longitudinally within the tube as is provided for by the slip-joint connections described.

The effect of longitudinally adjusting the gas ring will be to increase or decrease the volume of air induced relative to a given gas pressure, the volume of air being increased by moving the gas ring backward in the burner tube or decreased by moving it reversely towards the discharge end of the burner tube, these adjustments being made without bringing the apex point of combustion within the tube itself.

The specific form of burner shown is of a design which will give service of marked efficiency in various standard types of furnaces; however, it is to be understood that for adapting it to other or special services certain changes as to the sizes, shapes and number of fuel ports, the specific angles at which they are bored and the specific angles of the walls of the gas ring may be variously modified without departing from the broad scope of the invention, which provides a gas burner of the air induction type having a gas distributor forming an air passage and directing the gas and induced air longitudinally from the burner to an apex point of collision within the furnace with the volume of air varying directly as the velocity of the gas and with the proportion of air variable relative to the velocity of the gas by longitudinal adjustment of the gas distributor within the burner tube.

I claim as my invention:

1. A gas burner comprising a burner tube, and an annular gas distributor within the tube forming an air passage and directing air and gas to an apex point of collision exterior of the burner tube.

2. A gas burner comprising a burner tube, and an annular gas distributor within the tube forming a central air passage and having means diametrically beyond the throat of the air passage for directing fuel longitudinally outwardly to an apex point exterior of the burner tube.

3. A gas burner comprising a burner tube, and an annular gas distributor of Venturi-tube form providing a central air passage and having a plurality of fuel ports circularly disposed beyond the throat of the distributor and angled longitudinally to direct the fuel outwardly beyond the burner tube and towards the axial plane of the tube.

4. A gas burner comprising a burner tube, and an annular gas distributor providing a gas chamber and forming a central air passage with the wall of the air passage converging gradually from the intake end to the discharge throat, then diverging relatively abruptly to form an annular offset outwardly beyond the throat, fuel discharge ports communicating with said offset and with the gas chamber and longitudinally angled to direct fuel outwardly from the burner tube to an apex point of collision exterior of the tube, and means supplying fuel to the fuel chamber.

5. A gas burner comprising a burner tube, and an annular gas distributor within the tube providing a central air passage and having a plurality of peripherally disposed fuel ports radially spaced beyond the air passage and longitudinally angled in relative planes converging to a point exterior of the burner tube and alined with the axis of the tube.

6. A gas burner comprising a burner tube, and a converging diverging annular gas distributor within the tube forming a central air passage and having a plurality of peripherally disposed fuel ports directing fuel longitudinally from the diverging outlet end of the distributor in relative planes converging to a point exterior of the burner tube and alined with the axis of the tube.

7. A gas burner comprising a burner tube, and a hollow annular gas distributor within the tube and fitting closely to the wall of the tube to prevent the passage of air between the tube and the distributor, the inner peripheral wall of the distributor converging from the inlet end to an intermediate throat and then diverging from said throat to the outlet end with the diverging wall offset to provide a peripheral recess, fuel ports terminating within said recess and communicating with the interior of the hollow distributor, said ports being longitudinally angled in respective planes converging to a point exterior of the burner tube and alined with the axis of said tube, to direct a cone shaped annular column of fuel from the distributor to an apex point of collision beyond the discharge end of the burner tube, and create a suction drawing air through the central air passage.

8. A gas burner comprising a burner tube, and a gas distributor within the tube forming an air passage and provided with means directing gas in converging planes to a point of collision exterior of the burner tube.

Signed at Los Angeles, California, this 6th day of December, 1920.

JOHN KNUDSEN.

Witnesses:

LOUIS BAGSHAEVE,

A. Z. JOHNSTON.