

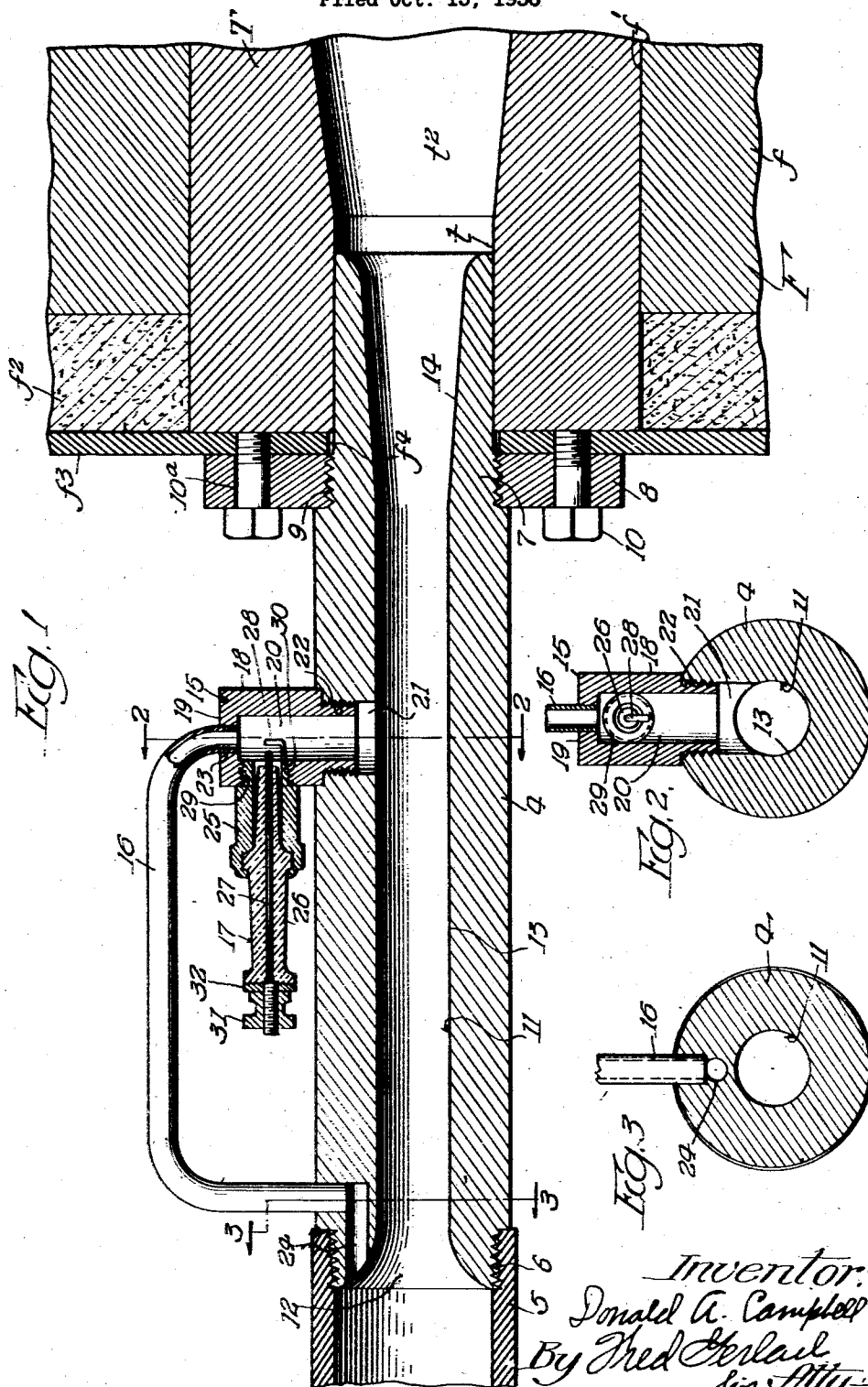
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GASEOUS FUEL BURNER

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GASEOUS FUEL BURNER

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The present invention relates generally to gaseous fuel burners for furnaces and like heating apparatus. More particularly the invention relates to that type of burner which is designed primarily to burn a combustible mixture of air and a gas such as butane or natural gas and consists of a tube-like member which is adapted to have the fuel mixture supplied to one end thereof under pressure, embodies at its other end means for connection to a tuyère in one wall of the furnace with which the burner is used, and has a longitudinal fuel passage therethrough with a short inwardly tapered mouth, a comparatively long narrow throat, and an outwardly flared outlet of intermediate length.

One object of the invention is to provide a gaseous fuel burner of this type which embodies a novel and comparatively simple device whereby the fuel mixture passing through the passage in the tube-like member may readily be ignited in connection with starting of the burner.

Another object of the invention is to provide a fuel burner of the last mentioned character in which the device for igniting the fuel mixture passing through the longitudinal passage in the tube-like member is located outside of the inlet end of the tube-like member in order that it is readily accessible for repair or replacement purposes and is not subject to heat from the furnace, and is in the form of an attachment which may be quickly and readily applied to the tube-like member after attachment or connection of the latter to its tuyère.

Another object of the invention is to provide a gaseous fuel burner of the type and character under consideration in which the igniting means for the fuel mixture comprises an expansion chamber which communicates with, and extends laterally from, the throat portion of the fuel passage in the tube-like member and is connected by a tube along the outside of the member to receive a small portion of the mixture from the mouth portion of the passage, and also comprises a spark plug of standard or conventional design for igniting the portion of the fuel mixture in the expansion chamber in order to produce a flame which traverses the throat portion of the fuel passage and ignites the fuel mixture passing therethrough to the outwardly flared outlet.

A further object of the invention is to provide a gaseous fuel burner of the last mentioned character in which the expansion chamber which constitutes a part of the igniting device for the fuel mixture passing through the tube-like member is formed in an open ended plug which carries

the spark plug and extends into a hole in the tube-like member.

A still further object of the invention is to provide a gaseous fuel burner of the type and character last mentioned in which the plug formed expansion chamber of the fuel igniting device is so arranged and formed that upon stoppage of the supply of current to the spark plug at the conclusion of a burner igniting operation the flame which is generated in the chamber as the result of the passage of a portion of the fuel mixture therethrough is automatically extinguished and hence there is no likelihood of fouling the spark plug.

Other objects of the invention and the various advantages and characteristics of the present gaseous fuel burner will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawing which accompanies and forms a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a vertical longitudinal section of a gaseous fuel burner with a fuel igniting device embodying the invention; and

Figures 2 and 3 are vertical transverse sectional views on the lines 2—2 and 3—3 of Figure 1, respectively.

The burner which is shown in the drawing constitutes the preferred embodiment of the invention and is characterized by the fact that it includes a simple and novel fuel igniting device. It is designed primarily to burn a combustible mixture of air and a gas such as butane or natural gas, comprises a tube-like member 4, and is adapted primarily for use in connection with a furnace F having a tuyère T. The furnace F embodies a side wall f having a hole f¹ therein through which the tuyère T extends. The tuyère, as shown in the drawing, projects outwardly a small distance beyond the side wall f of the furnace and embodies on the outer end thereof an entrance t. The latter is cylindrical and communicates with the firebox of the furnace F by means of an inwardly flared fire tunnel t². A facing f² of heat insulating material surrounds the projecting outer end of the tuyère and is held in place against the outer face of the side wall f of the furnace by means of a metal plate f³ which abuts against the outer end face of the tuyère and embodies a circular opening f⁴ in

alignment with the cylindrical entrance *t* of the tuyère.

The tube-like member 4 of the burner is axially aligned with the tuyère T. It is formed of steel or any other suitable material and is adapted to receive the fuel mixture under pressure by way of a pipe 5 which surrounds the outer or inlet end of the member 4 and is held in place by means of a screw thread connection 6. The inner or discharge end of the tube-like member 4 is in the form of a reduced or stem-like extension 7 which extends through the hole *f*⁴ in the plate *f*³ and fits within the cylindrical entrance *t* of the tuyère T. A ring type plate 8 serves to secure the burner in place as far as the tuyère T is concerned. This plate is connected by a screw thread 9 to the inner end of the stem-like extension 7 and is clamped against the hole defining portion of the plate *f*³ by means of a pair of bolts 10. The latter, as shown in Figure 1, extend through holes 10^a in the outer margin of the plate 8 and fit within internally threaded sockets in the plate *f*³ of the furnace F. The inner periphery of the tube-like member 4 defines a longitudinal passage 11 through which the fuel mixture passes from the discharge end of the pipe 5 to the entrance *t* of the tuyère T. This passage embodies a short mouth 12, a narrow throat 13 and an outwardly flared outlet 14. The mouth 12 is located at the inlet end of the tube-like member 4 and is inwardly tapered. The throat 13 extends from the mouth 12 to the member 4 and there joins and communicates with the outlet 14. It is circular in cross-section and is of uniform diameter from one end thereof to the other. The outlet 14 is located in the stem-like extension 7 and discharges into the cylindrical entrance *t* of the tuyère T. The fuel mixture in traveling through the passage 11 first enters the mouth 12, then flows through the throat 13 and finally passes through the outwardly flared outlet 14 into the entrance of the tuyère. Due to the inward taper of the mouth 12 the velocity of the fuel mixture is materially increased as the mixture passes into the throat 13. This increased velocity of the mixture is maintained during flow of the mixture through the throat due to the fact that the throat is narrower than the mouth and is of uniform diameter from one end thereof to the other. When the fuel mixture passes into the outlet 14 of the throat 13 the velocity of the mixture decreases due to the outward flare of the outlet. Upon entry of the fuel mixture into the tunnel *t*² combustion takes place. During normal operation of the burner no combustion of the gas takes place in the throat 13. This is due to the fact that the velocity at which the mixture passes through the throat is above, that is, in excess of, the rate of flame propagation of the gas. The fuel mixture as it enters the mouth 12 of the passage 11 is under "static" pressure and as it flows through the throat 13 is under "velocity" pressure. When the fuel mixture passes through the outlet 14 it is again under "static" pressure due to the outward flare of said outlet.

The igniting device for the burner is disposed for the most part on the outside of the tube-like member 4 and consists of an elongated plug 15, a tube 16 and a spark plug 17. The plug 15 is disposed in an upstanding position over the central portion of the tube-like member 4 and is formed of steel or any other suitable material. It comprises a cylindrical side wall 18 and a top

wall 19, and has an elongated vertically extending cylindrical expansion chamber 20 therein. This chamber receives a portion of the fuel mixture by way of the tube 16; as hereinafter described, and is open at its lower end. The lower end of the side wall 18 of the plug 15 is of reduced diameter and fits within a hole 21 in the tube-like member 4. An external screw thread 22 on the lower end of the side wall 18 coacts with an internal screw thread around the outer end of the hole to secure the plug in connected relation with the member 4. The hole 21 extends from the outer periphery of the member 4 to the throat 13 of the passage 11 and constitutes a passageway whereby the expansion chamber 20 is in direct communication with the throat 13. As shown in the drawing, the hole 21 is located in close proximity to the central portion of the throat. The tube 16 extends between the plug 15 and the outer or inlet end of the tube-like member 4 and may be formed of any suitable material. One end of the tube extends through and is fixed in a hole 23 in the top wall 19 of the plug 15 and the other end extends into and is fixed within one branch of an L-shaped duct 24 in the inlet end of the member 4. As shown in Figure 1, the other branch of this duct extends lengthwise of the member 4 and intersects and communicates with the large portion of the mouth 12 of the passage 11. The tube 16 is smaller in diameter than the expansion chamber 20 and serves to conduct a portion of the fuel mixture in the inlet end of the tube-like member 4 to the expansion chamber 20. Due to the fact that the duct 24 communicates with the large end of the mouth 12 of the passage 11 and the expansion chamber 20 is greater in diameter than the tube 16, the portion of the gas mixture which flows through the tube 16 enters and flows through the chamber 20 at an extremely low velocity and in such a condition or state that it is readily ignitable. The spark plug 17 is of conventional design and consists of a metallic shell 25, an elongated body 26 of insulating material and a pair of electrodes 27 and 28. It is disposed under the central portion of the tube 16 and when supplied with current serves to ignite the fuel mixture in the expansion chamber 18. The shell 25 surrounds one end of the body 26 and has a reduced externally threaded stem 29 which fits within and extends through an internally threaded hole 30 in the side wall 18 of the plug 15. The electrode 27 extends longitudinally through the body 26 and one end thereof projects through the stem 29 and into the expansion chamber 20 and is spaced from the electrode 28 so as to form a spark gap therebetween. The other or outer end of the electrode 27 embodies an enlarged externally threaded part for a nut 31 and is adapted to receive current through the medium of a conductor 32 which is clamped by the nut 31 against the contiguous end of the body 26. The electrode 28 is secured to the stem 29 and is grounded through the medium of the plug 15, the tube-like member 4, the ring-shaped plate 8, and the furnace plate *f*³. When current is supplied to the electrode 27 by way of the conductor 32 a spark is formed or occurs between the inner end of the electrode 27 and the electrode 28. This spark serves to ignite the portion of the fuel mixture within the chamber 20 and the flame resulting from combustion of the portion of the fuel mixture within the expansion chamber projects across the throat 13 of the passage 11 and

causes the fuel mixture passing through the throat to ignite. When the current to the spark plug is cut off combustion of the portion of the fuel mixture in the expansion chamber 20 in the plug 15 ceases. This is due to the comparatively high suction which occurs in the combustion chamber as the result of the aspirating action of the high velocity stream of fuel mixture passing through the throat and the fact that during normal operation of the burner no combustion takes place within the throat. As a result of the fact that during normal operation of the burner no combustion takes place within the expansion chamber 20 in the plug 15 there is no likelihood of the spark plug 17 becoming fouled with carbon.

When the fuel mixture is supplied under pressure to the tube-like member 4 of the burner the major portion of the mixture flows first into the mouth 12, then at high velocity through the throat 13, and finally at a reduced velocity through the outlet 14 and a less portion of the mixture flows through the tube 16 and passes into the expansion chamber 20, as hereinbefore described. When it is desired to ignite the burner, current is supplied by way of the conductor 32 to the spark plug 17. As a result of supply of current to the spark plug a spark is formed between the adjacent ends of the electrodes 27 and 28. This spark, as hereinbefore mentioned, ignites the portion of the fuel mixture within the expansion chamber and causes a flame which traverses the throat 13 of the passage 11 and ignites the main portion of the fuel mixture passing through the throat to the outlet 14. After the burner is started current to the spark plug is cut off. This results in extinguishment of the flame within the expansion chamber 20 of the plug 15 due to the fact that the flow of the mixture through the chamber 20 is too high to permit maintained combustion even of very slow burning fuel without continuous igniting by the spark.

The herein described igniting device consists of a small number of parts and hence may be manufactured at a low and reasonable cost. Due to the fact that the igniting device is located exteriorly with respect to the inlet end of the tube-like member 4, it is not subject to the heat of the furnace F. In addition the various parts are readily accessible for inspection or repair purposes. Because the tube 16 for conducting a portion of the fuel mixture under "static" pressure to the expansion chamber overlies the spark plug 17 the plug is protected or guarded from injury.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination with a tube-like burner member having one end thereof adapted for connection to a tuyère in a furnace wall and its other end adapted to receive gaseous fuel under pressure, and embodying a longitudinal fuel passage therethrough with an inwardly tapered mouth adjacent to said other end, an igniting device for the burner member comprising means forming an expansion chamber in communication with the passage, means for conducting a portion of the fuel from the mouth to the cham-

ber, and means for igniting the fuel in the chamber.

2. In combination with a tube-like burner member having one end thereof adapted for connection to a tuyère in a furnace wall and its other end adapted to receive gaseous fuel under pressure, and embodying a longitudinal fuel passage therethrough with an inwardly tapered mouth adjacent to said other end, an igniting device for the burner member comprising means forming an expansion chamber at one side of and in communication with the central portion of the passage, means for conducting a portion of the fuel from the large portion of the mouth of the passage to the chamber, and means for producing a spark in the chamber.

3. In combination with a tube-like burner member having one end thereof shaped to fit within a tuyère in a furnace wall and its other end adapted to receive gaseous fuel under pressure, and embodying a longitudinal fuel passage therethrough with a short inwardly tapered mouth adjacent to said other end, a comparatively long narrow throat of uniform thickness in the central portion of the member and an outwardly flared outlet of intermediate length in said one end of the member, an igniting device for the burner member comprising means forming an expansion chamber at one side of and in communication with the throat of the passage, means for conducting a portion of the fuel from the large portion of the mouth to the chamber, and means for igniting the fuel in the chamber.

4. In combination with a tube-like burner member having one end thereof adapted for connection to a tuyère in a furnace wall and its other end adapted to receive gaseous fuel under pressure, and embodying a longitudinal fuel passage therethrough with an inwardly tapered mouth adjacent to said other end, and also embodying a transverse hole in the central portion thereof leading to the passage, an igniting device for the burner member comprising a plug fitting within the hole and having an expansion chamber therein in communication with the passage, means for conducting a portion of the fuel from the large portion of the mouth of the passage to the chamber, and a sparking device for igniting the fuel in the chamber, carried by the plug exteriorly with respect to the member.

5. In combination with a tube-like burner member having one end thereof adapted for attachment to the tuyère in a furnace wall and its other end adapted to receive gaseous fuel under pressure, and embodying a longitudinal fuel passage therethrough with an inwardly tapered mouth adjacent to said other end, an igniting device for the burner member comprising means forming an expansion chamber in communication with the passage, a tube on the outside of the member connected to the chamber and the large portion of the mouth of the passage and adapted to conduct a portion of the fuel from said mouth to the chamber, and means for igniting the fuel in said chamber.

6. In combination with a tube-like burner member having one end thereof adapted for attachment to the tuyère in a furnace wall and its other end adapted to receive gaseous fuel under pressure, and embodying a longitudinal fuel passage therethrough with an inwardly tapered mouth adjacent to said other end, and also embodying a transverse hole in the central portion thereof leading to the passage, an igniting device for the burner member comprising a plug

fitting within the hole and having an expansion chamber therein in communication with the passage, a tube on the exterior of the member leading from the chamber and communicating with
5 the large portion of the mouth of the passage and adapted to supply fuel from said mouth to the chamber, and means carried by the plug for igniting the fuel in the chamber.

7. In combination with a tube-like burner
10 member having one end thereof shaped to fit within a tuyère in a furnace wall and its other end adapted to receive gaseous fuel under pressure, and embodying a longitudinal fuel passage therethrough with a short inwardly tapered
15 mouth adjacent to said other end of the member, a comparatively long narrow throat of uniform thickness throughout in the central portion

of the member and an outwardly flared outlet of intermediate length in said one end of the member, and also comprising a transverse hole extending through the central portion thereof and leading to the throat, an igniting device for
5 the burner member comprising a plug fitting within the hole and having an expansion chamber therein in communication with the throat, a tube for conducting a portion of the fuel to the chamber, extending longitudinally of and spaced
10 from the member and having one end thereof connected to the plug and its other end communicating with the large portion of the mouth of the passage, and a spark plug for igniting the fuel in
15 the chamber extending through the plug and positioned between the member and the tube.

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