Jan. 13, 1953 L. E. HART ET AL 2,625,215

GAS BURNER AND SECONDARY AIR FEED MEANS

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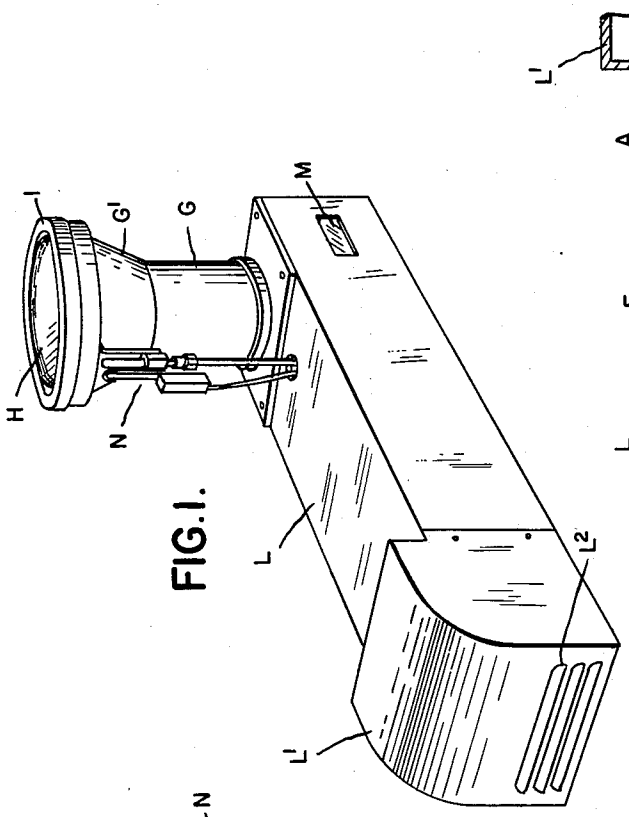

FIG. 1.

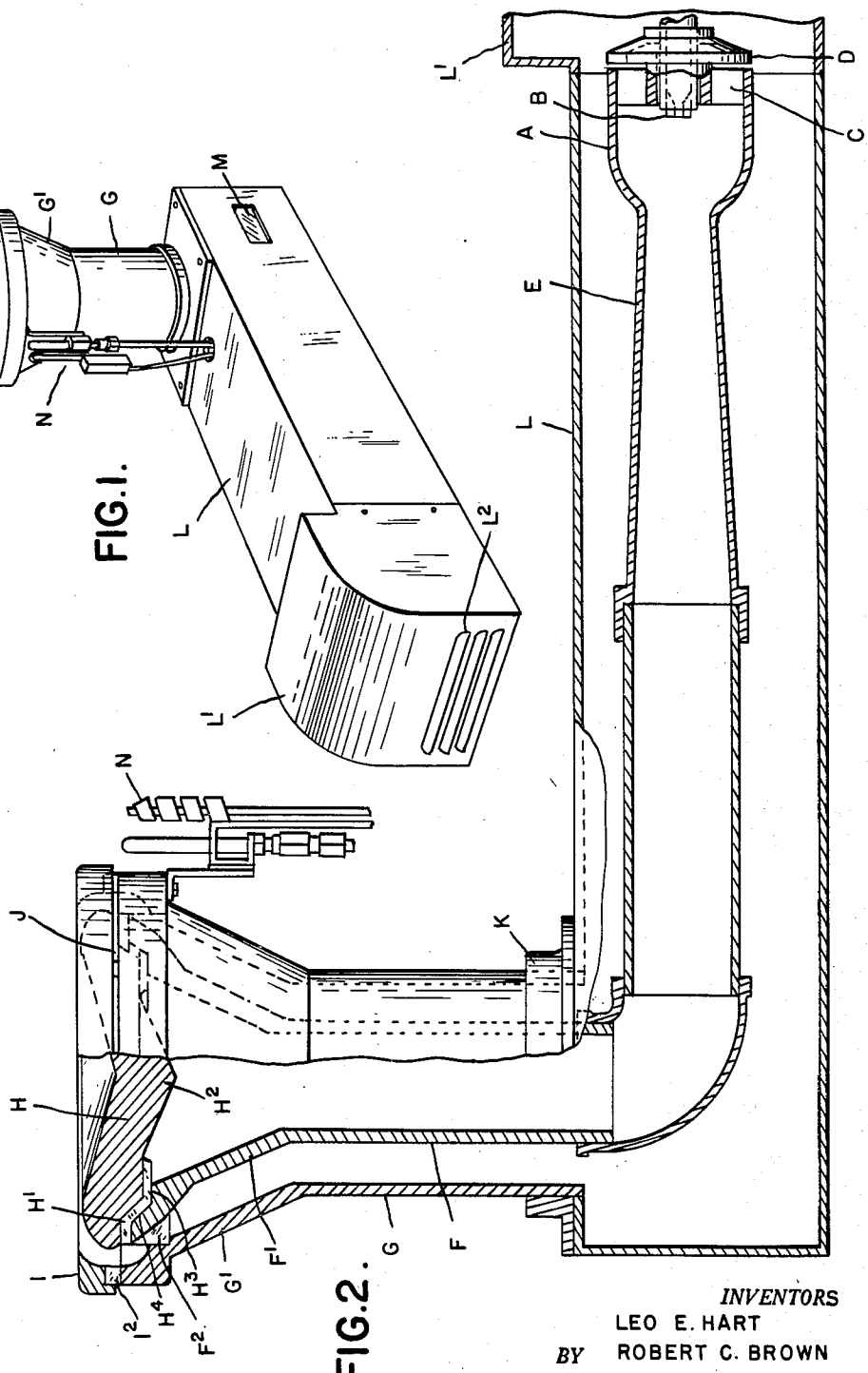

FIG. 2.

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FIG.3.

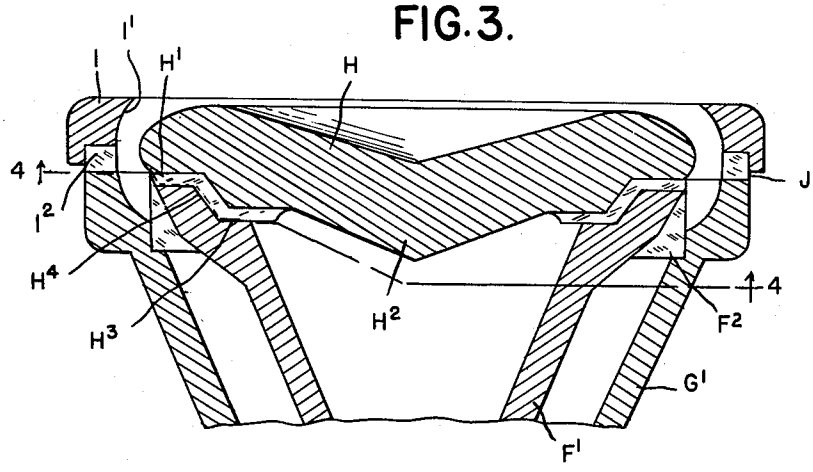
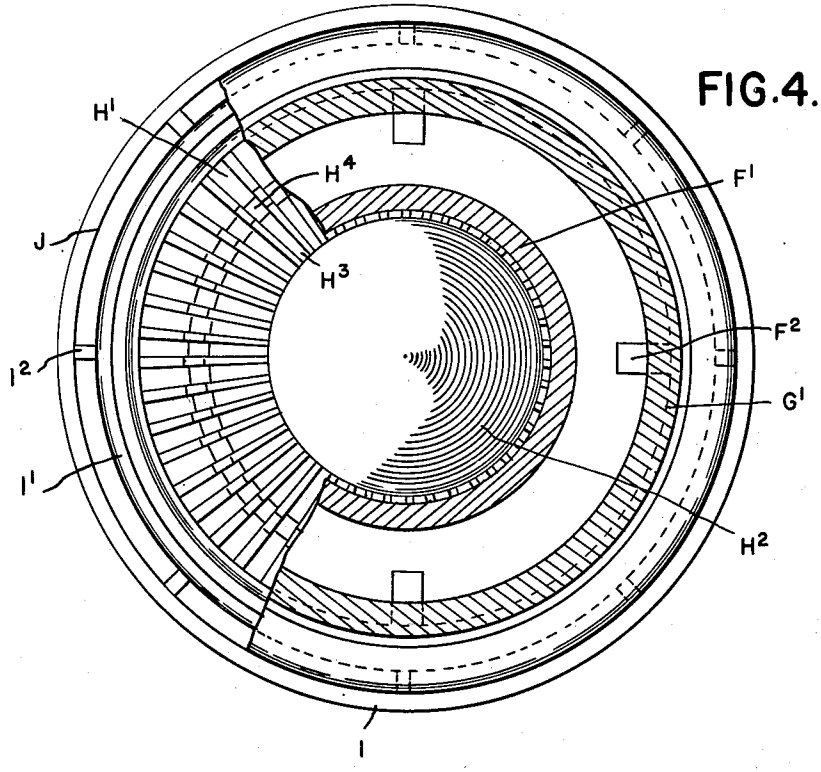


FIG.4.



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GAS BURNER AND SECONDARY AIR FEED MEANS

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3 Claims. (Cl. 158—99)

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The invention relates to the development of heat from the combustion of gaseous fuel and has for its object, first, the obtaining of more nearly perfect combustion of the fuel; second, the construction of apparatus with normally stationary parts which will effect such perfect combustion. To this end the invention consists, first, in the method and, second, in the apparatus as hereinafter described.

In the drawings:

Fig. 1 is a perspective view of the complete gas burning unit ready for installation in a furnace;

Fig. 2 is a vertical central longitudinal section through the unit;

Fig. 3 is an enlarged view of the burner portion of the unit; and

Fig. 4 is a section on line 4—4, Fig. 3.

In the burning of gaseous fuel in heating apparatus, it is usual to form a mixture of the fuel gas and air, which mixture is then conducted to a burner from which it is ejected. The original mixture of air and gas contains insufficient oxygen for combination with all of the fuel but the atmospheric air enveloping the jets is relied upon for furnishing the required supplemental oxygen. However, this supplemental air is not properly commingled with all of the fuel gas and, consequently, fuel values are lost through imperfect combustion.

As above stated, it is a primary object of my invention to obtain more nearly perfect combustion of the fuel, which is accomplished by supplying the supplementary air at a point in relation to the burning jet where it will be thoroughly commingled with the gases therein. Broadly described, my improved method consists in, first, forming a mixture of the fuel gas and air which is insufficient in oxygen content to support full combustion; second, in forming jets of this mixture which are ignited; and third, in directing supplemental air transversely against the base of each jet. Such method can be carried out in the apparatus illustrated, which is of the following construction.

A is a commingler of the usual Bunsen burner type having a central jet nozzle B for the gaseous fuel, an annular surrounding passage C for admission of air and an adjustable damper D for properly proportioning the quantity of air to fuel. The mixture thus formed is conducted through a tube E of a more or less Venturi form which assists in the thorough commingling of the gas and air. At the inner end of this tube E is an upward extension F having a flaring upper end portion F'. Surrounding the tube F is an outer tube G having a corresponding flaring upper portion G'. The adjacent surfaces of the portions F' and G' are so fashioned as to first contract and then expand the cross sectional area of the space therebetween, or to form what in effect is a venturi. Above the inner member F is a cap H which closes the flaring upper end thereof but is so fashioned in connection with the portion F' as to form an annular series of radially outwardly directed jets H'. These are located slightly below the upper end of the flaring portion G' of the member G and are transverse to the direction of current passing upwardly between the members F and G. An annular member I is placed on the portion of the member G' which is radially outward from the cap H and this member completes the upward passage between the members F and G. However, the member I is slightly spaced above the member G' to form a radially outwardly directed comparatively thin passage J which is slightly above the jets H'. More in detail, the cap member H has a depending central conical portion H^2 which, in conjunction with the flaring portion F', forms a converging annular stream of the gaseous mixture within the tube F directing it into the passages terminating in the jets H'. As illustrated these passages have first a horizontally extending portion H^3, then an upwardly and outwardly inclined portion H^4 and finally the horizontal outwardly extending portions H'. The periphery of the cap H is rounded to form an inwardly directed return bend in the passage between the members F and G, and the member I is also provided with an inwardly curving portion I'. This member I is supported on the member G by means of downwardly extending lugs I^2 on the member I giving just the desired thickness for the passage J. The member F with its flaring upward extension F' is supported on the member G by lugs F^2 on the former engaging notches in the latter. The member G is supported by a base K on an outer housing L, which surrounds the member E and forms an air channel through which air can find access to the space between the members F and G. Thus in case the unit is desired for use in a house heating furnace, the casing L can be inserted through the ash door opening to extend radially inward to the center of the combustion chamber and is then sealed into this opening so that all of the air entering the furnace chamber must pass through this casing or the tube E. An outer portion L' of the casing L is provided with louvers L^2 through which the air enters. There are also openings in one or both sides of the casing L below the base K, which can be regulated in area by dampers M adjustable from outside of the furnace by suit-

able means (not shown). A suitable igniter N is mounted on the outside of the member G adjacent to the discharge jets between the members G and I.

With the construction as described after the unit is installed the members G and I will be in the center of the furnace chamber with the jet openings J therebetween directed radially outward. On the other hand the air entering through the louvers L^2 and passing outside of the conduit E and upward between the members F and G will be directed transversely across the jets from the passages H'. Thus when the gas from the jets is ignited and the parts adjacent thereto become heated, there will be an upstream of air striking the lower face of the jets from the passages H' and commingling with the gaseous mixture issuing therefrom. If the gas pressure is low the commingled ignition gaseous stream will pass upward inside of the member I. When, however, the gas pressure is increased and the velocity of discharge of the mixture is correspondingly accelerated, the commingled gases will pass outward through the narrow passage J and will burn outside of the ring I. Tests have shown that the combustion of the fuel is very nearly perfect so that the content of carbon monoxide or unburnt hydrocarbons in the exhaust gases is practically negligible.

The object of the damper controlled openings M is to permit some air to enter the furnace chamber to surround the burning jets.

What we claim as our invention is:

1. Apparatus for burning gaseous fuels, comprising means for forming a mixture of fuel and air having insufficient oxygen content for burning all the fuel, an upwardly directed conduit through which said mixture is passed, said conduit having a flared upper end portion, a closure for the upper end of said flared portion providing in conjunction with the latter an annular series of radially outwardly directed jet apertures, a conduit surrounding the aforesaid conduit having a corresponding flared upper end portion extending slightly above said jet apertures and forming together with the aforesaid upwardly directed conduit an annular channel through which a current of air is passed, said channel having a contracted portion below and directing the air against and transversely of the base of the jets issuing from said passage to penetrate the same and commingle with the gaseous content thereof, a ring supported from the last mentioned conduit, spaced therefrom to form a thin passage therebetween offset above said jet apertures and through which said jets commingled with the air from said annular channel are normally projected, said ring also providing an upwardly directed annular passage for the commingled air and gases when operating under low pressure.

2. Apparatus for insertion as a unit in an otherwise enclosed furnace combustion chamber, said unit comprising a conduit for passing laterally through the wall of the enclosure and having an upward extension centrally of the combustion chamber, the outer end of said conduit having a portion outside of the furnace with an

opening for the passage of air thereinto, a gas jet conduit within the lateral portion of the aforesaid conduit, a conduit surrounding said jet conduit forming a commingler for mixing the gaseous fuel with air within said first mentioned conduit but with insufficient oxygen content to burn all of the fuel, the latter conduit having an upward extension within the upward extension of said first mentioned conduit and together therewith forming an annular air channel, the upper end portions of both conduits being outwardly flared and the outer one extending slightly above the inner one, a closure for the upper end of the inner conduit providing in conjunction with the latter an annular series of radially directed jet openings for discharge of the gaseous mixture transversely of the air current in said channel, whereby the air of said current penetrates and is commingled with the radially directed jets to support complete combustion of the fuel content thereof, and a ring supported upon and forming an upward extension of said outer conduit but spaced to form a thin passage therebetween offset above the plane of said jet apertures and through which the flame is normally projected, said ring in conjunction with said closure also providing an upwardly extending passage for the flame when the jet pressure is low.

3. In apparatus for burning gaseous fuels, an upwardly extending conduit having a flaring portion at its upper end, a similar inner conduit supported upon and spaced from the aforesaid conduit to form an annular channel therebetween with the opposite faces near the top of the flaring portions fashioned to impart a restriction of Venturi form to the channel therebetween, a closure for the upper end of the inner conduit resting thereon and together therewith forming a series of radially outwardly directed jet apertures below the upper end of the outer conduit and above the restriction portion of the angular channel, and a ring resting upon said outer conduit forming an upward extension thereof but with a thin slot between the same offset above the plane of said jet apertures.

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