July 17, 1956 L. E. HERSHEY 2,754,895

SINGLE PORT GAS BURNER AND REMOVABLE FLAME DEFLECTOR

Filed Jan. 2, 1952 2 Sheets-Sheet 1

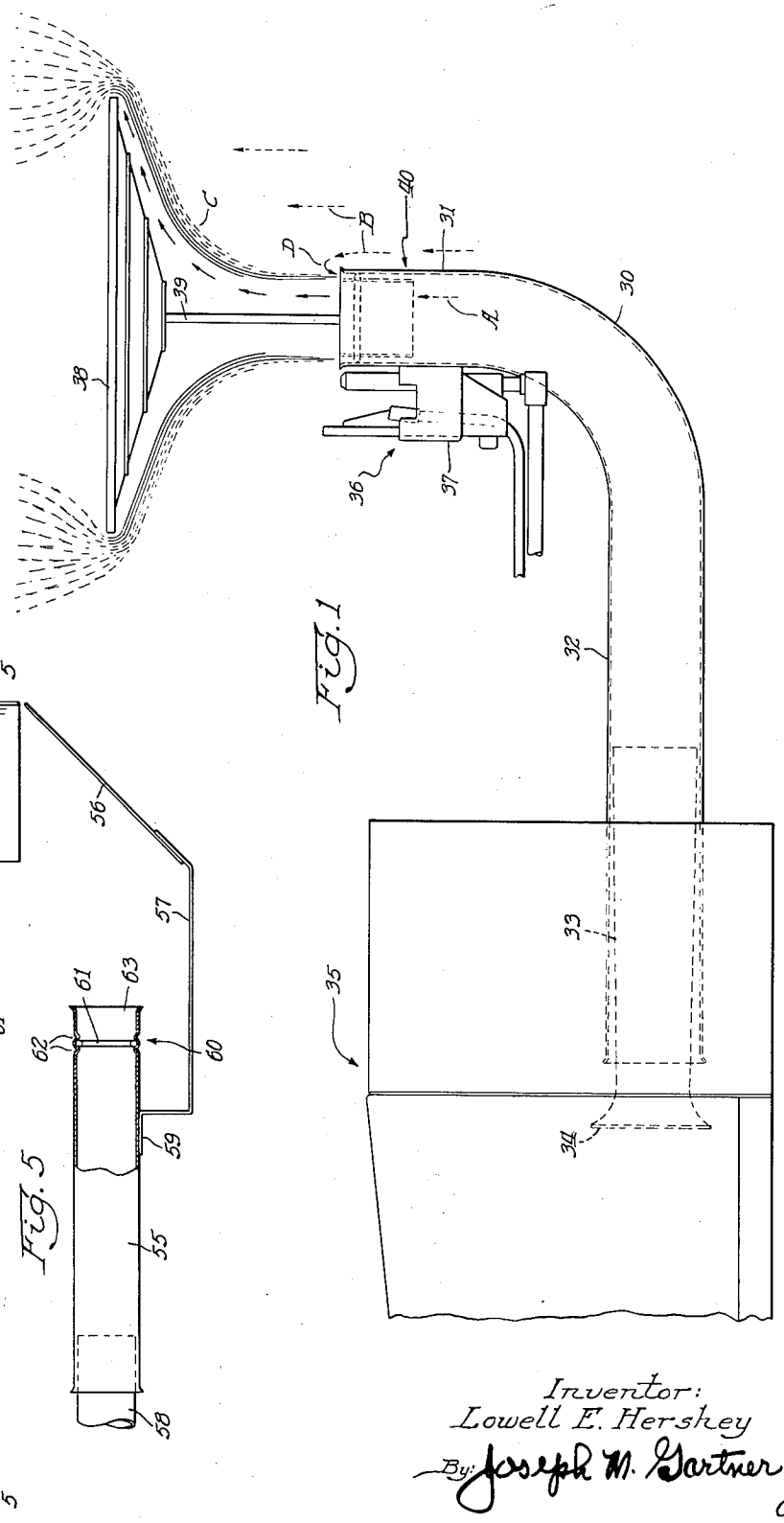

Fig. 1

Fig. 4

Fig. 5

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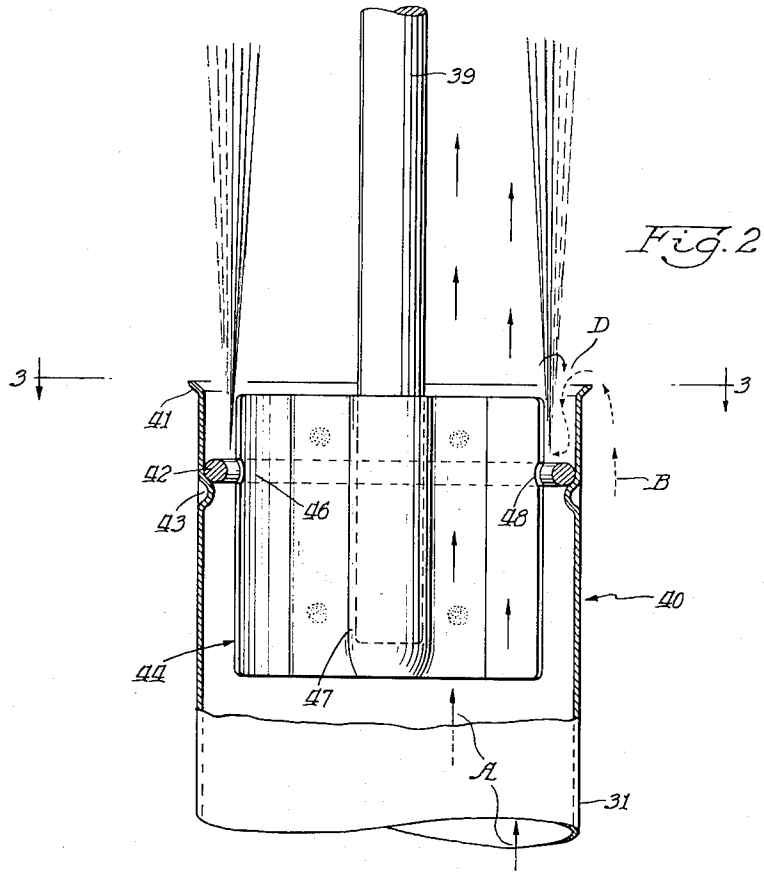

Fig. 2

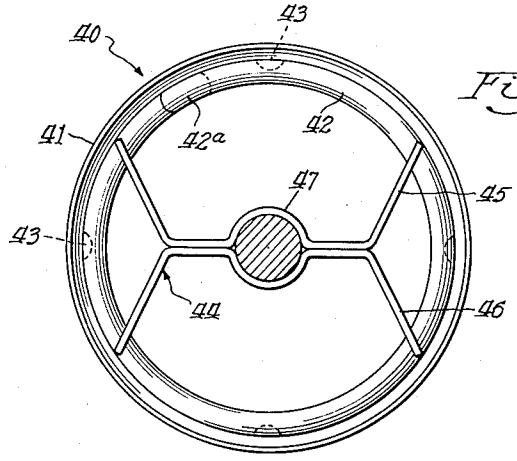

Fig. 3

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SINGLE PORT GAS BURNER AND REMOVABLE FLAME DEFLECTOR

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Application January 2, 1952, Serial No. 264,538

1 Claim. (Cl. 158—113)

This invention relates in general to gas burners for furnaces and other types of heating apparatus, and is particularly concerned with gas burner nozzles or burner heads for employment in the mixture and burning of combustible gases and air as required for example, in equipment originally designed for gas burning or in burner assemblies of the gas conversion type for conventional domestic heating furnaces originally designed for other types of fuel.

The expression "burner nozzles" or "burner heads" must be understood to mean any device, or that portion of a burner assembly, from which is discharged a jet of burning fuel.

In fuel burning devices, numerous attempts have been made to provide a gas burner nozzle or burner head which would meet the rigid requirements of burner operation in practical use. Of these numerous attempts, there have been designed many types of burner heads, some of which have been provided with a plurality of additional nozzles so that jets of air could be directed either radially or circumferentially into a stream of primary air and gas mixture, others of which have been provided with a multiplicity of apertures or ports so that the primary stream of air and gas is broken into a plurality of streams, thus effectively producing a plurality of flames, and still other attempts have been made to combine the two above attempted designs by employing both jets of secondary air and a plurality of ports in order to obtain an acceptable usable burner head. However, these numerous attempts have not been met with wide acceptance and approval because several undesirable features ensue. Some of these undesirable features have been high cost of manufacture, extreme ciriticalness in the adjustment and high cost of operation.

Accordingly, it is a general object of this invention to provide a gas burner head of the single port type which is highly efficient and better adapted to meet the rigid requirements of burner operation under varying gas loads and gas properties.

Another object and accomplishment of my invention is to provide a new and improved means in a burner of this type whereby secondary air is mixed with the flow of primary gas and air in such a manner as to improve the combustion of the gaseous fuel.

Another goal of my invention is to provide in burners of this type a burner head of simplified and improved construction in which the use of additional jets or other port means for conducing secondary air into the stream of gas and primary air are not necessary.

Another object of my invention is to provide in burner systems of this type an improved burner head which cooperates with the mixture of gas and primary air in such a manner as to suitably improve the burning thereof.

Still another object of my invention is to provide in a burner assembly of this type a new and improved burner head which cooperates with the mixture of gas and primary air to produce the combustion which is not subject to critical adjustment, thereby effectively improving the burning and operation thereof.

A still further object of my invention is to provide in a burner assembly of this type a burner head which will cooperate with the mixture of gas and primary air to produce combustion wherein the rate of flame propagation at the periphery of the air-gas mixture is equal to the velocity of the primary gas and air mixture at that point so that the flame is kept within the port of the burner head thus preventing what is commonly known as "blow-off" or "lifting."

Still another object of my invention is to provide a burner of the type above stated which is well adapted to be manufactured at low cost and yet give a maximum of satisfactory service while in use.

Another object of my invention is to provide in a burner assembly of this type a new and improved means for supporting a deflecting plate and arranged to cooperate with the burner head contemplated by this invention.

Another goal of the present invention is to provide a burner head of the single port type by correlating and especially designing the various elements thereof to effect advantageous cooperation between the various elements as will best serve the purpose of providing an effective system for the burning of fuel in any gas burning device.

It is still another purpose of this invention to provide a new and improved burner head of the single port type to be used in any gas burning device which is adapted to be economically manufactured and which is designed to permit manufacture and assembly thereof in accordance with present day large scale mass production manufacturing methods of construction and assembly.

My invention seeks as its further object to provide a burner head of the single port type particularly characterized by a design arrangement to satisfactorily perform the functions required of it and adapted to be used in, either equipment originally designed for gas burning, or in a conversion unit and which will successfully combine the factors of structural simplicity and durability, and yet be economical to manufacture.

Additional objects, features and advantages of the invention disclosed herein will be apparent to persons skilled in the art after the operation and construction thereof are understood from the within description.

It is preferred to accomplish the various objects of this invention and to practice the same in substantially the same manner as hereinafter more fully described, and as more particularly pointed out in the appended claim.

In general, my invention can be described as a new and improved burner head which is arranged for full cooperation with the primary mixture of gas and air and whereby a portion of secondary air, because of this cooperation, is caused to be intermixed with the outer periphery or layer of the stream or flow of the primary mixture so that the flame is retained within the burner head. This latter is accomplished by judiciously and advantageously positioning a ring within the inner periphery of the burner head in such a manner that secondary air is caused to travel downwardly into the burner head as far as the ring and simultaneously be intermixed with the outer layer of the primary gas and air mixture.

Embodiments of the invention are illustrated in the accompanying drawings which form a part hereof and wherein:

Fig. 1 is a side elevation view of a burner assembly embodying my invention with an accompanying diagrammatic illustration of the relative position of the combustion zone and flow or travel of the gas and air within a furnace;

Fig. 2 is a side elevation view partially broken away of the burner head showing the details of the means of supporting a deflecting plate in the burner assembly depicted in Fig. 1 and with accompanying diagrammatic illustration of the flow of the primary gas and air mixture

as well as the flow of secondary air to aid in combustion;

Fig. 3 is an end view of the burner head looking in the direction indicated by the arrows of line 3—3 in the burner assembly of Fig. 2 and showing the detailed construction of its deflecting plate support means;

Fig. 4 illustrates a gas burner head of the type contemplated by this invention and disclosed with respect to Figs. 1 to 3 but showing a different type of burner assembly with which the burner head of the present invention may be employed; and

Fig. 5 is a side elevation of the burner assembly looking in the direction of the arrows of line 5—5 of Fig. 4, and partially in section, showing the construction of its deflecting plate and support means in detail.

The drawings are to be understood to be more or less of a schematic character for the purpose of illustrating or disclosing a typical or preferred form of the improvements contemplated and in the drawings like reference characters identify the same part in the several views.

In the exemplary embodiment shown in Figs. 1 to 3, the burner head of a single port type with which my invention is primarily concerned is indicated in its entirety by reference numeral 40 and is shown in Figs. 1 and 2 as a portion of a tubular member or duct 30 having arms 31 and 32, generally at right angles to each other. When the burner assembly of this type is installed in its operative position similar to that shown in Fig. 1, the arm 31 is in a vertically disposed position and arm 32, which is extended laterally, is provided with a tube 33 of a venturi shape into which fuel comprising a mixture of gas and primary air is received for delivery and discharge out the discharge end of the duct 30. The flared end 34 of the venturi shaped tube may be operatively disposed within a casing, designated in its entirety by numeral 35, which would enclose or contain the necessary mechanism (not shown) for controlling the supply of and for ejecting gas and air into the venturi shaped tube to travel therethrough and be mixed for discharge at the end of the duct 30. The larger or flared end 34 of the tube 33 may be telescopically arranged with reference to the arm 32 of the duct 30 so as to permit adjustment of the gas receiving end of the venturi shaped tube with relation to the discharge end of the arm 31 so that burners of this type can readily be installed in different types and sizes of furnaces and heaters, or with the fuel supply connections arranged at different distances from the discharge end of the burner. However, it must be understood that the burner head 40 is equally adaptable for use in a burner assembly wherein the arm 31 is fixedly arranged with respect to the receiving end of the venturi shaped tube.

As is customary with gas burners, the operation of the fuel supply and control means therefor are subject to control by a safety pilot assembly indicated in its entirety reference numeral 36 shown mounted near the discharge port of the duct 30 by a mounting bracket 37. The control connections between the pilot assembly and the fuel supply and control means therefor have been omitted in the interest of simplification of disclosure.

When the burner is employed in a furnace or heater it is usually desirable that the flame thereof be deflected outwardly into substantial contact with the walls of the combustion chamber (not shown) and when such deflecting is desired, a flame deflecting device or plate 38 is employed and which will be located beyond the discharge end of the duct 30 or burner head 40. This deflecting device is supported in the position shown in Fig. 1 and in the construction illustrated by a supporting rod 39 mounted coaxially within the duct 30 or burner head 40 in a manner that will be explained in detail in relation to the description of the burner head.

Referring now to that portion of the burner assembly with which this invention is primarily concerned, namely, the burner head 40 which is an end portion of the arm 31 of the duct or tubular member 30, and shown

in detail in Fig. 2. It is to be understood that this burner head with its associated elements could be made of a separate piece of tubing and suitably connected with the arm 31 of the tubular duct. It can be seen that the head may be provided on its outer end with a flared portion 41 to expedite manufacturing processes. On the inner surface of the burner head there is a ring 42 secured and supported therein by any suitable means such as dimples or protuberances 43 and which may be provided with a split, as shown, at 42*a* to facilitate its insertion or removal therefrom when desired. To permit the coaxial supporting rod 39 for the flame deflecting plate 38 to be supported on the burner head and yet prevent interference with the flow of the combustible material, there is provided a rod holder 44 comprising two metallic elements 45 and 46 suitably bent and welded or otherwise secured together in the manner shown in Fig. 3 to provide a hole 47 in which the rod 39 is removably and free-fittedly supported. The rod holder may be provided with a plurality of recesses 48 into which the ring 42 is received. Thus, in the exemplary embodiment disclosed in Figs. 1 to 3 the entire assembly comprising the deflecting plate 38, the supporting rod 39, rod holder 44 and ring 42 are operatively associated and suitably affixed within the end portion of the tubular member 31. In some applications, it may be desirable to support the entire assembly on the ring 42, as shown for example, in Figs. 1 to 3, while in other applications a ledge may be provided within the tubular member upon which the rod holder 44 may be placed thereby supporting the entire assembly thereon.

It is notable that the instant burner head is versatile in its application and provides numerous advantages in this direction. For example, attention is now directed to Figs. 4 and 5 wherein there is illustrated the instant burner head, designated in its entirety as 60, in an assembly the function of which is substantially similar to that hereinbefore described with respect to the structure disclosed in Figs. 1 to 3. A review of the drawings will disclose that a different type of tubular member 55, deflecting device or plate 56 and support means 57 therefor are employed while the particular type of Venturi shaped tube 58 is similar in construction to the Venturi shaped tube 33 depicted in Figs. 1 to 3. In that portion of the tubular member 55 with which this invention is primarily concerned, namely, the burner head 60, it is apparent that a ring 61 in the burner head 60 is exactly the same as hereinbefore described with respect to the construction disclosed in Figs. 1 to 3 and is retained within the tubular member by dimples or protuberances 62. For the purposes of manufacturing expediency the tubular member 55 may be provided with a flared end portion 63. It is notable that in the construction of the burner head as illustrated in Figs. 4 and 5 there is no supporting means therewithin for the deflecting plate. Thus, the deflecting plate 56, instead of being axially centrally supported within the burner head, is suitably supported by a bracket or support means 58 which is so designed to be welded or otherwise suitably affixed to the outside of the tubular member as at 59 and designed to hold the deflecting device or plate at a desired angle with respect to the direction of the jet-like flow of gas and air from the burner head.

Thus, the burner assembly, when provided with the necessary mechanism (not shown in the interest of simplicity) for ejecting gas and primary air in the Venturi shaped tube 58, will discharge a jet-like flow of the combustible material against the deflecting plate 56.

Having thus described the particular structure of the new and improved burner head of the single port type, for use primarily in gas type burner assemblies, and to provide in general a working knowledge of the principles involved in its operation and use, reference is again made to the drawings, particularly Figs. 1 and 2,

wherein there is shown a plurality of arrows diagrammatically respectively representing the flow picture of the combustible material consonant with the operation of this burner.

For the purposes of illustration, let us consider that in the operation of the burner described, the gas and primary air as traveling in the duct **30** toward the discharge end thereof in the direction generally indicated by arrows A located in that vicinity. This flow will be ejected from the discharge end or port of the duct to form a jet-like flow containing fuel either partially or fully mixed with primary air, the outer periphery or outer layer of which will have substantially complete combustion because of the subsequent mixture of secondary air, the flow of which is generally indicated by arrows B in the furnace or chamber (not shown in the interest of simplicity). As is evident, the greater portion of the jet will be largely uninfluenced until it reaches the proximity of the deflecting plate **38** (the underside thereof as shown in Fig. 1) where it will be deflected outwardly thereby, as generally indicated by the arrow C. Obviously, the deflecting plate **38** ultimately causes more secondary air to mix with the primary gas and air mixture so that complete combustion is had beyond the deflecting plate, as clearly indicated in Fig. 1, wherein the multiplicity of dashed lines indicate the flaming or burning portions of said jet. Obviously, the principles involved in the operation and use of the burner assembly indicated in Figs. 4 and 5 will be substantially similar with the exception that the jet-like flow is directed towards a deflecting plate **56** where it will be deflected upwardly.

In order to make the burning jet operate efficiently, it is necessary (1) that secondary air be introduced into the flow of primary air and gas, and (2) that the velocity of the mixture of gas and primary air or a portion thereof must be slow enough so that combustion can take place within or near the port of the burner head. If these two steps are not followed either the jet will not burn at all, or if it does burn and the velocity is not reduced there will be caused a phenomena known as "blow-off" or "lifting" in which the flame will burn beyond the end of the burner head and which may cause it to be extinguished.

Thus, in the burner head of the type contemplated by this invention, the applicant has judiciously placed a ring or impediment in the duct **30** so that the mixture of primary air and gas is forced to contract and withdraw from the surface of the duct or burner head, as clearly illustrated in Fig. 2. On the side of the ring nearest the port, a negative pressure area or vacuum will result because of the lessening of the pressure caused by the ring reacting against the flow of the mixture. This negative pressure is less than the pressure of the mixture and less than the pressure of the ambient secondary air in the chamber. Thus, secondary air is caused to flow down the inside of the tubular member or duct and to mix with an outer layer of the primary mixture as illustrated by flow arrows D. Obviously, the ring must be located or suitably arranged so that the normal expansion of the mixture intermediate the ring and the end portion of the tube will allow a suitable space for the secondary air to be admitted along the end portion of the burner head and thence to the negative pressure area. This travel of secondary air along the inner surface on the burner head toward the negative pressure area being in the opposite direction will result in the formation of a number of vortices and produce a somewhat turbulent area which will perform two functions to increase the efficiency of the burning jet. One of these functions will be the mixture of the secondary air with the primary mixture of gas and air, and the other of these functions will be the reduction in the velocity of the outer periphery or layer of the primary mixture. This latter function has the advantage of maintaining the outer layer and the mixture thereof with the secondary air at a slower velocity so that the rate of combustion or rate of flame propagation will be at least as great as the velocity of the jet of primary mixture outward from the port. This will maintain the flame at or in the burner head thus preventing the "blow-off" or "lifting" phenomena previously mentioned.

Thus, by judiciously placing a ring within the burner head, a new and improved type of burner has been accomplished which cooperates with the primary mixture of air and gas to overcome all the prior objections of the previously cited attempts toward improvement in this type of burner.

In adapting this burner head for use in a particular application, consideration should be given to the location and size of the ring in order to provide the required negative pressure and availability of the secondary air along the inner periphery of the tube.

The instant burner head being formed of simple parts and readily available materials, lends itself to mass production manufacturing principles, thus affording a substantial savings in the manufacturing costs.

From the foregoing disclosure, it may be observed that I have provided a new and improved burner head of the single port type which efficiently fulfills the objects and accomplishments as hereinbefore stated and provides numerous advantages over prior type burner heads which is apparent to anyone skilled in the art.

While there is illustrated preferred embodiments of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but wish to avail myself of all changes within the scope of the appended claim.

I claim:

A gas burner head comprising an open ended duct having a flared portion thereon at its open end through which a jet of fuel is discharged and provided with a plurality of inwardly extending proturberances spaced a relatively short distance from said flared portion, ring means having an external diameter substantially the same as the internal diameter of said duct removably supported within said duct by said protuberances and in contact with said duct for a substantial portion of its periphery so that when the ring means cooperates with the flow of the primary mixture a negative pressure is created between said flared portion and said ring means whereby secondary ambient air is caused to flow in a direction opposite to the flow of the primary mixture causing intermixing of the secondary air in the primary mixture, support means disposed within said open ended duct radially inwardly of and supported by said ring means, said support means and said ring means forming a unitary assembly capable of being removed from said duct as a unit, a deflecting plate having a supporting rod, said support means including a pair of angularly formed metallic members affixed to each other and providing a recess receiving said deflecting plate supporting rod, and said members further having recesses on their periphery receiving said ring means in circumscribed relation for supporting the assembly within the open ended duct.

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