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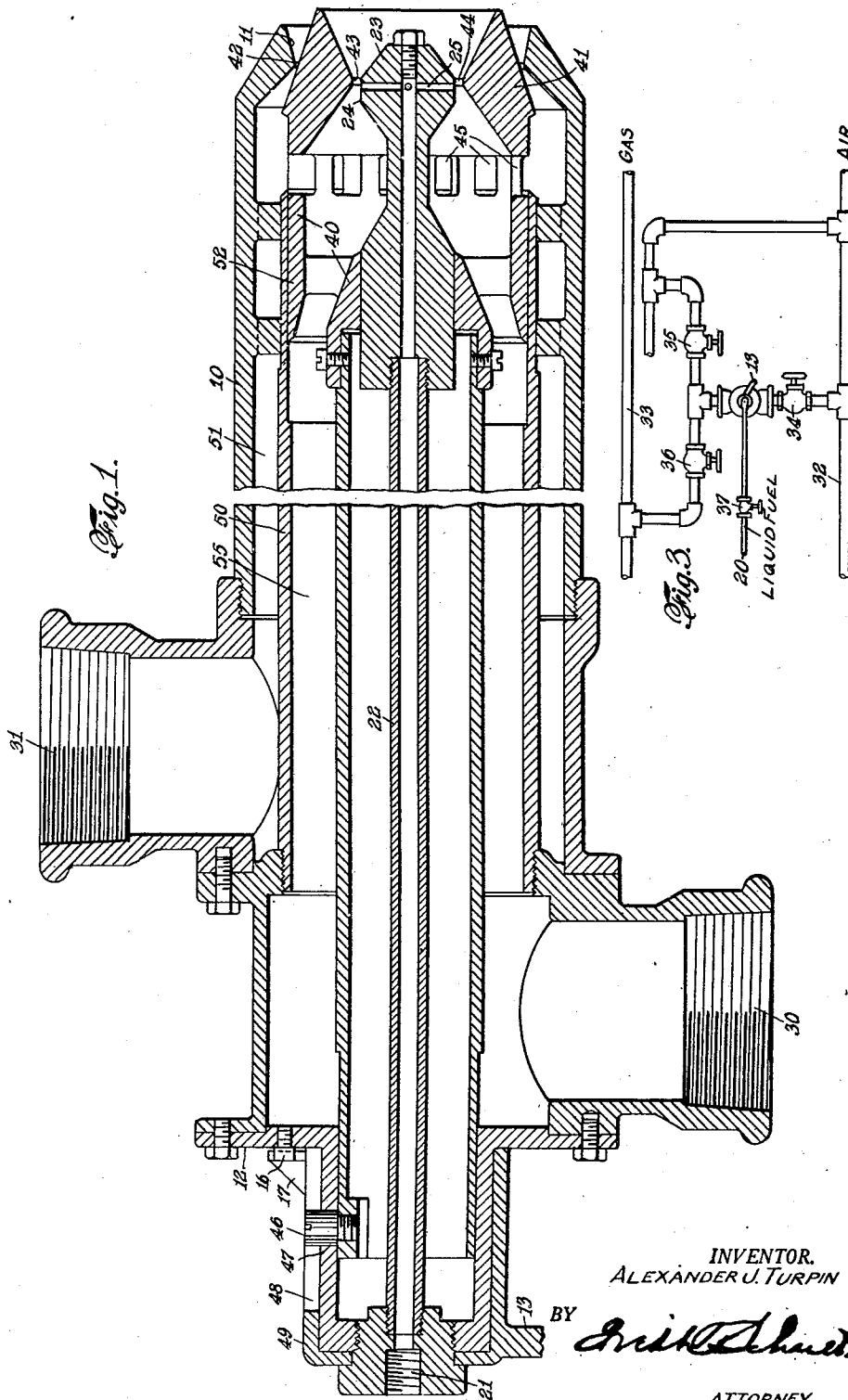
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2,368,178

COMBINATION BURNER FOR LIQUID AND GASEOUS FUELS.

Filed Jan. 26, 1943

2 Sheets-Sheet 1



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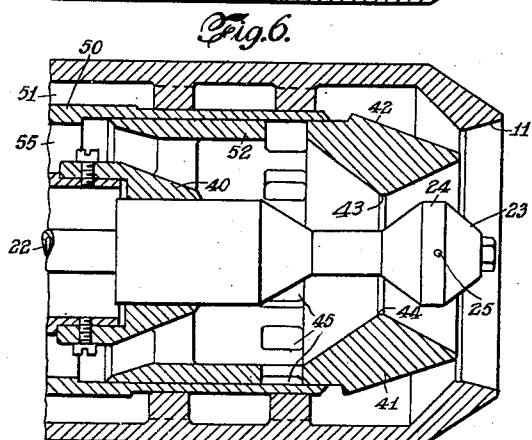
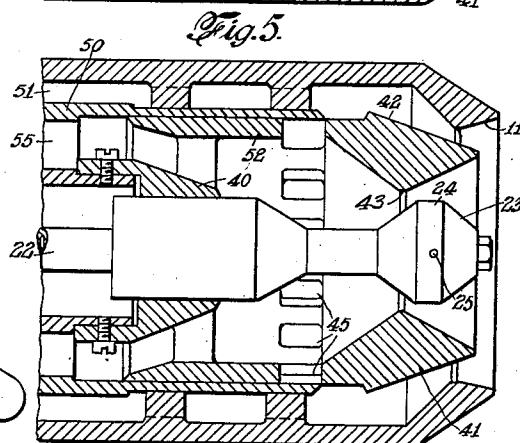
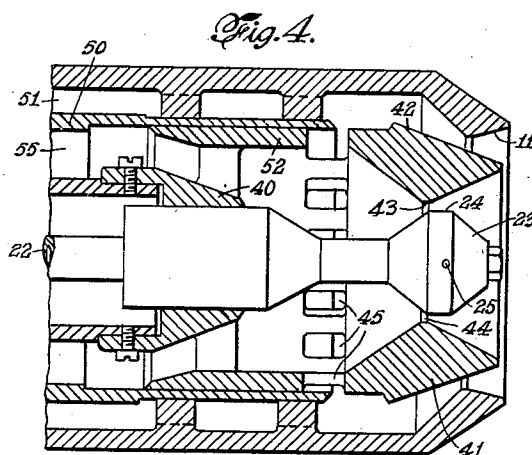
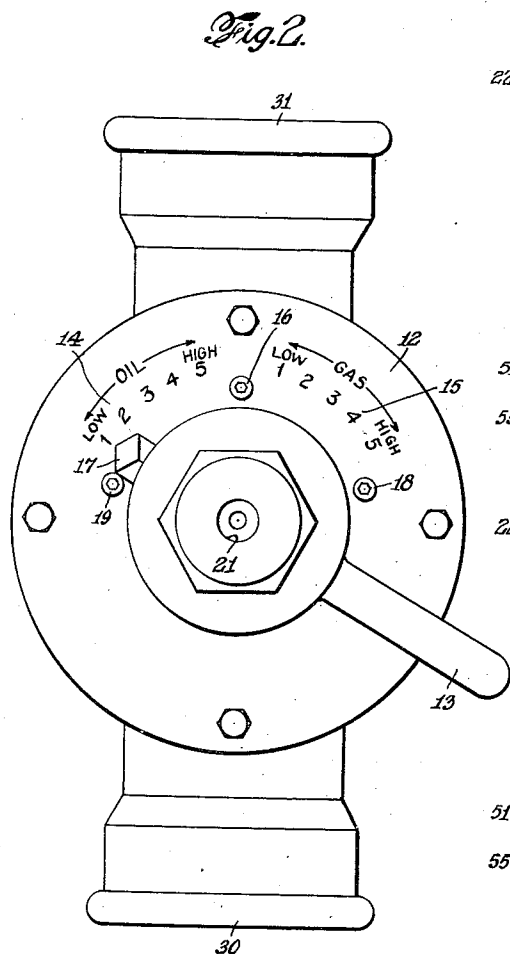
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COMBINATION BURNER FOR LIQUID AND GASEOUS FUELS

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2 Sheets-Sheet 2



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COMBINATION BURNER FOR LIQUID AND GASEOUS FUELS

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3 Claims. (Cl. 158-11)

The invention relates to mixer and burner apparatus suitable for the intimate mixture and combustion of various fluids and of the extended nozzle type such, for example, as of the nature set forth in U. S. Letters Patent #1,740,296 and #2,219,119, granted to applicant's assignee.

The present invention has for an object to provide a burner, retaining generally the desirable features of the aforesaid burners but so constructed and arranged that the burner is suitable alternatively to provide an atomized combustible mixture either of a liquid fuel such as oil and air or of a gaseous fuel and air.

A further object of the invention is to provide a burner of this nature in which the conversion to render the same suitable for burning a different fuel may be accomplished merely by the opening and closing of certain valve means associated therewith.

A still further object of the invention is to provide a control means common to the operation of the burner with either liquid fuel or gaseous fuel mixtures.

Another object of the invention is to provide a construction of burner such that when the same is operated with a gaseous fuel, an ample supply of combustion air will be afforded; also, that this air will be so distributed that the required cooling effect of the outer nozzle portion of the burner will be maintained.

The invention has for an object, also, to provide a construction of burner wherein the violent rotary effect for causing turbulence in connection with the operation of the burner with liquid fuel is eliminated when the burner is operated with a gaseous fuel.

In carrying out the invention, the novel burner is constructed of an elongated cylindrical casing affording a longitudinally disposed chamber with axial outlet, the casing having also two peripheral inlet connections for gaseous medium in addition to a connection for liquid fuel which is delivered to a fuel nozzle member extending axially within the casing from the rear thereof. This nozzle member has a discharge head at the far or discharge end of the casing with circularly disposed radial outlets. One of the aforesaid inlet connections is designed for the admission of air when operating the burner with a gaseous fuel and admission of air through this inlet connection may be cut off by suitable valve means included therein. The other inlet connection is designed for the admission of air or gas alternatively, the former being provided as an atomizing and combustion medium in the operation of the burner with liquid

fuel. When the burner is to be operated with a gaseous fuel, this is introduced through the second-named inlet connection and the air for use therewith is then provided through the first-named inlet connection, the former connection to this end being arranged with suitable valve means for placing the same in communication with the proper supply mains.

In addition, there is provided coaxially within the casing intermediate said casing and the fuel nozzle member a longitudinally adjustable tubular member whose outer end is in the nature of a combined valve piece and conical discharge tip, the latter juxtaposed to the outlet of the casing to cooperate therewith and form a constricted annular opening, the effective area of which is variable to control the discharge through the outlet.

At its inner surface, the tip cooperates for a predetermined axial travel with the periphery of the head of the nozzle member in the discharge of fuel therefrom to atomize the same by air passing through an annular opening formed between said periphery and the inner surface of the tip. Immediately behind the discharge tip of the movable tubular member, the same is provided with circularly disposed peripheral ports.

Suitable means, for example of the nature set forth in the aforesaid Letters Patent, are provided to retract and advance this movable tubular member.

Intermediate this tubular member and the casing there is provided a coaxial fixed or cut-off sleeve affording with the casing a gaseous-medium supply chamber in free communication with the second of the said inlet connections and normally with the chamber formed between said intermediate sleeve and the tubular member only through the aforesaid peripheral ports in the latter. The fixed sleeve when the movable member is at its extreme outer position is designed to terminate substantially at the inner edges of these peripheral ports, which are of a width somewhat greater than the effective periphery of the nozzle head. When the said tubular member is retracted beyond this point, the fixed sleeve will begin to cut off the communication through these ports but will maintain the required air flow past the nozzle head through the range for combustion of liquid fuel. This communication is entirely interrupted, however, when operating the burner with a gaseous fuel. The nozzle member is then inactive so far as the delivery of fluid fuel is concerned, and it will be understood that then gaseous fuel may be introduced to the second-named inlet connection and the first-named inlet con-

nection opened to introduce the required air for combustion thereof. This combustion air then flows to the chamber formed between the sleeve and the movable tube and past the liquid fuel nozzle head without any leakage to the gas supply as the peripheral ports are then sealed by the sleeve.

The nature of the invention, however, will best be understood when described in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal section of the novel burner apparatus.

Fig. 2 is an end elevation thereof.

Fig. 3 is a fragmentary elevation of the piping system showing the manner of connecting-in the burner apparatus with supplies of both gaseous and liquid fuels and the atomizing air therefor.

Fig. 4 is a fragmentary longitudinal section of the discharge end of the burner apparatus showing the position of the parts when the burner is operating at maximum capacity with liquid fuel, the position shown in Fig. 1 of the drawings being that for operation at minimum capacity with liquid fuel.

Figs. 5 and 6 are similar views illustrating the position of the parts for operation of the burner with a gaseous fuel and respectively at minimum and maximum capacities.

Referring to the drawings, 10 designates an elongated, cylindrical casing or tubular element inwardly turned at one end to afford a conical outlet 11, the casing being closed at its opposite end by suitable closure means including a plate and dial member 12 over which is adapted to move angularly an operating handle 13 for controlling the gaseous fuel supply and combustion air. As indicated in Fig. 2, the dial member carries two scales 14 and 15 covering respectively the control when operating with liquid fuel, such as oil, and with gaseous fuel, such as artificial or natural gas. Provision is made, however, for limiting the movement of the operating handle 13 so that control may not be beyond any one of the selected ranges while utilizing the particular fuel. Thus, a stud 16 such as a socket screw or the like may be removably secured in the dial member to extend somewhat above the surface thereof for contact with the pointer end 17 of the operating handle. This stud will serve normally to limit the maximum flow of air for the oil and, when temporarily removed, as when it is desired to utilize gaseous fuel, will then permit the operating handle to swing through a greater angle for operation over the range for gas supply and will when replaced constitute the minimum stop limit therefor.

A further stud 18 similarly inserted in the dial member serves to limit the position of the operating handle for maximum supply of gaseous fuel. A similar stud 19 limits the position of the said handle to operation over the range for liquid fuel supply.

The liquid fuel is introduced from a source of supply indicated at 20, Fig. 3, through an inlet opening 21 in the end closure for the casing 10 supplying a longitudinal and axially disposed nozzle member 22 which terminates in a head 23 at the outlet 11. The said head has a cylindrical periphery 24 of predetermined width and is provided with radial outlets 25 discharging at said periphery.

Gaseous medium is designed to be introduced through the casing 10 through two inlets 30 and 31, the former being adapted for connection to

a source of air supply 32 and the latter with said source of air supply 32 or alternatively with a source of gaseous fuel 33. A shut-off valve 34 is included in the connection or inlet 30 between the air supply and the burner apparatus to interrupt the supply of air through said inlet; and two shut-off valves 35 and 36 are provided in the connections respectively from said source of air supply and from the source of gaseous fuel supply to the inlet 31. In this arrangement, the burner apparatus may be operated with liquid fuel by shutting off the supply of air to inlet 30, at the valve 34, and the gaseous fuel supply at valve 36 with valve 35 open to admit a supply of air. A valve 37 in the liquid fuel or oil supply line 20 is to be opened under these conditions for controlling the actual amount of oil supplied. For operating with a gaseous fuel, valve 37 is closed and valve 34 for air supply opened, but the valve 35 in the air supply line is closed. Valve 36 is then opened to admit the gaseous fuel.

The construction of the novel burner involves also means for suitably atomizing the oil discharged from the head 23 under uniform supply of air, for example, by the provision of a longitudinally adjustable tubular member such as the tube 40 mounted over the nozzle member 22 coaxially therewith and having a conical outer end 41 whose outer surface is designed to cooperate with the outlet nozzle to provide a variable constricted annular outlet 42. Along its inner surface at said end, which tapers in opposite directions to a reduced portion 43 juxtaposed to the periphery 24, there is provided a constricted annular outlet 44 of uniform cross-sectional area maintained over the width of said periphery which corresponds also to the range of adjustment of the control handle 13 when operating the burner apparatus in the combustion of liquid fuel. Air is delivered through this opening 44, together with the discharged oil or other liquid fuel, the same being received from the inlet 31 through tangentially disposed peripheral openings or ports 45 circularly disposed in the said outer end of tubular member 40 and located behind the nozzle head 23.

A portion of this air passes through the opening 42 to meet, beyond the outlet 11 of the burner, the discharged atomized oil. The amount of this air discharged is determined by the area of opening afforded by outlet 42 which is variable through reciprocation of said tubular member, the same being effected, for example, in the manner set forth in the aforesaid U. S. Letters Patent #2,219,119, through a stud 46 carried by the tubular member fitting through a helical slot 47 of the casing and a longitudinal slot 48 in a member 49 rotatable with the handle 13.

Another cylindrical or tubular element or sleeve 50 is mounted in the casing over said tubular member coaxially therewith, providing with casing 10 a chamber 51 for air or a gaseous fuel. Sleeve 50 at its inner end is sealed to the casing and at its outer end terminates, when the parts are located in the position indicated in Fig. 1 which is the position for minimum oil supply, over a displaced portion 52 of the tubular member and substantially at the inner edges of the peripheral ports 45 which are located therein. Sleeve 50 at its outer end will thus act as a cut-off member for the supply of air through the ports 45 as the tubular member 40 is retracted until the extreme position indicated in Fig. 5 is reached, at which point communication be-

tween chamber 51 and a chamber 55 formed between the fixed sleeve and the member 40 will be cut off. This is the position of minimum control in the range for burning of gaseous fuel, as indicated in Fig. 2 of the drawings. Fig. 4 indicates the relationship of the different members of the burner apparatus for maximum oil supply in the range indicated in Fig. 2 for operation with a liquid fuel.

Retraction beyond this point of sealing off of the ports 45 will cause chamber 51 to remain sealed except for the outlet 42 through continued operation of handle 13 to its maximum position, and will control thereby the amount of gas discharged, it being understood that for this operation the valve 36 has been opened and valve 35 closed, as hereinbefore set forth. Valve 34 also has been opened so that air is now supplied to the chamber 55 which is in direct communication with inlet 30 for combustion of the gas which occurs beyond the burner apparatus, said air being discharged only through the outlet 44. This outlet is variable in accordance with the longitudinal adjustment of the tubular member to conform to the adjustment of the gas supplied through inlet 31 and chamber 51, passing through the variable outlet 42. By this expedient, there is no pre-mixing and excessive turbulence of the two gaseous media; and by providing at all times and under both conditions for the circulation through the outer chamber 51 of large volumes of gaseous medium, combustible or otherwise, there is provided adequate cooling of the exposed casing of the burner apparatus when placed in operation. The novel construction set forth provides, also, for accommodating the burner apparatus to either the large volume of total gaseous medium when burning gas or the considerably less volume of air only required when burning a liquid fuel.

I claim:

1. Apparatus of the nature set forth, comprising an elongated cylindrical casing with two peripheral inlet connections, one solely for air and the other alternatively for gas or air, said casing terminating at one end in a tubular conical discharge tip, a movable tube with peripheral ports mounted coaxially within the casing, one of its ends affording with said discharge tip an annular variable discharge area, an axially disposed liquid fuel nozzle member extending within the tube having a head with periphery of predetermined width less than the width of the said peripheral ports and provided with radial outlet ports at said periphery, the periphery being adapted to cooperate with the movable tube to define and maintain a discharge area therebetween, a fixed cut-off sleeve intermediate the cylindrical casing and the movable tube affording with the casing a gaseous medium supply chamber in communication with the gas or air inlet connection and with the tube a second gaseous medium supply chamber in communication with the air inlet connection, said second chamber being in communication with the first chamber through the peripheral ports and terminating substantially at the inner edges thereof when the movable tube is at its extreme outward position, means to close the said air inlet connection, and means to retract the movable tube from its extreme outward position.

2. Apparatus of the nature set forth, comprising

an elongated cylindrical casing with two peripheral inlet connections, one solely for air and the other alternatively for gas or air, said casing terminating at one end in a tubular conical discharge tip, a movable tube with peripheral ports mounted coaxially within the casing, one of its ends affording with said discharge tip an annular variable discharge area, an axially disposed liquid fuel nozzle member extending within the tube having a head with periphery of predetermined width less than the width of the said peripheral ports and provided with radial outlet ports at said periphery, the periphery being adapted to cooperate with the movable tube to define and maintain a discharge area therebetween, a fixed cut-off sleeve intermediate the cylindrical casing and the movable tube affording with the casing a gaseous medium supply chamber in communication with the gas or air inlet connection and with the tube a second gaseous medium supply chamber in communication with the air inlet connection, said second chamber being in communication with the first chamber through the peripheral ports and terminating substantially at the inner edges thereof when the movable tube is at its extreme outward position, means to close the said air inlet connection, means to retract the movable tube from its extreme outward position, and means to limit the range of retraction substantially to the width of said periphery of the nozzle member head when burning liquid fuel.

3. Apparatus of the nature set forth, comprising an elongated cylindrical casing with two peripheral inlet connections, one solely for air and the other alternatively for gas or air, said casing terminating at one end in a tubular conical discharge tip, a movable tube with peripheral ports mounted coaxially within the casing, one of its ends affording with said discharge tip an annular variable discharge area, an axially disposed liquid fuel nozzle member extending within the tube having a head with periphery of predetermined width less than the width of the said peripheral ports and provided with radial outlet ports at said periphery, the periphery being adapted to cooperate with the movable tube to define and maintain a discharge area therebetween, a fixed cut-off sleeve intermediate the cylindrical casing and the movable tube affording with the casing a gaseous medium supply chamber in communication with the gas or air inlet connection and with the tube a second gaseous medium supply chamber in communication with the air inlet connection, said second chamber being in communication with the first chamber through the peripheral ports and terminating substantially at the inner edges thereof when the movable tube is at its extreme outward position, means to close the said air inlet connection, means to retract the movable tube from its extreme outward position, a movable handle member for operating the retracting means, a stud to engage the handle member to limit the range of retraction substantially to the width of said nozzle member head when burning liquid fuel, said stud being adapted for removal to pass the handle member for operation of the retracting means when burning gaseous fuel, and additional limiting means beyond said stud to limit the range of retraction beyond said first range.

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