

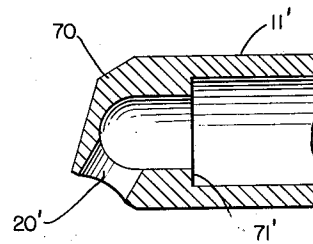
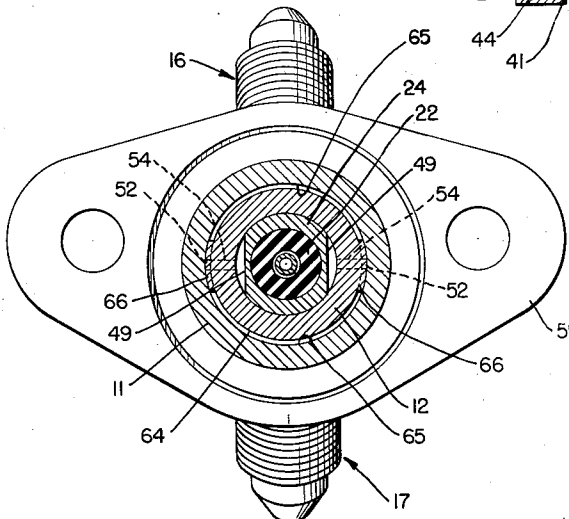
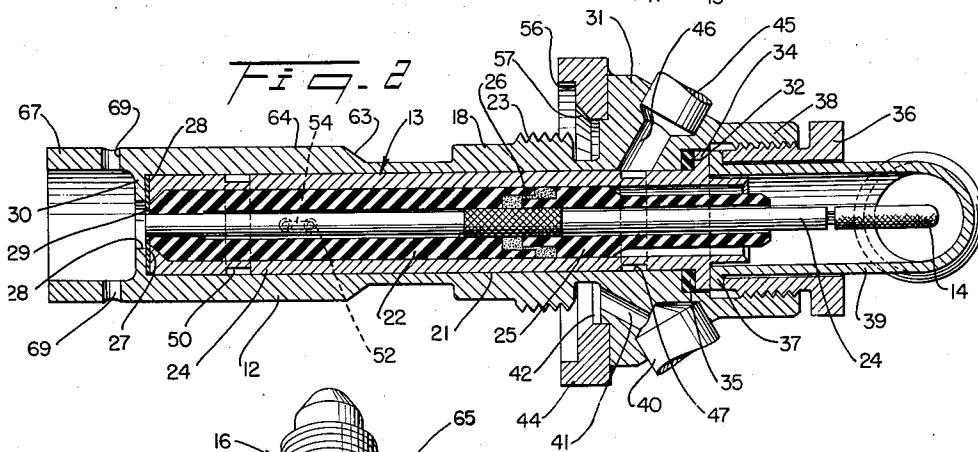
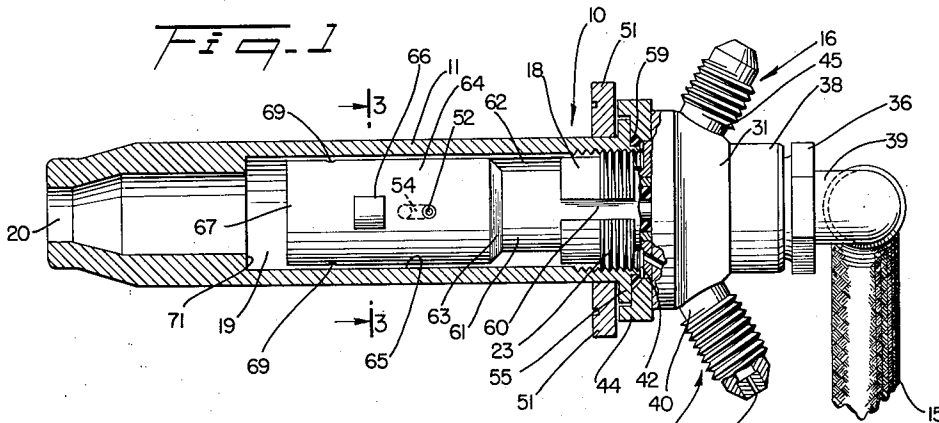
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IGNITER

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1

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This invention relates to an igniter and more particularly to a flame-producing torch type igniter.

The invention has among its objects the provision of a novel flame-producing igniter of the torch type.

Another object of the invention is the provision of a flame-producing igniter which is characterized by the completeness of combustion of the flame-producing fuel, the positiveness of ignition of the fuel, and the desirable force and fullness of the flame.

Yet another object is the provision of a flame-producing igniter which is compact and rugged in construction, which remains free of requirements for operator attention for long periods, and which is easily assembled or disassembled and is thus readily serviced when it is necessary to do so.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views:

FIG. 1 is a view in longitudinal axial section through an illustrative embodiment of igniter made in accordance with the invention, certain of the parts or portions thereof, including the inner, spark-producing device, being shown in elevation;

FIG. 2 is a view in longitudinal axial section through the igniter of FIG. 1 with the outer housing or shell removed therefrom, the inner, spark-producing device being shown in section, certain of the parts being shown in elevation;

FIG. 3 is a view in transverse section through the igniter of FIG. 1, the section being taken generally along line 3—3 of FIG. 1; and

FIG. 4 is a fragmentary view in axial section through the flame-discharging end of a modified igniter housing.

The igniter unit of the invention is capable of use to advantage in a variety of applications, particularly where a directed jet of flame is desired. Typical of such uses of the igniter is that for igniting the main fuel mixture supply of a jet or ram jet engine.

The illustrative igniter is designated generally by the reference character 10. The igniter has an elongated outer, flame-discharging housing or shell 11 within which is mounted a shorter elongated inner housing 12 which has a spark-producing device, generally designated 13, mounted therewithin. The device 13 is supplied with electrical impulses through a wire 14 which is housed in a protective conduit 15. Oxygen containing gas for the flame of device 10 is supplied thereto through a gas inlet means 17, and fuel, in this instance liquid hydrocarbon, is supplied thereto through fuel inlet means 16. The gas and fuel are mixed within housing 11 and are then ignited in a combustion chamber 19 in housing 11 by device 13, the resulting flame issuing from a nozzle 20 at the inner end of housing 11.

The inner housing 12 of the spark-producing device 13 is secured to outer housing 11 by threads 23 on an enlargement 18 at the outer end of housing 12, such threads being received in internal threads on the outer end of

2

housing 11. The spark-producing device 13 may have a construction such as that shown in the application of Logan, Serial No. 706,715, filed January 2, 1958, now Patent No. 3,013,174. Device 13 has a metallic shell or sleeve 21 which is snugly telescoped with the inner housing 12. Within shell 21 there are disposed a first, inner annular ceramic insulating sleeve 22 and a second, outer annular ceramic insulating sleeve 25, the sleeves 22 and 25 serving to hold a central electrode 24 axially of shell 21. A flowed in situ seal 26 between the sleeves 22 and 25 serves to seal the two sleeves together, to seal the central electrode 24 to the sleeves 22 and 25, and to seal such assembly of central electrode and ceramic insulating sleeves to the shell 21.

The inner end of shell 21 is provided with an inwardly projecting flange 27 which both serves as a support or abutment for the inner end of sleeve 22 and as an outer electrode. The inner portion of flange 27 coacts with the exposed inner end of central electrode 24 to form an annular spark gap 29. An inwardly directed annular flange 30 on inner housing 12 adjacent the inner end thereof serves as an abutment for the inner end of spark discharge device 13. An annular sealing washer 28, made of soft metal such as copper, may be interposed between flanges 27 and 30. A central opening 28 through the flange 30 is of at least slightly larger diameter than the inner edge of flange 27, whereby to provide full communication between the spark gap and the combustion chamber, to be described.

Inner housing 12 is provided at its outer end with a thickened head portion 31 serving to provide support and passage for the gas and fuel supply means for the igniter. Head 31 also functions as the means whereby the igniter 10 may be secured to the housing of a jet engine or the like. The outer end of head 31 has an axial counterbore 32 therein, such counterbore receiving in that order an annular packing 35 and an outwardly directed flange 34 on the outer end of shell 21 of spark-producing device 13. An internal hollow nut 36 is threadedly received in axially extending portion 38 of head 31, such nut serving to retain and seal device 13 in inner housing 12. Nut 36 also embraces a tube-like protective hood 39 about conductor 14 and retains the hood by thrusting a flange 37 on the hood against flange 34. Hood 39 is connected to conduit 15, as shown in FIG. 1.

The gas inlet means 17 includes a tube-like threaded fitting 40 which is secured as by being brazed or welded to head 31 in communication with a first angularly inwardly directed passage 41 in the head. The inner end of passage 41 communicates with an annular channel 42 in the axially inner face of a flange member 44 which is secured to head 31 as by being welded thereto. A removable annular orifice-providing member 43 may be positioned in a seat in the outer end of fitting 40 to restrict the flow of gas thereto. It will be understood that fitting 40 is connected to a suitable source of gas under pressure when the igniter is in operation.

The fuel inlet means 16 includes a tube-like threaded fitting 45 which is secured as by being brazed or welded to head 31 in communication with a second angularly inwardly directed passage 46 in the head. The inner end of passage 46 communicates with an annular groove 47 extending about shell 21 of the spark-producing device 13. It will be understood that fitting 45 is connected to a suitable source of fluid fuel such as oil when the igniter is in operation.

The construction of the igniter is such that, when assembled in operative condition as shown in FIG. 1, the fuel admitted thereto through fuel inlet means 16 flows longitudinally in passages between shell 21 of device 13 and inner housing 12, emerging from the latter through

3

small passages 54 leading to orifices 52. The air or other oxygen-containing gas admitted to the igniter through gas inlet means 17 flows longitudinally of the igniter between inner and outer housings 12 and 11, the thus flowing annular stream of gas meeting the jets of fuel issuing from orifices 52 and thoroughly entraining and mixing with such fuel. The combustible mixture then flows into the combustion chamber 19 where it is ignited and issues as a flame from nozzle 20.

The manner of flow of the fuel will be apparent in FIGS. 2 and 3. As shown in FIG. 3, the shell 21 of device 13 is provided with two oppositely disposed longitudinally extending flatted portions 49, so that there are two longitudinally extending passages between the inner housing 12 and the shell 21. Such passages extend from the annular groove 47 adjacent the rear end of shell 21 to an annular groove 50 adjacent the forward end of shell 21. The inner ends of passages 54 communicate with the longitudinal passages provided by flatted surfaces 49, as shown in FIGS. 2 and 3. The passages 54 incline axially rearwardly, so that the jets of fuel travel in countercurrent to the inwardly travelling annular stream of gas in the igniter.

The annular channel or cavity 42, into which combustion gas is delivered under pressure, is closed at its forward end by the means shown in FIG. 1. Flange 44 has a forwardly open annular seat 56 therein, such seat receiving an annular flange 55 on the rear end of outer housing 11. A further flange 51, for the purpose of securing the igniter to an engine housing, is mounted on outer housing 11. Flange 51 may be integral with or separate from flange 55, the former construction being shown in FIG. 1. Means (not shown) such as threaded studs extending through flange 51 into flange 44, retain flange 55 in seat 56. An annular sealing means such as a packing 59, is interposed between a seat on housing 11 rearwardly of flange 55 and a frusto-conical surface 57 on flange 44 inwardly of seat 56.

The enlarged threaded portion 18 on the inner housing 12 is provided with two oppositely located longitudinal grooves 60 which communicate at their rear ends with annular cavity 42. Gas under pressure thus flows from means 17 into cavity 42, along passages provided by grooves 60 and the inner wall 65 of outer housing 11, and into an annular chamber 62 between the reduced diameter zone 61 of the inner housing 12 and the outer housing 11. From chamber 62 gas flows through a transition zone at frusto conical zone 63 on inner housing 12 into a radially thin annular path between the outer surface of the elongated larger diameter portion 64 of the inner housing 12 and the inner surface 65 of the outer housing 11. Because of the restricted area of the path of flow at surface 64, the gas, and the gas-fuel mixture, flow there-through at high speed and decreased pressure. This aids greatly in securing an intimate mixture of gas and fuel.

In order still more efficiently to disperse the fuel in the gas, there are provided flow diverting abutments 66 aligned with the fuel orifices 52, as shown in FIGS. 1 and 3. Abutments 66 are in the form of shallow rectangular projections, integral with inner housing 12, and projecting into contact with the inner wall of outer housing 11. Fuel issuing from orifices 52 meets the counterflowing gas stream, and is dispersed therein. The portions of the resulting gas-fuel mixture which are in alignment with orifices 52 impinge upon the rear faces of abutment 66. The abutments divide the thin annular stream of gas-fuel mixture, thus creating eddy currents therein which result in the more thorough mixing of the fuel in the gas. Further, the larger droplets of fuel which have issued from orifices 52 will not have travelled circumferentially of the thin chamber sufficiently to clear abutments 66 by the time such larger droplets have been carried forwardly by the forwardly travelling stream. Consequently such larger droplets are smashed against the abutments, and

4

are efficiently broken up and dispersed in the mixture. By the time the gas-fuel mixture reaches chamber 19, therefore, such mixture will be substantially uniform.

A transverse annular shoulder 71, defining the junction between the chamber 19 and the thicker walled nozzle portion of outer housing 11 of the igniter, is positioned in axial alignment with the thin annular passage defined by the outer surface 64 of the inner housing 12 and the inner surface 65 of the outer housing 11. The gas-fuel mixture impinges upon shoulder 71 and still further mixes it and tends to break down any large droplets therein.

The inner end of inner housing 12 forms a hood 67 for the annular spark gap. Holes 69 through such hood allow communication between the spark gap and the radially thin passage at zone 64, thereby aiding in the lighting of the gas-fuel mixture, and the maintenance of its combustion so long as spark gap 29 is energized.

In some instances it may be desired that the flame discharged from the nozzle of the igniter extend at an angle with respect to the longitudinal axis thereof. One modified nozzle construction to make this possible is shown in FIG. 4 wherein the outer housing of the igniter is designated 11'. Beyond shoulder 71' of the housing, the housing is hooded at 70. A nozzle opening 20' extends through hood 70 at a desired angle with respect to the longitudinal axis of the hood.

Although only a limited number of embodiments of the invention have been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art.

What is claimed is:

1. An igniter of the flame type, comprising an elongated housing having a flame discharge opening adjacent the forward end thereof, means defining within the housing an elongated and at least substantially annular passage extending longitudinally of the housing and having a radial thickness which is substantially less than the radius of said housing; means to supply said annular passage with oxygen-containing gas under pressure to form an annular stream of said gas flowing toward said opening, abutment means projecting into the annular passage intermediate the length thereof, means to introduce a liquid fuel into the annular stream of gas to form a combustible mixture therewith, said last-named means being located in alignment with and rearwardly of said abutment means and directing the fuel in a direction generally radially outwardly into the annular passage, and means located within the annular stream of the combustible mixture and rearwardly of the opening in the housing to ignite said combustible mixture.

2. An igniter as defined in claim 1, wherein said abutment means substantially spans radially across the annular passage.

3. An igniter as defined in claim 1, wherein the means to introduce fuel comprises an angularly directed passage discharging fuel countercurrent to the flow of gas in said annular stream.

4. An igniter as defined in claim 1, comprising a combustion chamber in the housing between the flame discharge opening and the means to ignite the combustible mixture.

5. An igniter as defined in claim 4, comprising an annular inwardly projecting shoulder at the forward end of the combustion chamber in alignment with the annular stream of combustible mixture.

6. An igniter of the flame type, comprising an elongated outer tubular housing having a generally cylindrical bore longitudinally thereof and having a flame discharge

5

opening adjacent the forward end thereof communicating with said bore, an elongated inner member disposed within the housing, said member having a longitudinally disposed passage therein and having a generally cylindrical portion spaced from the discharge opening in the housing and forming with the confronting inner wall of the housing a radially thin generally annular passage therebetween, means to introduce an oxygen-containing gas to said radially thin passage to form a generally annular stream of said gas in said radially thin passage flowing toward the discharge opening, abutment means projecting into said radially thin passage intermediate the length thereof, means to feed a liquid fuel to the passage within the inner member, at least one fuel discharge passage through the wall of the inner member connecting the fuel conducting passage therewithin with the radially thin passage, said fuel discharge passage being located in alignment with and rearwardly of said abutment means and directing the fuel in a direction generally radially into said radially thin passage to form a combustible mixture with said gas, and means telescopically mounted within the passage in said inner member to ignite the combustible mixture inwardly of the opening in the housing.

7. An igniter as set forth in claim 6 wherein said telescopically mounted ignition means is spaced rearwardly of the forward end of said passage whereby a first combustion chamber is formed in the forward end of the passage in the inner member.

8. An igniter as defined in claim 7, comprising a second combustion chamber communicating with said first chamber and positioned in the housing between the flame discharge opening and the forward end of said first chamber.

9. An igniter as defined in claim 8, comprising an annular inwardly projecting shoulder at the forward end of the second combustion chamber in alignment with the annular stream of combustible mixture.

10. An igniter of the flame type, comprising an elongated outer tubular housing having a generally cylindrical bore longitudinally thereof and having a flame discharge opening adjacent the forward end thereof communicating with said bore, an elongated inner member disposed with-

6

in the housing, said member having a longitudinally disposed passage therein and having a generally cylindrical portion spaced from the discharge opening in the housing and forming with the confronting inner wall of the housing a radially thin generally annular passage therebetween, means to introduce an oxygen-containing gas to said radially thin passage to form a generally annular stream of said gas in said radially thin passage flowing toward the discharge opening, abutment means projecting into said radially thin passage intermediate the length thereof, means to feed a liquid fuel to the passage within the inner member, at least one fuel discharge passage through the wall of the inner member connecting the fuel conducting passage therewithin with the radially thin passage, said fuel discharge passage being located in alignment with and rearwardly of said abutment means and directing the fuel in a direction generally radially into said radially thin passage to form a combustible mixture with said gas, means telescopically mounted within the passage in said inner member to ignite the combustible mixture inwardly of the opening in the housing, said telescopically mounted ignition means being spaced rearwardly of the forward end of said passage in the inner member whereby a first combustion chamber is formed in the forward end of the passage in the inner member, a second combustion chamber communicating with said first chamber and positioned in the housing between the flame discharge opening and the forward end of said first chamber, and an opening in the wall of the forward end of said inner member and communicating said radially thin passage with said first chamber.

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