Aug. 7, 1951 R. H. GODDARD 2,563,023

COMBUSTION CHAMBER WITH MULTIPLE DISCHARGE NOZZLES

Filed April 12, 1946

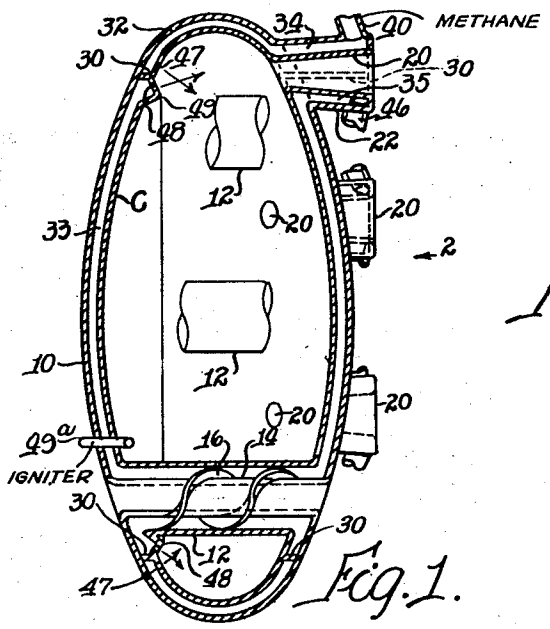

Fig. 1.

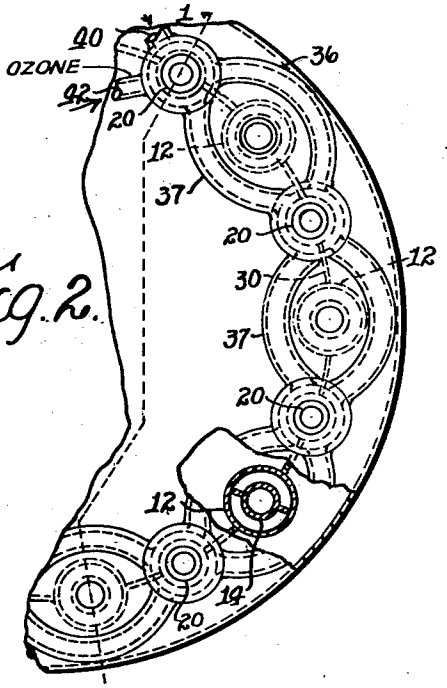

Fig. 2.

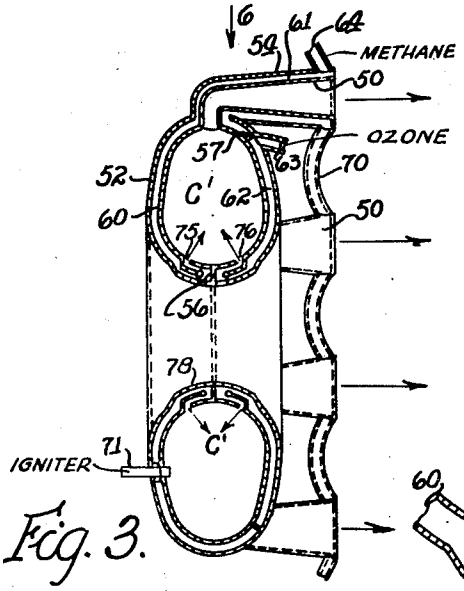

Fig. 3.

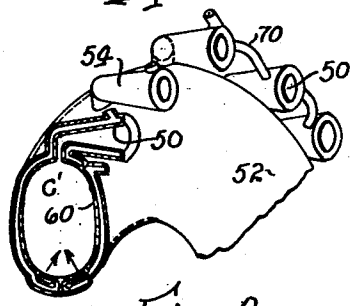

Fig. 4.

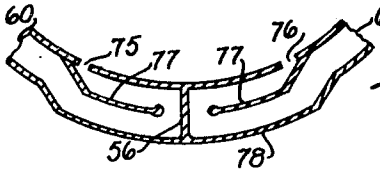

Fig 5.

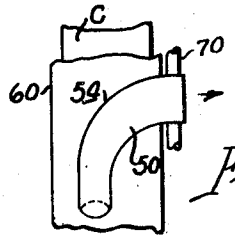

Fig. 6.

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UNITED STATES PATENT OFFICE

2,563,023

COMBUSTION CHAMBER WITH MULTIPLE DISCHARGE NOZZLES

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Application April 12, 1946, Serial No. 661,825

4 Claims. (Cl. 60—35.6)

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This invention relates to combustion chambers having multiple discharge nozzles, and more particularly to combustion chambers where it is desired to have a very short travel of the combustion gases between the point where the combustion fluids mix and ignite and the point where the combustion gases enter the discharge nozzles. Such short travel is especially desirable in the case of very active fluids with high energy content, such as ozone or methane.

It is the general object of the invention to provide a single combustion chamber of large diameter and relatively short axial length, and to provide a plurality of discharge nozzles for said single combustion chamber.

Further objects are to provide improved means for cooling such a combustion chamber and for cooling the discharge nozzles, and also to provide improved means for feeding the combustion fluids to the combustion chamber.

The invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

Preferred forms of the invention are shown in the drawing, in which

Fig. 1 is a sectional side elevation of one form of the invention, the section being taken along the line 1—1 in Fig. 2;

Fig. 2 is a partial end view, looking in the direction of the arrow 2 in Fig. 1;

Fig. 3 is a sectional side elevation of a second form of the invention;

Fig. 4 is a partial perspective view, partly in section;

Fig. 5 is an enlarged fragmentary section to be described; and

Fig. 6 is a fragmentary plan view, looking in the direction of the arrow 6 in Fig. 3.

Referring to Figs. 1 and 2, the combustion chamber C is shown as a relatively flat oblate spheroid surrounded by a spaced jacket casing 10.

Reenforcing tubes 12 extend through the combustion chamber C at separated points and are attached at their ends to the casing of the chamber. Each tube 12 surrounds an open tube 14 spaced within the tube 12 and having its ends secured in the walls of the jacket casing 10. Spiral partitions 16 are provided between the tubes 12 and 14 to hold the tubes in concentric relation and also to facilitate travel of the cooling fluid through the annular spaces between the tubes 12 and 14 and in intimate contact with the tubes 12.

A plurality of nozzles 20 are mounted in one

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side face of the combustion chamber C and extend axially therefrom as shown in Fig. 1. Each nozzle is provided with a jacket casing 22 surrounding the nozzle and connecting into the jacket space between the chamber C and the casing 10. The jacket space of both the chamber C and nozzle 20 is divided circumferentially by a partition 30, thus forming an outer jacket space 32 and an inner jacket space 33 for the chamber C and an outer jacket space 34 and inner jacket space 35 for each nozzle 20.

The outer nozzle jacket spaces 34 for adjacent nozzles may be connected by tubes 36 (Fig. 2), and the inner jacket spaces 35 for adjacent nozzles may be similarly connected by tubes 37, so that circulation through all of the nozzle jacket spaces will be insured.

A supply pipe 40 is connected into the outer jacket space 34 of one of the nozzles 20 as shown in Fig. 1 and supplies one of the combustion liquids, as methane, to the outer jacket spaces 34 and to the outer chamber jacket space 32. A second supply pipe 42 is connected into one of the inner nozzle jacket spaces 35 and similarly supplies a second combustion liquid, as ozone, to the inner jacket spaces 35 and to the inner chamber jacket space 33.

An annular series of perforations 47 (Fig. 1) are provided in the wall of the combustion chamber C outside of the partition 30 and similar perforations 48 are provided just inside of the partition 30 in an annular raised ridge 49. The combustion liquids are supplied under pressure and enter the combustion chamber through the perforations 47 and 48 as indicated in Fig. 1 and in directions oblique to a plane perpendicular to the axis of the chamber C.

The combustion liquids, having circulated through the jacket spaces before being sprayed from the openings 47 and 48, are substantially heated and to some extent vaporized before entering the combustion chamber. The sprays of the different liquids intersect shortly after entering the chamber, as indicated by the arrows in Fig. 1, and are very thoroughly mixed and intermingled. Combustion thereupon takes place and the combustion gases reach the discharge nozzles 20 after very short travel across the combustion chamber in an axial direction. Any suitable ignition device 49a may be provided to start combustion.

A combustion chamber of large capacity is thus provided, in which a plurality of nozzles are positioned closely adjacent the point of ignition of the combustion fluids, and all of the nozzles discharge in parallel directions and axially of the

combustion chamber. Provision is also made for cooling all parts of the apparatus and at the same time utilizing the heat of combustion for raising the temperature of the combustion liquids.

In Figs. 3 to 6 a modified construction is shown in which the combustion chamber C' is in the shape of a toroidal ring having a plurality of nozzles 50 mounted about the periphery thereof. Each of the nozzles 50 is curved in plan view as shown in Fig. 6, so that all of the nozzles discharge axially of the ring. The chamber C' is surrounded by a jacket casing 52 and each nozzle 50 is surrounded by a jacket casing 54 connecting into the casing 52.

The jacket space between the chamber C' and the casing 52 is divided by partitions 56 and 57 to form a larger jacket space 60 to which the nozzle jacket spaces 61 are connected, and a smaller jacket space 62 to which a supply pipe 63 is connected. A second supply pipe 64 is similarly connected into one of the nozzle jacket spaces 61 and thence to the main jacket space 60.

The jacket spaces 61 in adjacent nozzles 50 are preferably connected by tubes 70 to insure circulation of a cooling liquid through all of the nozzle jacket spaces. Any suitable igniter may be provided as indicated at 71.

Annular series of perforations 75 and 76 (Figs. 3 and 5) are provided at each side of the partition 56, and deflector plates 77 are provided in enlarged end portions 78 of the jacket spaces 60 and 62, as clearly shown in Fig. 5. The extreme edge portion of each deflector 77 is preferably enlarged and rounded as also shown in Fig. 5.

With the construction as described, liquid fuel, as methane, may be provided through the supply pipe 63 and smaller jacket space 62 to the feed openings 76, and a liquid-oxidizing agent, as ozone, may be provided through the supply pipe 64, nozzle jacket spaces 61 and larger jacket space 60 to the feed openings 75.

Both of these liquids are supplied under substantial pressure and sprays of the two more or less vaporized liquids are ejected through the openings 75 and 76 in intersecting directions, so that the sprays cross and are effectively intermingled. Combustion then takes place and the combustion gases enter the several nozzles 50 in radially outward directions but have their directions changed by the curved contours of the nozzles, so that they are discharged parallel to the axis of the chamber C' as indicated by the arrows in Fig. 3.

The advantages of this form of the invention are similar to those of the form previously described and the construction is in some respects stronger and more simple.

No claim is made herein to the specific structure shown in Fig. 3, which forms the subject matter of divisional application Serial No. 208,931 filed February 1, 1951.

Having described two preferred constructions, the invention is not to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what is claimed is:

1. A combustion chamber enclosed by surfaces of revolution and of substantially greater outside diameter than axial length, a plurality of discharge nozzles connected into said chamber and discharging the combustion gases therefrom along paths parallel to each other and to the axis of said chamber, a cooling jacket structure surrounding said combustion chamber and said nozzles and partitioned to receive two different combustion liquids and to spray said liquids into said chamber along paths which intersect in said chamber relatively close to their points of injection, and tubular connections between the jacket spaces for the same liquid associated with adjacent discharge nozzles.

2. In combination, a combustion chamber enclosed by surfaces of revolution and of substantially greater outside diameter than axial length, means to feed two different combustion liquids to said chamber, and a plurality of discharge nozzles connected into one side wall of said chamber and extending therefrom in directions parallel to the axis of said chamber, and said combustion chamber being an oblate spheroid with a relatively flat elliptical cross section and having a plurality of reenforcing tubes crossing said chamber parallel to the axis thereof and secured at their ends in the side walls of said chamber.

3. In combination, a combustion chamber enclosed by surfaces of revolution and of substantially greater outside diameter than axial length, means to feed two different combustion liquids to said chamber, and a plurality of discharge nozzles connected into one side wall of said chamber and extending therefrom in directions parallel to the axis of said chamber, said combustion chamber being an oblate spheroid with a relatively flat elliptical cross section and having a plurality of reenforcing tubes crossing said chamber parallel to the axis thereof and secured at their ends in the side walls of said chamber, and jacket tubes being provided which are mounted within said reenforcing tubes and which are secured to a jacket casing enclosing said combustion chamber.

4. In combination, a combustion chamber enclosed by surfaces of revolution and of substantially greater outside diameter than axial length, means to feed two different combustion liquids to said chamber, and a plurality of discharge nozzles connected into one side wall of said chamber and extending therefrom in directions parallel to the axis of said chamber, said combustion chamber being an oblate spheroid with a relatively flat elliptical cross section and having a plurality of reenforcing tubes crossing said chamber parallel to the axis thereof and secured at their ends in the side walls of said chamber, and jacket tubes being provided which are mounted within said reenforcing tubes and which are secured to a jacket casing enclosing said combustion chamber, and helical partitions being provided which separate said reenforcing tubes and said jacket tubes and which hold them in concentric relation.

ESTHER C. GODDARD.

Executrix of the Last Will and Testament of Robert H. Goddard, Deceased.

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