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APPARATUS FOR CONTINUOUSLY FEEDING A LIQUID FUEL AND A LIQUID OXIDIZER TO A COMBUSTION CHAMBER OF PROPULSION TYPE AND HAVING AN OPEN DISCHARGE NOZZLE

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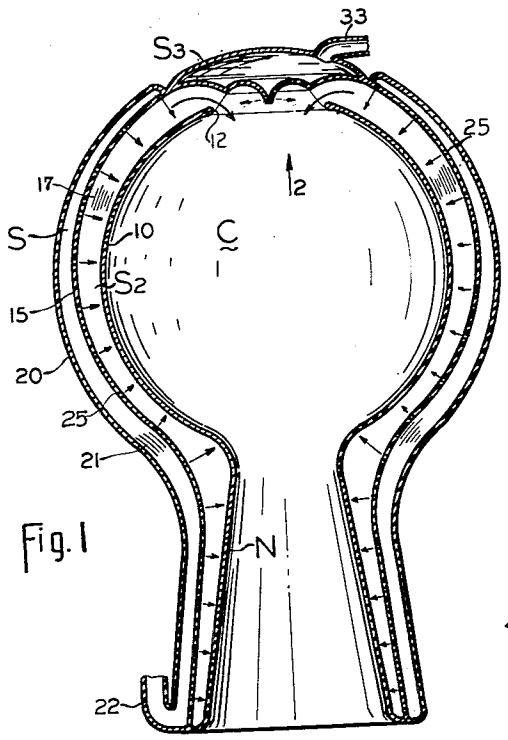


Fig. 1

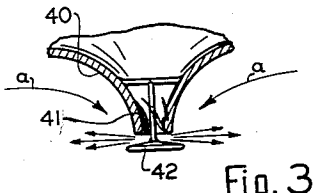


Fig. 3

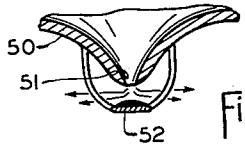


Fig. 4

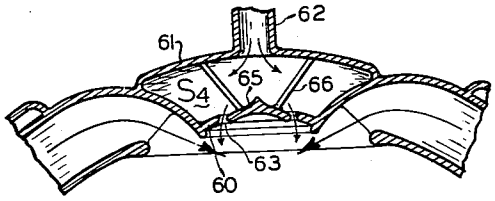


Fig. 5

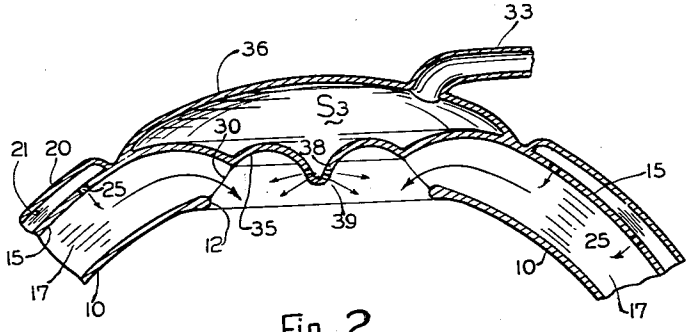


Fig. 2

INVENTOR.
ROBERT H. GODDARD, DEC'D.
ESTHER C. GODDARD. EXECUTRIX.
BY
Chas. W. Hawley
ATT'Y.

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APPARATUS FOR CONTINUOUSLY FEEDING A LIQUID FUEL AND A LIQUID OXIDIZER TO A COMBUSTION CHAMBER OF PROPULSION TYPE AND HAVING AN OPEN DISCHARGE NOZZLE

Robert H. Goddard, deceased, late of Annapolis, Md., by Esther C. Goddard, executrix, Worcester, Mass., assignor of one-half to The Daniel and Florence Guggenheim Foundation, New York, N. Y., a corporation of New York

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3 Claims. (Cl. 60—35.6)

This invention relates to a combustion chamber of the propulsion type which is in general of spherical section and which has an open discharge nozzle at one end thereof.

It is the general object of the invention to provide an improved construction for cooling the combustion chamber wall with a liquid oxidizer, for injecting a liquid fuel at the closed or inner end of the combustion chamber and near the axis thereof, and for presenting the partially vaporized oxidizer directly in the path of the injected liquid fuel.

Preferably, the two combustion elements engage each other in a substantially head-on relation, thus ensuring effective intermingling of the more or less vaporized liquids.

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 front elevation of a combustion chamber embodying the invention;

Fig. 2 is an enlarged sectional front elevation of certain parts shown in Fig. 1; and

Figs. 3, 4 and 5 are detail sectional views showing modified fuel-admitting structures.

Referring particularly to Figs. 1 and 2, a combustion chamber C is provided with a substantially spherical casing **10** connected at its outer end with an open discharge nozzle N, and having an axial feed opening **12** at its inner end.

An inner jacket casing **15** encloses the casing **10** and nozzle N and is held in spaced relation therefrom by a plurality of vanes **17** (Fig. 2) extending axially of the chamber C and in radiating planes. An outer jacket casing **20** encloses the inner jacket casing **15** and is held in spaced relation thereto by additional radiating vanes or partitions **21**.

The jacket space S defined by the jacket casings **15** and **20** is supplied with liquid oxygen or other liquid oxidizer through a feed pipe **22** adjacent the outer end of the nozzle N. The inner jacket casing **15** (Fig. 2) has a plurality of openings **25** through which sprays or jets of liquid oxygen are delivered to the cooling space S2 between the casings **10** and **15**, and these jets also impinge against the outer faces of the combustion chamber casing **10** and the nozzle N. The casing **10** and nozzle N are thus effectively cooled.

The partially vaporized oxidizer is delivered to the combustion chamber C through an annular slot **30** at the inner end of the chamber.

Liquid fuel, as gasoline, is delivered through a feed pipe **33** to a jacket space S3 formed between an inner end wall **35** and an outer end jacket casing **36**. The axial portion of the wall **35** is displaced inwardly of the combustion chamber, as indicated at **38**, and is provided with a plurality of spray openings **39**.

When combustion liquids are supplied under pressure through the pipes **22** and **33**, a stream of liquid or partially vaporized oxidizer enters the combustion chamber through the annular slot or opening **30**, and this stream of oxidizer is directly engaged by the fuel jets injected through the openings **39**. All parts of the combustion chamber wall and also the nozzle N are thus effectively cooled and protected from excessive heat, and the two combustion elements are very effectively intermingled.

In Fig. 3, a modified construction is shown in which the inwardly-projecting portion **40** of the inner end jacket casing is provided with a spirally grooved or ribbed rotator **41** and with a slightly conical deflector **42** mounted below the axial opening of the portion **40**. By the use of this construction, the fuel is injected with a rotary or whirling motion and is even more directly opposed to the path of travel of the injected oxidizer, which path is indicated by the arrows *a*.

In the construction shown in Fig. 4, the displaced axial portion **50** of the combustion chamber end wall is provided with a single axial opening **51** and with a deflector **52** mounted in alignment with said opening. The result is similar to that produced by the construction shown in Fig. 3 but the construction is more simple.

An additional modification is shown in Fig. 5 in which a fuel space S4 is provided between an inner end wall **60** and an outer jacket casing **61**. The liquid fuel is supplied under pressure through a a pipe **62** and enters the combustion chamber through an annular slot **63**. The axial portion **65** of the end wall **60** which is within the annular slot **63** may be supported from the outer jacket casing **61** by suitable spaced braces **66**.

In this construtcion, the combustion elements enter the chamber along substantially perpendicular paths and are also effectively intermingled.

With all forms of the invention, effective mixing of the combustion elements is attained and a high degree of combustion efficiency results.

Having thus described the invention and the advantages thereof, it will be understood that 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. In propulsion apparatus having a combustion chamber with an open-discharge nozzle at its outer end, in combination, a substantially spherical chamber wall for said combustion chamber and having an axial feed opening at its inner end, an inner casing enclosing an inner jacket space about said spherical wall, an outer casing enclosing an outer jacket space about said inner casing, and means to supply a liquid oxidizer under pressure to said outer jacket space, said inner jacket casing having spaced openings through which portions of said liquid are sprayed against the combustion chamber wall, said inner jacket space communicating with an inner opening at its inner end, which opening is formed between adjacent portions of said combustion chamber wall and said inner casing, and through which annular opening partially vaporized oxidizer is fed from said inner jacket space to said combustion chamber, and means to supply liquid fuel to said combustion chamber in a direction opposed to the path of travel of the oxidizer.

2. The combination in propulsion apparatus as set forth in claim 1, in which the means to supply liquid fuel comprises an axial hollow end wall structure having an inwardly-displaced portion with an axial feed opening therethrough, and having means to outwardly deflect the liquid fuel fed through said axial opening.

3. The combination in propulsion apparatus as set forth in claim 1, in which the means to supply liquid

fuel comprises an axial hollow end wall structure having an inwardly-displaced portion with an axial feed opening therein, and having means to outwardly deflect the liquid fuel to feed through said axial opening and to give said axially fed liquid fuel a whirling motion.

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