April 13, 1954 R. H. GODDARD 2,674,848

COMBUSTION CHAMBER WITH MULTIPLE TARGET RECESSES FOR USE IN ROCKET APPARATUS

Original Filed June 28, 1946

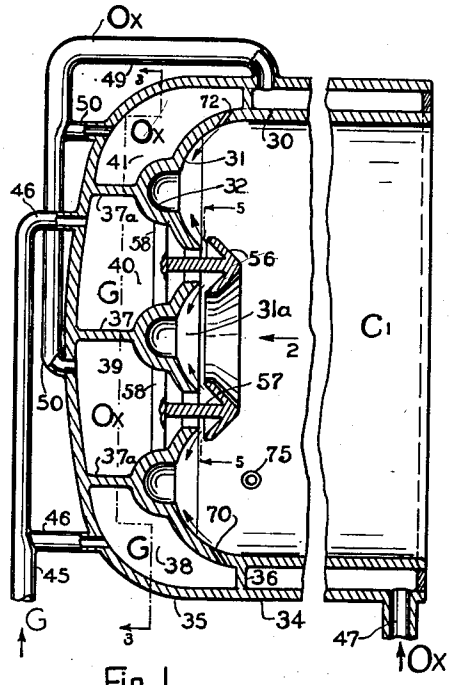


Fig. 1

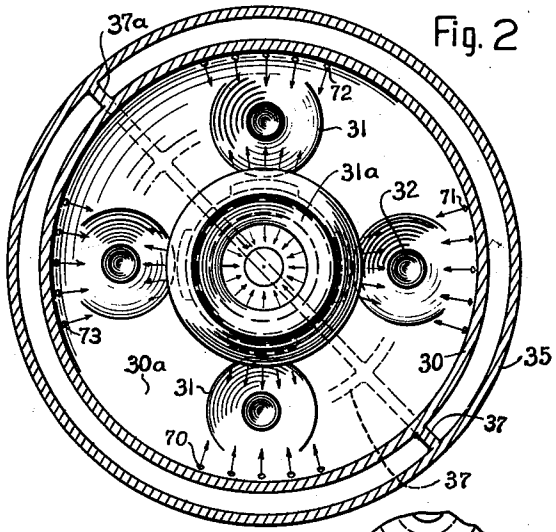


Fig. 2

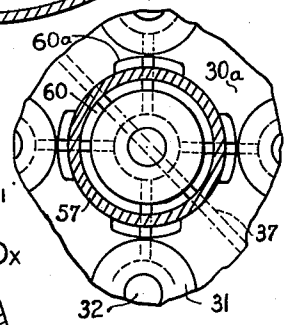


Fig. 5

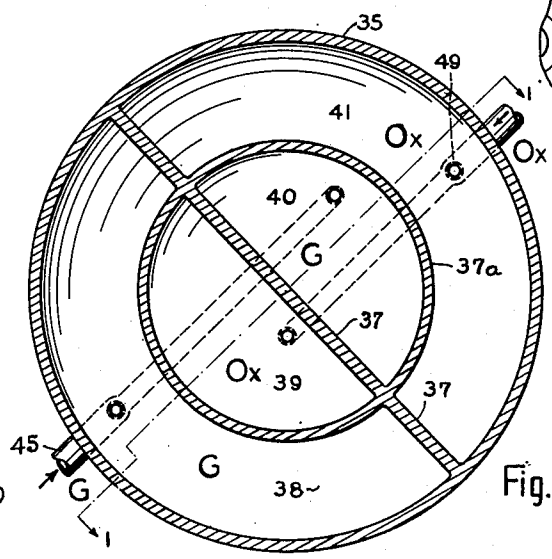


Fig. 3

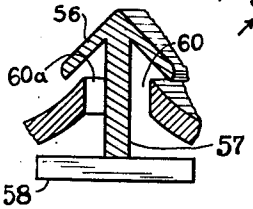


Fig. 4

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COMBUSTION CHAMBER WITH MULTIPLE TARGET RECESSES FOR USE IN ROCKET APPARATUS

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Original application June 28, 1946, Serial No. 680,229, now Patent No. 2,633,706, dated April 7, 1953. Divided and this application February 1, 1951, Serial No. 208,932

5 Claims. (Cl. 60—39.46)

1

This application is a division of prior application Serial No. 680,229 filed June 28, 1946, now Patent No. 2,633,706.

This invention relates to a combustion chamber designed to operate with high efficiency when using liquid combustion agents, such as gasoline or methane and liquid oxygen or ozone. The initial reaction between such liquids is violent and produces high temperature and high velocity of the combustion gases at the point of ignition.

It is the general object of the present invention to provide a combustion chamber so designed and constructed that the heat of such combustion gases will be progressively transformed to energy of motion; that the mechanical energy of the rapidly moving gases will not be substantially reduced by friction; that combustion will be progressively completed at falling temperatures, and that the combustion gases will leave the chamber at very high velocity but at relatively low pressure and temperature.

To the attainment of this general object, a form of combustion chamber is disclosed herein which is of uniform diameter throughout the length thereof and in which the discharge end is entirely open and unobstructed.

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

A desirable form of the invention is shown in the drawing, in which—

Fig. 1 is a sectional side elevation of an elongated cylindrical combustion chamber embodying the invention, the section being taken along the line 1—1 of Fig. 3;

Fig. 2 is a right-hand end elevation, partly in section, and looking in the direction of the arrow 2 in Fig. 1;

Fig. 3 is a sectional end elevation, taken along the line 3—3 in Fig. 1;

Fig. 4 is a detail sectional view of a spreader to be described; and

Fig. 5 is a detail sectional elevation, taken along the line 5—5 in Fig. 1.

Referring to the drawing, an open-end combustion chamber C′ is shown as having a cylindrical side wall 30 and as having a closed inner end wall 30*a* (Fig. 2) formed with a plurality of depressed and concave wall portions 31 each having a small target recess 32 at its axial center.

The combustion chamber C′ is surrounded by jacket casings 34 and 35, and the jacket spaces are separated by an annular partition 36 (Fig. 2). The portion of the jacket space which is

2

within the casing 35 is subdivided as shown in Fig. 1 into jacket spaces 38, 39, 40 and 41. This subdivision may be effected by a transverse partition 37 (Fig. 3) and an annular partition 37*a*.

Fuel is supplied to the jacket spaces 38 and 40 by a feed pipe 45 and branch pipes 46 (Fig. 1). A liquid oxidizer, as liquid oxygen, is supplied to the jacket space which is within the casing 34 through a feed pipe 47 (Fig. 1) and is conducted from this jacket space to the jacket spaces 39 and 41 through a connecting pipe 49 and branch pipes 50.

A spreader 56 (Figs. 1 and 4) is supported on an annular partition 57, which in turn is mounted in fixed position on cross bars 58. The spreader 56 and partition 57 (Fig. 4) are jointly arrow-shaped in section, and the partition 57 extends through a slot or opening 60 outside of the middle concave wall portion 31*a* and its associated target recess.

Inside of the partition 57, the opening 60 (Fig. 5) is halved by upstanding portions of the partition 37, and outside of the partition 57, the openings are interrupted and segmental, as shown at 60*a*.

Pipes and jacket spaces containing liquid oxygen are designated "Ox" on the drawing, and corresponding parts containing liquid fuel or gasoline are marked "G."

Feed openings or ports 70, 71, 72 and 73 are provided from the jacket spaces 38 and 41 to the outer series of concave wall portions 31 and target recesses 32. Gasoline will be supplied through the ports 70 and 73, and oxygen will be supplied through the ports 71 and 72.

Oxygen sprays will be similarly supplied through the segmental openings 60*a* at the bottom and at the left as viewed in Figs. 2 and 5, and gasoline will be supplied through the segmental openings 60*a* at the top and at the right in Figs. 2 and 5.

Oxygen will be provided through the lower and left-hand portion of the inner slot 60 to the middle concave wall portion 31*a*, and gasoline will be similarly provided through the upper and left-hand portion of the slot 60 to said portion 31*a*.

All of the liquids supplied through the slots or openings 60 and 60*a* will engage the under side of the spreader 56 and will be deflected thereby into the concave wall portions 31 and recesses 32, while the liquids introduced through the ports 70 and 73 will be delivered direct to the outer series of concave portions and associated recesses.

The combustion liquids are thus effectively directed into the target recesses 32 in which they

are fully intermingled. A spark-plug 75 may be provided to start initial combustion.

The combustion chamber herein shown and described may be of relatively large diameter, and the inner end portion of the chamber may be provided with any desired number of concave wall portions and target recesses, so that the entire inner end area of the chamber may be effectivly covered with the intermingled sprays, and a correspondingly larger volume of combustion gases will be produced. This construction is preferred when it is desired to increase the capacity of a combustion chamber without corresponding increase in length.

With this type of combustion chamber, it is found that final combustion is exceptionally complete; that the heat in the combustion gases is very effectively transformed into energy of motion or transferred to the cold liquids in the jackets, and that frictional losses in the combustion chamber are reduced to a minimum.

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. A chamber for the continuous combustion of a liquid fuel and a liquid oxidizer comprising an elongated open-end cylindrical wall and an inner end wall connected thereto and having a circular series of separate, circumferentially-spaced and substantially semi-spherical concave wall portions formed therein, each separate concave wall portion having an outwardly-displaced end target recess centered therein, a casing providing a jacketed enclosure outside of the entire inner end wall, partitions dividing said jacketed enclosure into a plurality of separate jacketed spaces, means to provide liquid fuel and a liquid oxidizer under pressure, means to deliver said liquid fuel to a certain plurality of said separate jacketed spaces only, means to deliver said liquid oxidizer to the remaining plurality of said separate jacketed spaces only, and all of said separate jacketed spaces having feed openings to said separate concave wall portions and associated target recesses, whereby elements of both of said combustion liquids are projected from associated but separate jacketed spaces to each concave wall portion and to its associated target recess.

2. The combination in a combustion chamber as set forth in claim 1, in which said end wall has an axially-located concave portion and target recess, and in which an axially-centered inverted spreader of V-shaped cross section and with oppositely-inclined inner and outer deflecting flanges surrounds said axially-located concave end wall portion and target recess, and in which spreader is effective to deflect segmental conical portions of said liquid fuel and of said liquid oxidizer into said axially-located concave end wall portion and recess.

3. The combination in a combustion chamber as set forth in claim 2, in which the outer deflecting flange of said spreader deflects elements of one of said combustion liquids into certain of the circular series of concave end wall portions and associated target recesses, and deflects elements of the second combustion liquid into the remaining concave end wall portions and associated target recesses in said circular series.

4. The combination in a combustion chamber as set forth in claim 1, in which an inverted spreader is mounted on a partition concentric with an axially-located end wall portion and its associated target recess but spaced radially therefrom, and in which said spreader deflects segmental annular portions of said liquid fuel and of said liquid oxidizer into said axially-located concave end wall portion and associated recess.

5. The combination in a combustion chamber as set forth in claim 1, in which an inverted spreader is mounted on a partition concentric with an axially-located end wall portion and its associated target recess but spaced radially therefrom, and in which said spreader deflects segmental annular portions of said liquid fuel and of said liquid oxidizer into said axially-located concave end wall portion and associated recess and deflects additional portions of said liquid fuel and of said liquid oxidizer into the circular series of concave end wall portions and associated target recesses which surround said inverted spreader.

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