Oct. 7, 1952 R. H. GODDARD 2,612,750

ROTATABLE COMBUSTION CHAMBER

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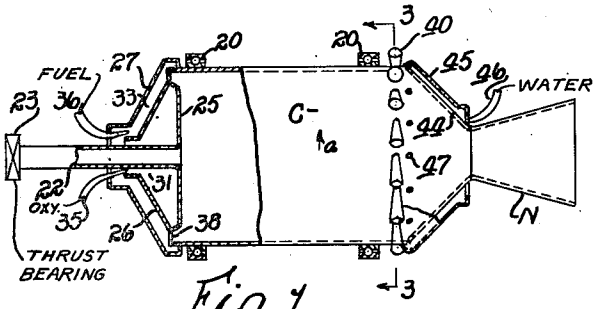

Fig. 1.

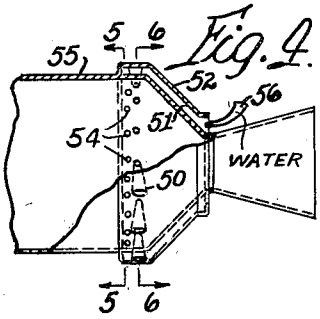

Fig. 4.

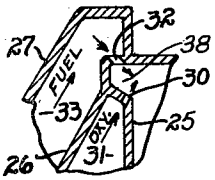

Fig. 2.

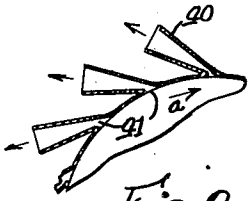

Fig. 3.

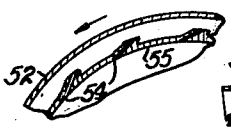

Fig. 5.

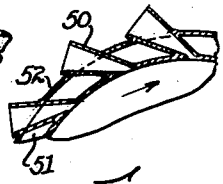

Fig. 6.

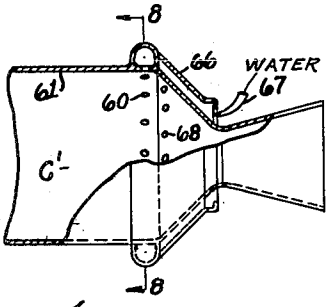

Fig. 7.

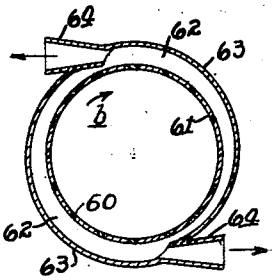

Fig. 8.

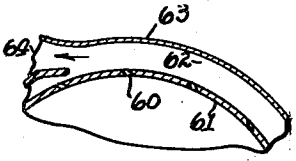

Fig. 9.

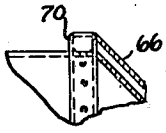

Fig. 10.

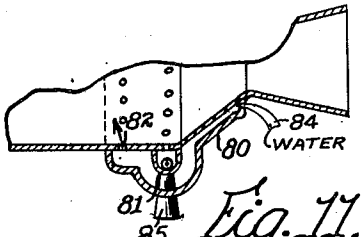

Fig. 11.

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ROTATABLE COMBUSTION CHAMBER

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Application July 26, 1946, Serial No. 686,389

5 Claims. (Cl. 60—35.6)

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This invention relates to a combustion chamber of the type having an open conical discharge nozzle and adapted for use in the aerial propulsion of rockets and rocket craft.

The invention relates more particularly to combustion chambers which are rotated when in operation, it being the general object of the invention to provide improved means for effecting such rotation.

To the accomplishment of this general object, a plurality of small auxiliary nozzles are mounted on the combustion chamber and discharge a portion of the combustion gases tangentially of the chamber. Improved means is also provided for feeding combustion liquids to the chamber and for cooling the feeding means, the auxiliary nozzles and adjacent portions of the combustion chamber walls.

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 side elevation, partly in section, showing a combustion chamber with the improved construction embodied therein;

Fig. 2 is an enlarged fragmentary section of certain parts shown in Fig. 1;

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

Fig. 4 is a view similar to Fig. 1 but showing a modified construction;

Figs. 5 and 6 are fragmentary detail sectional elevations, taken along the lines 5—5 and 6—6 in Fig. 4 respectively;

Fig. 7 is a side elevation, partly in section, and showing a further modification;

Fig. 8 is a transverse sectional view, taken along the line 8—8 in Fig. 7;

Fig. 9 is an enlarged fragmentary sectional view, also taken along the line 8—8 in Fig. 7;

Fig. 10 is a fragmentary side elevation showing a modification of Fig. 7; and

Fig. 11 is a view similar to Fig. 7 but showing a further modification thereof.

Referring to Figs. 1, 2 and 3, a rotatable combustion chamber C is shown, mounted in bearings 20 and provided with a nozzle N at the discharge end and with an ignition tube 22 at the opposite end. The tube 22 engages a thrust bearing 23 which prevents displacement of the chamber C to the left in Fig. 1.

The end wall 25 of the chamber C is enclosed by an inner jacket casing 26 and an outer jacket

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casing 27. Feed openings 30 (Fig. 2) connect the inner jacket space 31 with the combustion chamber, and similar feed openings 32 connect the outer jacket space 33 with the chamber.

A liquid oxidizer, such as liquid oxygen, is fed to the inner jacket space 31 through a feed nozzle 35 (Fig. 1) and a suitable liquid fuel such as gasoline is fed to the outer jacket space 33 through a feed nozzle 36, both liquids being under pressure.

The jets of gasoline and liquid oxygen intersect adjacent an annular recess 38 (Fig. 1) in the end wall 25 of the combustion chamber and are effectively intermingled at such intersection.

At the discharge end of the cylindrical body portion of the chamber C, a plurality of small auxiliary nozzles 40 are tangentially mounted as shown in Fig. 3 and communicate at their small or entrance ends with the combustion chamber C through ports 41. As combustion gases are produced in the chamber C, a portion of the gases is discharged through the auxiliary nozzles 40 in substantially tangential directions, and the combustion chamber is thereby rapidly rotated as indicated by the arrows *a* in Figs. 1 and 3.

The conical end wall 44 at the discharge end of the combustion chamber C may be enclosed by a jacket 45 (Fig. 1) to which a cooling liquid, as water, is supplied through a feed nozzle 46. This liquid, after passing through the jacket space, is discharged into the combustion chamber through ports or openings 47 adjacent the nozzles 40.

A portion of this cooling liquid will be thrown outward by centrifugal force against the conical end wall 44 with a cooling effect on the end wall and also on the main discharge nozzle N.

In Figs. 4, 5 and 6, a modified construction is shown in which the auxiliary nozzles 50 project outward through the jacket space 51 enclosed by the jacket 52. The water, after cooling the nozzles 50, passes into the combustion chamber through port openings 54 (Fig. 5) in the combustion chamber wall 55. Cooling liquid is supplied to the jacket space 51 through a feed nozzle 56 (Fig. 4).

As the port openings 54 are to the left of the nozzles 50, as viewed in Fig. 4, a somewhat larger proportion of steam or vaporized cooling liquid will enter the auxiliary nozzles than with the construction shown in Fig. 1.

In the modified construction shown in Figs. 7, 8 and 9, tangentially disposed port openings 60

(Fig. 9) are provided in the cylindrical wall 61 of the combustion chamber C' (Fig. 7), and these port openings 60 communicate with volute passages 62 enclosed by volute casings 63 and communicating with discharge nozzles 64, all preferably provided in balanced pairs.

As the combustion gases escaping through the port openings 60 travel along the volute passages 62 and are discharged through the nozzles 64, they produce rotation of the combustion chamber as indicated by the arrow *b* in Fig. 8.

The conical discharge end of the combustion chamber C' (Fig. 7) is preferably provided with a jacket 66, feed nozzle 67 and spray openings 68, all as previously described in connection with the structure shown in Fig. 1.

Instead of the substantially semi-circular cross section of the volute passages 62 shown in Fig. 7, these passages may desirably have the rectangular cross section indicated at 70 in Fig. 10, the construction being otherwise as in Figs. 7 to 9.

In Fig. 11, the construction is similar to that shown in Fig. 7, except that the jacket casing 80 is extended to enclose the volute casing 81, and the discharge ports 82 for the cooling liquid are at the left of the volute casing 81, so that more of the vaporized cooling liquid will be drawn into the volute passages. The liquid is supplied through a nozzle 84 and the combustion gases are discharged through nozzles 85. The construction has similar advantages in this respect with the construction shown in Fig. 4.

Having described several forms of the invention, 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 rotatable combustion chamber comprising a rotatably mounted body, a discharge nozzle at the rear end thereof, a plurality of auxiliary nozzles mounted about the periphery of said body near the rear end of said chamber and discharging a portion of the combustion gases substantially tangentially to effect rotation of said chamber and nozzle, a jacket for the rear end of said combustion chamber, and means to supply a cooling liquid thereto, and said combustion chamber having port openings in the rear end portion thereof connecting the jacket space to the combustion chamber and discharging said cooling liquid into said chamber adjacent the intake of said auxiliary nozzles, whereby the rear portion of said chamber is cooled and vapor is provided for cooling said auxiliary nozzles.

2. The combination in a rotatable combustion chamber as set forth in claim 1, in which the port openings discharge angularly into said chamber in the direction of rotation of said chamber, whereby the rate of rotation of the injected cooling liquid is increased.

3. The combination in a rotatable combustion chamber as set forth in claim 1, in which the port openings discharge angularly into said chamber in the direction of rotation of said chamber, whereby the rate of rotation of the injected cooling liquid is increased, and in which the jacket also encloses and cools the intake portions of said auxiliary nozzles.

4. A rotatable combustion chamber comprising a rotatably mounted body, a volute encircling the rear portion of said combustion chamber, said chamber having port openings into said volute and said volute terminating in a tangentially disposed auxiliary nozzle operative to rotate said chamber, and a cooling jacket adjacent said volute having port openings into said combustion chamber adjacent said first-named port openings, whereby cooling liquid from said jacket provides vapor to cool said volute.

5. The combination in a rotatable combustion chamber as set forth in claim 4, in which the cooling jacket encloses the volute and in which the port openings from said jacket to the combustion chamber are forward of the port openings from the combustion chamber to said volute.

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

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