July 25, 1950 R. H. GODDARD 2,516,462

DOUBLE JACKET MEANS FOR FEEDING TWO LIQUIDS TO A ROTATING COMBUSTION CHAMBER

Filed Oct. 17, 1946 2 Sheets-Sheet 1

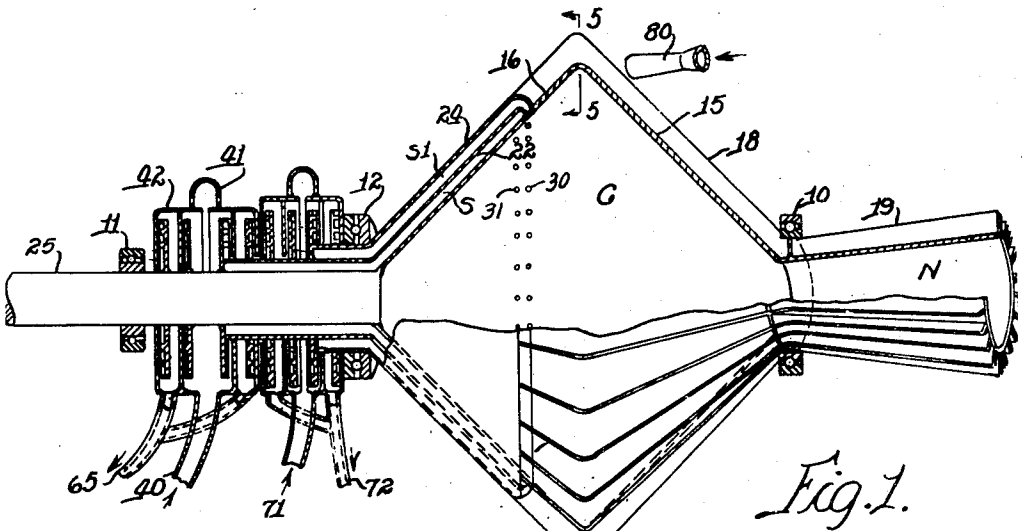

Fig. 1.

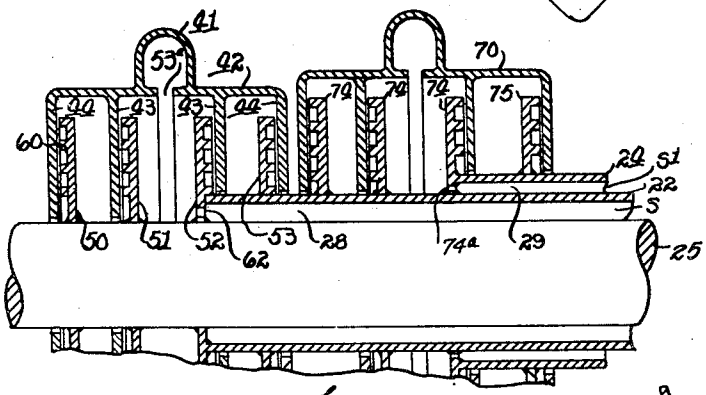

Fig. 2.

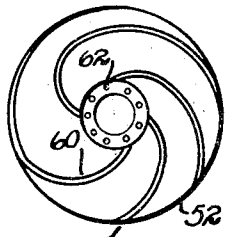

Fig. 3.

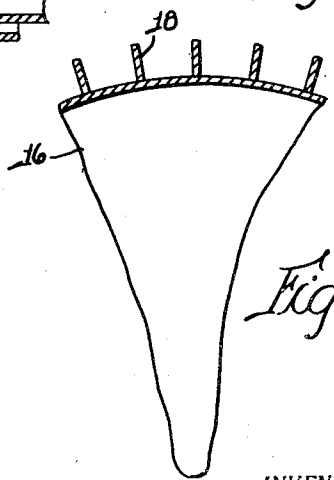

Fig. 5.

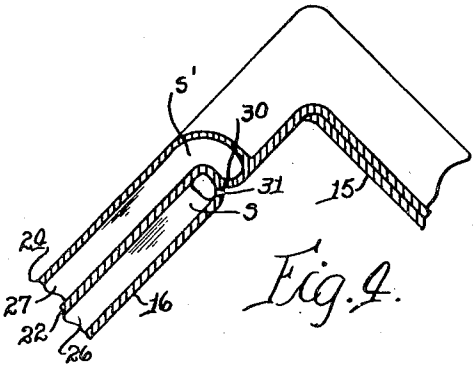

Fig. 4.

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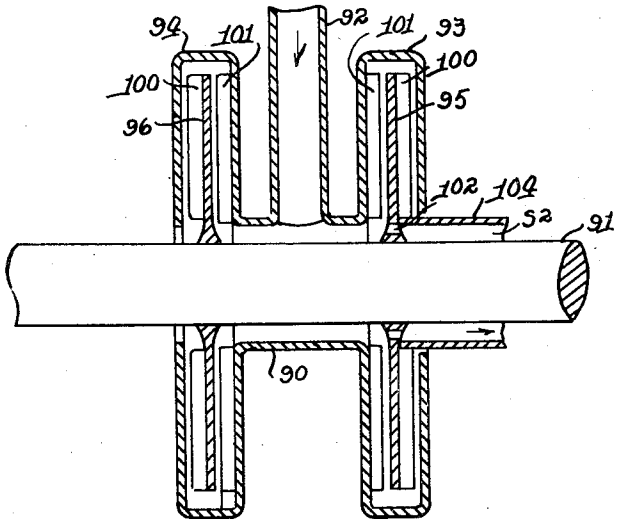

Fig. 6.

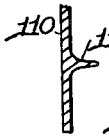

Fig. 9.

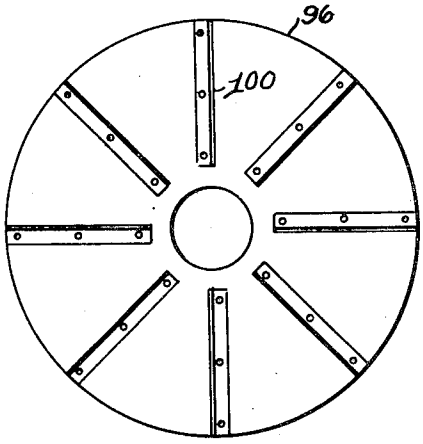

Fig. 7.

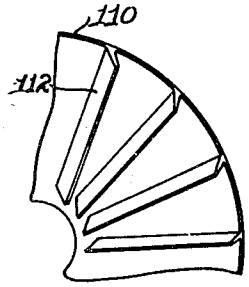

Fig. 8.

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2,516,462

DOUBLE JACKET MEANS FOR FEEDING TWO LIQUIDS TO A ROTATING COMBUSTION CHAMBER

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Application October 17, 1946, Serial No. 703,881

3 Claims. (Cl. 60—35.6)

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This invention relates to combustion chambers having open discharge nozzles and adapted for use in rockets and rocket craft. The invention relates more particularly to combustion chambers mounted to rotate about a longitudinal axis during the operation of the chamber.

It is the general object of the invention to improve and simplify the construction shown in the prior Goddard application, which is now Patent No. 2,479,829 issued August 23, 1949.

Another feature of the invention relates to the provision of improved sealing means for the combustion liquid connections.

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 drawings, in which

Fig. 1 is a front elevation, partly in section, of the improved combustion chamber;

Fig. 2 is an enlarged partial sectional front elevation of the improved sealing means;

Fig. 3 is a detail perspective view of a portion of a sealing disc;

Fig. 4 is an enlarged fragmentary sectional view of certain parts shown in Fig. 1;

Fig. 5 is a partial sectional end view, taken along the line 5—5 in Fig. 1;

Fig. 6 is a sectional front elevation of a modified sealing construction;

Fig. 7 is a side elevation of a sealing disc;

Fig. 8 is a partial perspective view of a modified disc construction; and

Fig. 9 is a transverse section of a portion of the sealing disc shown in Fig. 8.

Referring to Fig. 1, a rotatable combustion chamber C and nozzle N are shown mounted in bearings 10 and 11 and provided with a thrust bearing 12. The chamber C is in the form of reversed cones 15 and 16, abutting at their largest diameters and provided with axially extending cooling vanes 18 (Fig. 5) on their outer surfaces. Corresponding vanes 19 are provided for the nozzle N.

The conical portion 16 of the rotating chamber C is provided with inner and outer jacket casings 22 and 24 which define inner and outer jacket spaces S and S'. The jacket casings 22 and 24 are extended along the shaft 25 which supports that end of the chamber C which is opposite to the nozzle N. Longitudinally extending vanes 26 and 27 corresponding to the vanes 18 are provided in the jacket spaces S and S' and associated partitions 28 and 29 are provided in the jacket space portions alongside the shaft 25.

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At their upper ends, the jacket casings 22 and 24 are joined to the chamber wall 16 as shown in Fig. 4, and spray openings 30 and 31 are provided. The inner jacket space S preferably supplies fuel through the openings 31 in sprays substantially parallel to the axis of the chamber, and the outer jacketed space S' supplies an oxidizing liquid through the openings 30 in sprays directed radially inward. Thorough and effective mixing of the two combustion liquids is thus accomplished.

It will be noted in Figs. 1 and 4 that the chamber wall portion 15 is preferably substantially thicker than the wall portion 16, as the portion 15 is not reenforced by the pressure of the combustion liquids in the jacket spaces S and S'.

Special provision is made for supplying the combustion liquids to the jacket spaces S and S' and for preventing leakage from the rotating parts.

The liquid fuel is fed under pressure through a pipe 40 (Fig. 1) to an annular passage or volute 41 surrounding a stationary sealing housing 42 which is provided with inwardly extending fixed inner and outer annular discs or partitions 43 and 44 (Fig. 2). Sealing discs 50, 51, 52 and 53 are mounted within the housing 42 and rotate with the shaft 25. The discs 50, 51 and 52 are mounted on the shaft 25 and the disc 53 is mounted on the inner jacket casing 22.

Each of the rotating discs is provided with outwardly spiralling ribs 60 best shown in Fig. 3, and these ribs rotate with relatively close clearances adjacent the stationary partitions 43 and 44. The disc 52 (Fig. 2) is provided with a series of ports or openings 62 through which liquid entering the housing 42 from the volute 41 through an annular slot 53*a* can flow axially into the inner jacket space S.

The outwardly spiralling ribs 60 on the rotating discs 51 and 52 largely prevent leakage from the feeding area between the inner fixed partitions 43. The outer discs 50 and 53 provide supplementary sealing for any liquid which may pass the discs 51 and 52 and such liquid is drained off through a discharge pipe 65 (Fig. 1).

A similar housing 70 is provided for the oxidizing liquid and receives said liquid through a feed pipe 71 (Fig. 1). Leakage is discharged through a pipe 72. Three rotating ribbed discs 74 in the housing 70 are mounted on the inner jacket casing 22 and one disc 75 on the outer housing 70. The outer disc 74 has openings 74*a* (Fig. 2) into

the outer jacket space S'. The construction and operation is as previously described.

With this construction, combustion liquids may be delivered under pressure but without wasteful leakage through the jacket spaces S and S' and the use of stuffing boxes or other mechanical packing is avoided.

Angularly disposed compressed air nozzles 88 (Fig. 1) may coact with the external vanes 18 to start rotation of the combustion chamber, and rotation may be maintained by suitable means, which, however, forms no part of the present invention.

The partitions 28 and 29 (Fig. 2) strengthen and support the cylindrical portions of the jacket casings 22 and 24 and define passages along which the combustion liquids flow to the conical jacket spaces S and S'.

A modified sealing construction is shown in Fig. 6, in which a fixed housing 90 surrounds the shaft 91 which supports a rotating combustion chamber, not shown. A feed pipe 92 delivers liquid under pressure to the housing 90, which housing is provided with enlarged sealing portions 93 and 94 at each side thereof.

A disc 95 is mounted on the shaft 91 and rotates in the housing portion 93, and a similar disc 96 rotates in the housing portion 94. Each disc 95 and 96 is provided with radial vanes 100 on its outer face, which vanes rotate with limited clearance relative to the periphery and to the outside end wall of each housing 93 and 94. The inner side walls of the housings are provided with fixed radial vanes 101 which extend adjacent the inside faces of the rotating discs 95 and 96. The disc 95 has a plurality of ports or openings 102 adjacent the shaft 91, so that liquid from the housing 90 may flow through the disc 95 to the jacket space S2 between the shaft 91 and an inner jacket casing 104. Fig. 7 shows a side elevation of the rotating disc 96 with its radially extending vanes 100.

In Fig. 8, a similar disc 110 is shown, provided with vanes 112. The vanes 112 are tapered to provide relatively narrow points adjacent the fixed housing. The viscous drag of the liquid at high speed rotation is thereby reduced. The vanes 112 are preferably provided with fillets at their bases as shown in Fig. 9 for increased strength.

It will be understood that the feeding and sealing structure shown in Fig. 6 may be duplicated to feed a second liquid to an outer jacket space, as in Fig. 1.

Having been thus described, 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 rotating combustion chamber having two opposed conical portions both coaxial with the axis of rotation of said chamber and abutting at their sections of greatest diameter, an axial discharge nozzle for one conical portion, a coaxial double jacket substantially enclosing the other conical portion and having inner and outer jacket spaces, means to feed separate combustion liquids to said inner and outer jacket spaces, and associated spray openings from said jacket spaces to said combustion chamber.

2. A rotating combustion chamber having opposed conical portions, a discharge nozzle for one conical portion, a double jacket for the other conical portion having inner and outer jacket spaces, means to feed separate combustion liquids to said inner and outer jacket spaces, and associated spray openings from said jacket spaces to said combustion chamber, said openings being substantially at the points of greatest radius of said jacket spaces.

3. A rotating combustion chamber having opposed conical portions, a discharge nozzle for one conical portion, a double jacket for the other conical portion having inner and outer jacket spaces, means to feed separate combustion liquids to said inner and outer jacket spaces, and associated spray openings from said jacket spaces to said combustion chamber, said openings being substantially at the points of greatest radius of said jacket spaces but being substantially spaced inward from the point of greatest radius of the combustion chamber.

ESTHER C. GODDARD,

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

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,127,865	Goddard	Aug. 23, 1938
2,407,852	Smith	Sept. 17, 1946

FOREIGN PATENTS

Number	Country	Date
3,744	Austria	Mar. 26, 1901