Aug. 7, 1951 R. H. GODDARD 2,563,029

JACKETED REACTION NOZZLE WITH HOLLOW SPIRAL VANES FOR ROCKET MOTORS

Original Filed Nov. 1, 1947

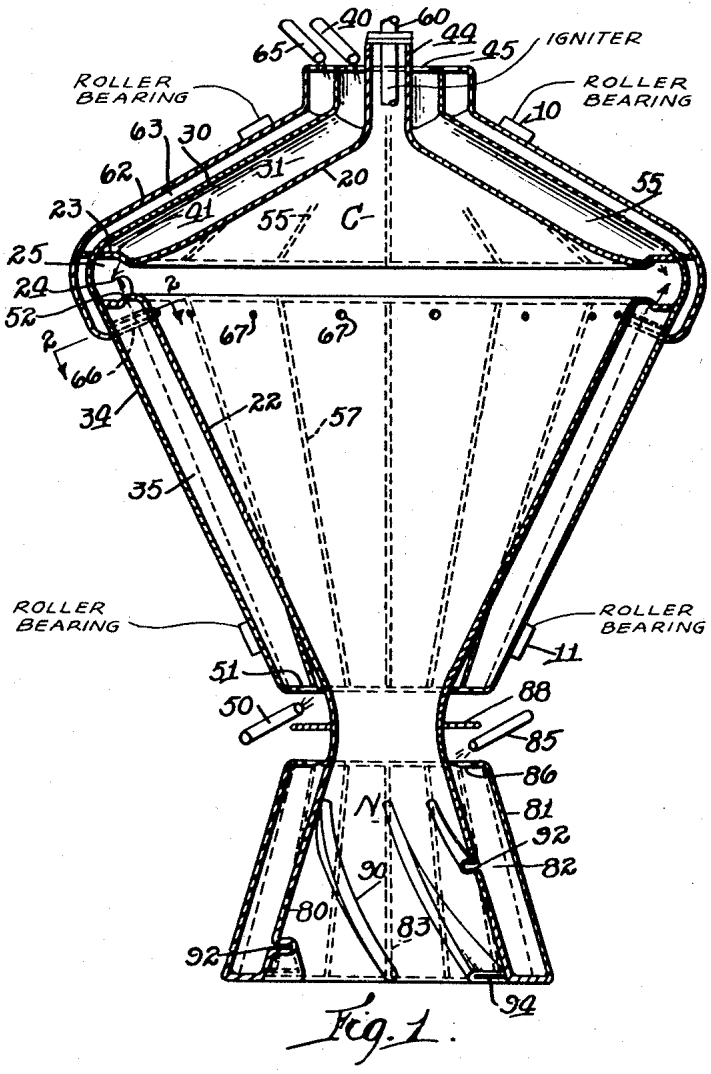

Fig. 1.

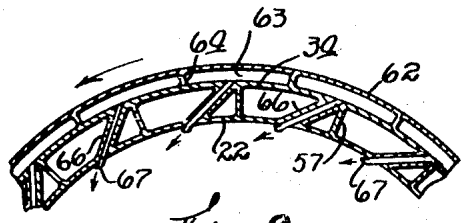

Fig. 2.

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JACKETED REACTION NOZZLE WITH HOLLOW SPIRAL VANES FOR ROCKET MOTORS

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Original application November 1, 1947, Serial No. 783,593, now Patent No. 2,523,011, dated September 19, 1950. Divided and this application December 10, 1949, Serial No. 132,356

3 Claims. (Cl. 60—35.6)

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This invention relates to combustion apparatus of the general type in which a rotating combustion chamber is provided with a rearwardly open discharge nozzle, and is a division of original application Serial No. 783,593 filed November 1, 1947, and issued as Patent No. 2,523,011 on September 19, 1950.

It is the general object of the present invention to provide a rotating combustion chamber having improved means for centrifugally feeding combustion liquids to said chamber and for cooling the walls of said chamber.

Provision is also made for centrifugally supplying a tangential film of a cooling liquid within the combustion chamber and for jacketing and cooling the discharge nozzle. A novel construction of hollow liquid-cooled spiral vanes is also provided in the nozzle for rotating 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.

A preferred form of the invention is shown in the drawing, in which

Fig. 1 is a sectional elevation of a combustion chamber showing the invention; and

Fig. 2 is an enlarged fragmentary sectional view, taken along the line 2—2 in Fig. 1.

Referring to the drawing, a combustion chamber C is shown, which is supported for rotation in roller bearings indicated at 10 and 11.

The combustion chamber C comprises a conical upper inner wall portion 20 and a reversed conical lower inner wall portion 22. The adjacent edge portions 23 and 24 of the wall portions 20 and 22 are spaced apart to provide an annular recess 25 within which mixing of the combustion liquids may take place.

An outer wall portion 30 encloses a conical recess 31 outside of the wall portion 20, and a conical outer wall portion 34 encloses a conical recess 35 outside of the wall portion 22.

A combustion liquid, as liquid oxygen, may be fed through a pipe or nozzle 40 to the upper end of the recess 31, and the lower edge portion 23 of the inner wall portion 20 is provided with openings 41 through which the liquid oxygen may be sprayed into the mixing recess 25. The upper inner wall portion 20 has a tubular upward extension 44 surrounded by an annular opening 45 through which the liquid oxygen is supplied.

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A second combustion liquid, as gasoline, is supplied from a pipe or nozzle 50 through an annular opening 51 at the lower end of the annular recess 35, and this liquid fuel is sprayed into the mixing recess 25 through openings 52.

Radiating vanes 55 are provided in the upper recess 31, by which vanes the liquid oxygen is given a whirling motion and is caused to flow toward the spray openings 41 by centrifugal force. The construction and operation of the vanes 55 correspond to the construction and operation of the vanes or partitions 57 which are provided in the annular recess 35, and by which vanes the gasoline is caused to flow by centrifugal force toward the spray openings 52. Similar vanes are shown in detail in Fig. 3 of Goddard Patent No. 2,395,403, issued February 26, 1946.

The two combustion liquids are effectively mixed in the annular recess 25 and may be ignited in the combustion chamber C by any suitable igniting device 60.

An outer jacket 62 encloses a recess 63 outside of the upper outer wall 30, and this recess is provided with radiating partitions 64 (Fig. 2) by which water delivered through a pipe or nozzle 65 is caused to flow to a plurality of tubes 66 which extend tangentially through the upper end of the recess 35 and supply water in tangential streams to spray openings 67 in the lower inner wall portion 22.

The tangential direction of these streams, together with the rapid rotation of the chamber, causes the water to form a cooling film on the inner wall of the combustion chamber and to thus protect the wall from the very high temperature of the combustion gases.

It is desirable that the tubes 66 pass through the recess 35 containing gasoline, rather than through the recess 31 containing liquid oxygen, as otherwise the water would freeze and plug the tubes before it reached the combustion chamber.

The conical wall 80 of the nozzle N is preferably displaced inward as indicated in Fig. 1 to form hollow spiral vanes 90, which vanes react with the combustion gases to rotate the combustion chamber as the gases are discharged through the nozzle. These hollow vanes 90 communicate through lengthwise-extending slots 92 with the annular

recess 82 within the jacket casing 81 and containing cooling liquid, and the hollow vanes 90 are open at their lower ends as indicated at 94 for discharge of the cooling liquid or vapor. The vanes 90 are thus effectively cooled, and the cooling liquid is conveniently discharged into the gas stream. The cooling liquid for the jacket recess 82 may be supplied through an annular opening in the upper end of the jacket casing 81 from a pipe or nozzle 85.

Very effective provision is thus made for feeding combustion liquids to the chamber C under centrifugal force and for feeding a cooling liquid as water to the jacket spaces 63 and 82. Effective provision is also made for thoroughly mixing the sprays of combustion liquids and for supplying the mixed liquids and vapors to the combustion chamber C.

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 a rotated combustion chamber having a conical rearwardly-open discharge nozzle, in combination, an outer casing providing an annular conical jacket space about said nozzle, radiating vanes in said jacket space, means to supply cooling water to said jacket space at the smaller end thereof, and hollow spiral vanes in said nozzle having longitudinal openings to said jacket space and having discharge openings in the rear ends of said hollow spiral vanes adjacent the blast of discharge gases.

2. The combination in a rotated combustion chamber as set forth in claim 1, in which the spiral vanes comprise folded and inwardly displaced portions of said nozzle wall and in which said folded portions are slightly spaced to provide slots extending lengthwise of said vanes and communicating with said jacket space.

3. In a rotated combustion chamber having a conical rearwardly-open discharge nozzle, in combination, an outer casing providing an annular conical jacket space about said nozzle, means to supply cooling water to said jacket space at the smaller end thereof, and hollow spiral vanes in said nozzle having longitudinal openings to said jacket space and having discharge openings in the rear ends of said vanes adjacent the blast of discharge gases, and said combustion chamber being rotated by the reaction of the discharging combustion gases on said spiral nozzle vanes.

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

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

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Number	Name	Date
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