Nov. 27, 1951 R. H. GODDARD 2,576,678

FEEDING AND MIXING MEANS FOR ROTATING COMBUSTION CHAMBERS

Filed March 22, 1947

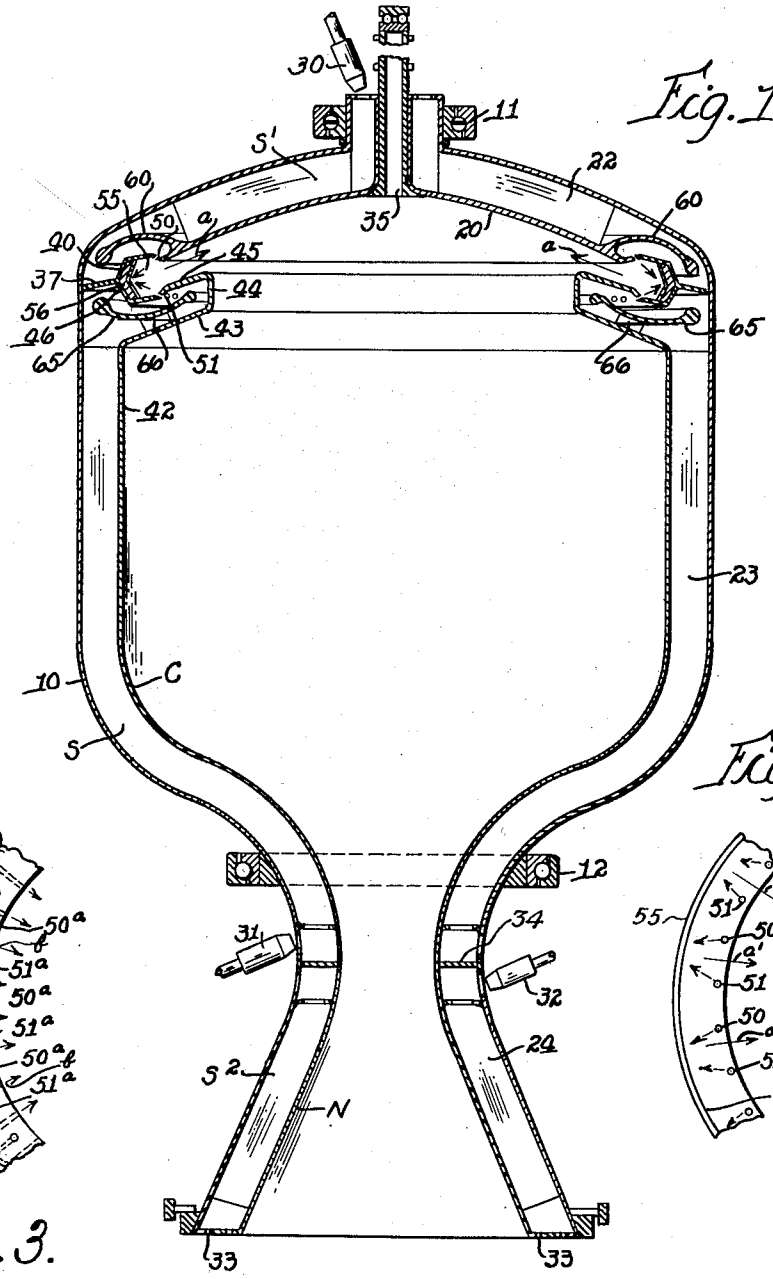

Fig. 1.

Fig. 2.

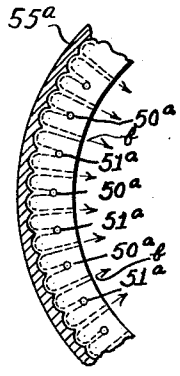

Fig. 3.

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Patented Nov. 27, 1951 2,576,678

UNITED STATES PATENT OFFICE

2,576,678

FEEDING AND MIXING MEANS FOR ROTATING COMBUSTION CHAMBERS

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Application March 22, 1947, Serial No. 736,442

2 Claims. (Cl. 60—39.46)

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This invention relates to combustion chambers as used in propulsion apparatus.

It is the general object of the invention to provide improved means for feeding and mixing liquid combustion elements for such a combustion chamber and for cooling the feeding and mixing structure.

A further object is to provide feeding means which will effect intimate mixing of the combustion elements and which will provide clear radial inward paths for the mixed elements.

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 a diagrammatic view showing the paths of flow of the combustion elements and of the resulting mixture; and

Fig. 3 is a view similar to Fig. 2 but showing a modified construction.

Referring to Fig. 1, a combustion chamber C is enclosed in a jacket or casing 10 and is rotatably mounted in bearings 11 and 12. The chamber C has a closed inner end portion 20 and a discharge nozzle N, both of which are also enclosed. A jacket space S is thus provided around the chamber C, a space S' over the end portion 20, and a space S2 around the nozzle N.

Spaced partitions 22, 23 and 24 extend lengthwise of the jacket spaces and hold the jacket casing in spaced relation to the combustion chamber and chamber end portion and to the discharge nozzle.

A feed pipe 30 supplies liquid oxygen to the jacket space S', a feed pipe 31 similarly supplies gasoline to the jacket space S, and a pipe 32 may supply a cooling liquid, such as water, to the space S2, which liquid thereafter escapes through end openings 33. An annular partition 34 separates the jacket spaces S and S2.

Any suitable ignition device 35 may be provided and this may be of the general type shown in Fig. 1 of the prior Goddard Patent No. 2,090,039, issued August 17, 1937.

The present invention relates particularly to improved devices and structure for feeding the combustion elements, as gasoline and liquid oxygen, to the closed or inner end of the combustion chamber C and for effectively mixing these combustion elements.

The jacket spaces S and S' are separated by an annular partition 37 to which the flanged and down-turned outer edge portion 40 of the inner end 20 of the combustion chamber is firmly secured. The cylindrical wall 42 of the chamber C has a frustro-conical upper portion 43, a smaller cylindrical portion 44, and an outwardly projecting flange 45 having an upturned edge portion 46 which is also secured to the annular partition 37.

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Spray openings 50 and 51 are provided in the peripheral flanges 40 and 45, and oxygen and gasoline are sprayed through these openings to intersect adjacent the refractory facing 55 of an annular lining member 56, desirably of copper.

The resulting gaseous combustible mixture is projected inward from the refractory surface 56 and in relatively close contact with the chamber end portion 20, as indicated by the arrows *a*. A very intimate and effective mixture of the combustion elements is thus produced and these mixed elements are delivered adjacent the axis of the combustion chamber and adjacent the ignition device 35.

In order to effectively cool all parts of the feeding structure, a baffle plate 60 is secured to the chamber end portion 20 and projects upward and outward. The liquid oxygen entering through the pipe 30 must thus flow around the outer end of the baffle plate 60 and cool the entire upper surface of the flanged end portion 40 before reaching the spray openings 50.

A baffle plate 65 is similarly mounted above the inwardly projecting conical surface 43 of the combustion chamber C and is supported by spaced lugs 66 on said conical portion. Both edge portions of this baffle plate 65 are spaced from all adjacent surfaces, so that the gasoline introduced through the pipe 31 and space S is divided by the baffle plate 65 and cools the portions 43 and 44 of the combustion chamber, as well as all parts of the peripheral flange 45 and its upturned edge portion 46 as the gasoline approaches the spray openings 51 from both directions.

Effective provision is thus made for cooling all metal surfaces exposed to the high temperature of the combustion chamber gases.

In Fig. 2 it is indicated diagrammatically that the sprays from the upper openings 50 and the sprays from the lower openings 51 are angularly directed to converge against the refractory facing 55 at points circumferentially midway between each pair of associated openings 50 and 51, thus providing for effective mixing of the combustion elements, and additionally providing free paths for the mixture as it moves inward along the direction of the arrows *a'*.

In Fig. 3, a modified construction is shown diagrammatically in which the structure **55***a* supporting a corrugated refractory facing is also vertically grooved or corrugated, so that the sprays from the upper and lower spray openings **50***a* and **51***a* are each divided by the ridges between corrugations. Portions of the different sprays then intermingle and thereafter travel toward the chamber axis along paths indicated by the arrows *b*. These paths do not cross or interfere with the sprays injected through the feed openings **50***a* and **51***a*.

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 combustion apparatus, a combustion chamber having a closed inner end portion, an outer casing enclosing jacket spaces for said chamber and for said inner end portion, means to separate said jacket spaces, means to feed different liquid combustion elements to said separated jacket spaces, adjacent upper and lower annular flanged portions of said chamber and of said inner end portion having openings through which streams of combustion elements are injected, and annular baffle plates in said jacket spaces effective to direct said combustion liquids to cool all surfaces associated with said feeding and spraying means and which are exposed to high combustion temperatures, and the baffle plate in the chamber jacket space being mounted on spaced supports and having its inner edge portion adjacent but spaced from the combustion chamber wall and having its outer edge portion adjacent but spaced from the chamber jacket casing and from the separating partition.

2. In combustion apparatus, a combustion chamber having a closed inner end portion, an outer casing enclosing jacket spaces for said chamber and for said inner end portion, means to separate said jacket spaces, means to feed different liquid combustion elements to said separated jacket spaces, adjacent upper and lower annular flanged portions of said chamber and of said inner end portion having openings through which streams of combustion elements are injected, and annular baffle plates in said jacket spaces effective to direct said combustion liquids to cool all surfaces associated with said feeding and spraying means and which are exposed to high combustion temperatures, and an outer deflecting surface being provided having corrugations extending axially of said combustion chamber and having the alternate ridges of the corrugated deflecting surface engaged by streams of alternated combustion liquids, and having intervening ridges which redirect associated combustion elements radially inward in said chamber and along paths which do not interfere with the outwardly moving streams of injected liquids.

ESTHER C. GODDARD.

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

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