May 1, 1951 R. H. GODDARD 2,551,112

PREMIXING COMBUSTION CHAMBER

Filed Sept. 5, 1946

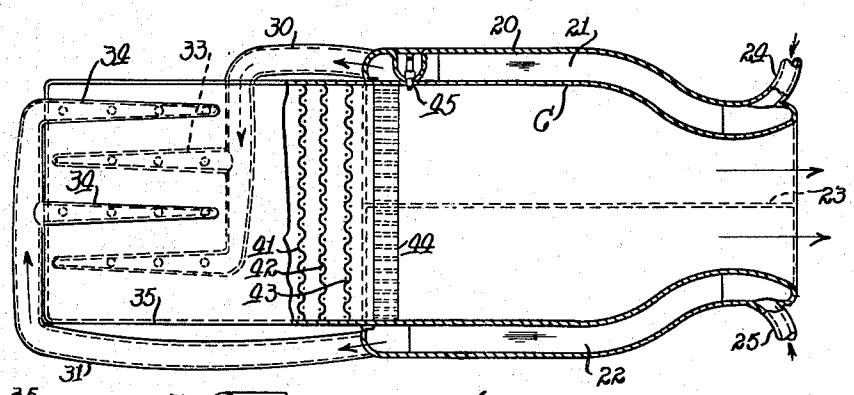


Fig. 1.

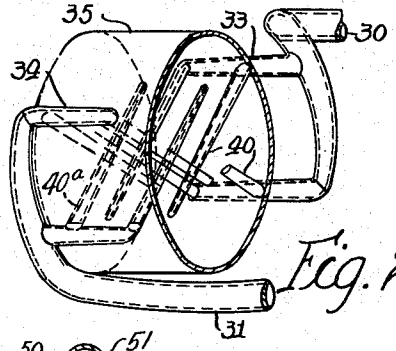


Fig. 2.

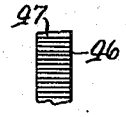


Fig. 4.

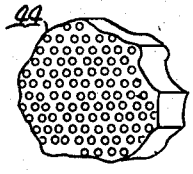


Fig. 3.

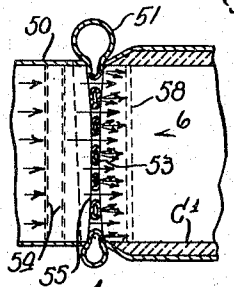


Fig. 5.

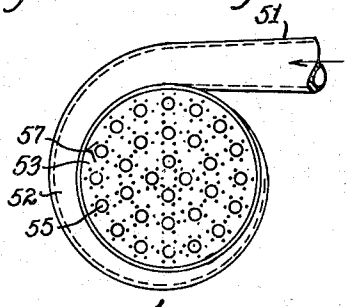


Fig. 6.

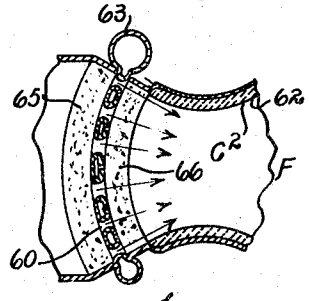


Fig. 7.

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UNITED STATES PATENT OFFICE

2,551,112

PREMIXING COMBUSTION CHAMBER

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Application September 5, 1946, Serial No. 694,921

2 Claims. (Cl. 60—44)

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This invention relates to chambers having separate premixing and combustion portions and adapted for use in rockets or other propulsion apparatus and in which gaseous or vaporized combustion elements are effectively premixed before admission to that part of the combustion chamber in which combustion takes place.

It is the general object of the invention to provide improved means for premixing the fuel and the oxidizing agent and for preventing flash-back to the inner chamber portion where premixing takes place.

A further object is to provide improved feeding devices for use in such a premixing chamber portion.

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, of a chamber embodying the invention;

Fig. 2 is a perspective view of certain parts shown in Fig. 1;

Fig. 3 is a fragmentary perspective view of a portion of a porous partition;

Fig. 4 is a partial edge view of another type of partition;

Fig. 5 is a sectional side elevation of portions of a chamber showing a modified premixing construction;

Fig. 6 is an end view of the volute and hollow perforated partition shown in Fig. 5, and looking in the direction of the arrow 6 in Fig. 5; and

Fig. 7 is a view similar to Fig. 5 but showing a curved hollow perforated partition.

Referring to Figs. 1, 2 and 3, a chamber C is enclosed by a jacket casing 20 providing jacket spaces 21 and 22 separated by longitudinal partitions 23. The jacket space 21 receives one combustion liquid under pressure through a feed pipe 24, and the other jacket space 22 receives a second combustion liquid under pressure through a feed pipe 25.

The combustion liquids are vaporized in the jacket spaces 21 and 22 and are delivered through tapered feed pipes 30 and 31 to longitudinally disposed tapered distributing pipes 33 and 34 which extend alongside the inner or premixing portion 35 of the chamber C. The pipes 33 extend rearward and the pipes 34 extend forward and the taper of these pipes gradually reduces the cross section in the direction of flow, thus providing uniform distribution.

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The pipes 33 and 34 are each provided with a plurality of tapered spray pipes 40 or 40*a*, alternately arranged as shown in Fig. 2. The spray pipes 40 and 40*a* are positioned in two axial planes perpendicular to each other, and the pipes 40 and 40*a* are alternately arranged in each plane.

Each pipe 40 or 40*a* has slots or spray openings throughout its length and these slots or openings in adjacent spray pipes are opposite to each other and are all equally spaced apart. Very complete premixing and intermingling of the vaporized combustion elements is thus effected in the inner chamber portion 35.

Substantial pressure is maintained in the inner chamber portion 35, so that the intermingled gases are forced through successive wire screens 41, 42 and 43 and then through a relatively thick perforated partition 44 into the combustion portion of the chamber C where they are ignited by a sparkplug 45 or in any other convenient manner.

The partition 44 may be made as indicated in Fig. 3 and may comprise a relatively thick disc of metal having a multiplicity of fine holes or perforations extending through the metal. Such a disc might be made by introducing fine filaments into a cast metal disc and thereafter dissolving out the filaments. Turbulence and eddies occasioned by the passing of the gases or vapors through the screens and partition increase the effectiveness of the premixing.

In Fig. 4, a modified disc construction is shown in which the disc 46 is formed of thin metal strips 47 rolled up to form a relatively close spiral.

If the pressure in the inner of premixing chamber portion 35 is maintained substantially above the pressure in the outer or combustion portion, the premixed and intermingled gases will move quite rapidly through the screens 41, 42 and 43 and through the disc or partition 44. Flash-back from the outer chamber portion to the inner chamber portion will be practically avoided by this rapid movement. Should a flash through the partition 44 occur, it will be restricted by the wire screens 43, 42 and 41 successively, so that it will be substantially impossible for fire to be communicated to the premixing portion of the chamber.

In Figs. 5 and 6, a modified construction is shown in which gaseous fuel is fed to an inner chamber portion 50 in any convenient manner, and an oxididing liquid or vapor is fed through a pipe 51 (Fig. 6) to a volute 52 from which it is delivered to a hollow partition 53.

This partition **53** is provided with relatively large passages **55** through which the gaseous fuel, after passing through screens **54**, enters the chamber portion C' in which combustion takes place. The hollow partition **53** also has a large number of fine spray openings **57** in that wall of the partition which is adjacent to the combustion portion C'. Screens or perforated partitions **58** are preferably interposed between the hollow partition **53** and the chamber portion C'.

Consequently, sprays of oxidizing liquid or vapor are delivered into the chamber portion C' and are intimately intermingled with the streams of vaporized fuel entering through the openings **55**. Very effective mixing and intermingling of the combustion elements is thus effectively accomplished prior to combustion of the mixture in the chamber portion C'.

In Fig. 7 a quite similar construction is shown, except that the hollow partition **60** is formed with a concave surface toward the combustion portion C2, so that the intermingled combustion elements are directed to a focus F at the axis of the chamber portion C2 and relatively remote from the wall of the chamber which is shown as provided with a thin refractory lining **62**. A volute **63** is provided, as in the construction shown in Figs. 5 and 6. In place of the wire screens **54** and **58** shown in Fig. 5, layers of porous or sintered metal **65** and **66** may be substituted. These may be formed from fine copper filings or finely precipitated copper.

The modified constructions shown in Figs. 5, 6 and 7 are not specifically claimed herein but form the subject matter of a divisional application, Serial No. 137,112, filed January 6, 1950.

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 that what is claimed is:

1. In a chamber for combustion apparatus comprising an enclosing casing, partition means in said casing separating said chamber into an inner premixing portion and an outer combustion portion but permitting passage of premixed combustion elements therethrough, means to feed liquid combustion elements to said premixing portion, and means to ignite said mixed combustion elements in said outer combustion portion, that improvement which comprises feeding means for one combustion element having a plurality of spaced perforated feeding tubes extending transversely across said inner premixing portion in one direction and in a plane substantially parallel to the chamber axis, and feeding means for the other combustion element having a plurality of spaced perforated feeding tubes extending transversely across said inner premixing portion in the same plane but in the opposite direction and alternating with said first-mentioned feeding tubes.

2. The combination in a chamber for combustion apparatus as set forth in claim 1, in which the feeding means includes an additional set of perforated feeding tubes for each combustion element, and in which all of said additional feeding tubes are positioned in a second plane which is at a substantial angle with the plane of said first set of feeding tubes.

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

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