Sept. 20, 1949. R. H. GODDARD 2,482,262

STEAM PRODUCTION IN JACKETED COMBUSTION CHAMBERS

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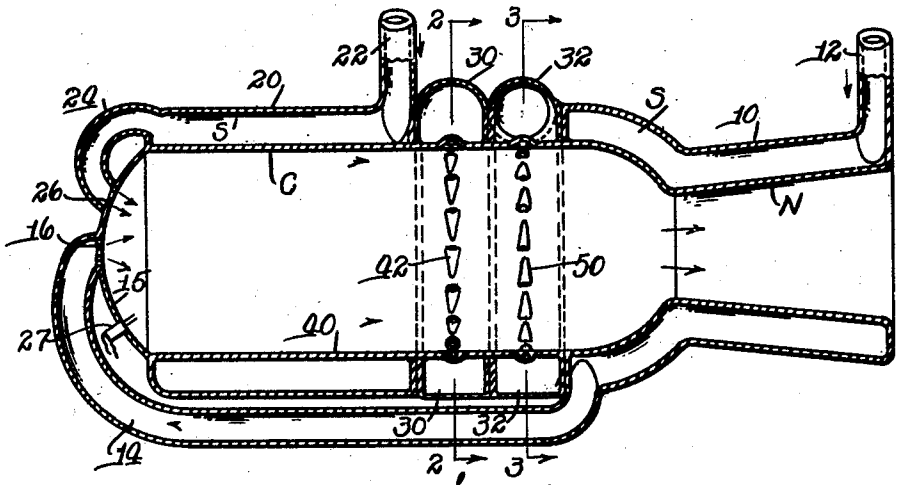

Fig. 1.

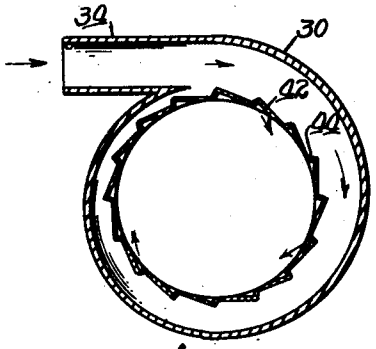

Fig. 2.

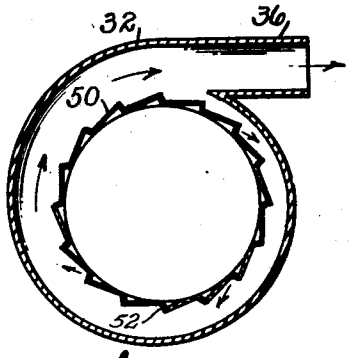

Fig. 3.

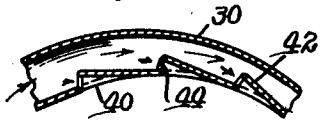

Fig. 4.

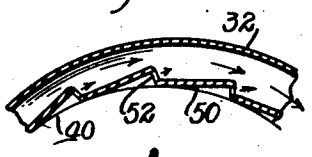

Fig. 5.

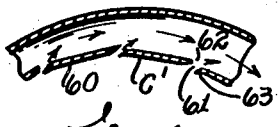

Fig. 6.

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STEAM PRODUCTION IN JACKETED COMBUSTION CHAMBERS

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6 Claims. (Cl. 60—35.6)

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This invention relates to combustion chambers as more commonly used in propulsion apparatus, and relates more particularly to combustion chambers which are jacketed to separately receive two combustion liquids.

It is frequently desirable to produce a relatively small amount of steam from such a combustion chamber, which steam may be used to drive one or more feed pump turbines or for other useful purposes.

It is the general object of this invention to provide improved means for direct production of steam in a combusion chamber and without substantial interference with the normal operation of the chamber.

A further object is to provide steam-producing means which may be interposed between axially adjacent jackets on a cylindrical combustion chamber wall.

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 longitudinal section of a combustion chamber embodying this invention;

Figs. 2 and 3 are transverse sections, taken along the lines 2—2 and 3—3 in Fig. 1;

Figs. 4 and 5 are enlarged sectional details of certain parts shown in Figs. 2 and 3 respectively; and

Fig. 6 is a view similar to Fig. 5 but showing a slightly modified construction.

Referring to Fig. 1, a combustion chamber C is shown as of general cylindrical shape and as being provided with a discharge nozzle N. A casing 10 surrounds the nozzle N and a portion of the chamber C and provides a jacket space S to which gasoline may be supplied through a pipe 12. The left-hand portion of the space S (as viewed in Fig. 1) is connected by a pipe 14 to the end wall 15 of the chamber C, where it is fed through spray openings 16 to the combustion chamber.

A second casing member 20 surrounds the left-hand portion of the combustion chamber C and encloses a jacket space S' which may be supplied with liquid oxygen through a feed pipe 22. The space S' is connected by a pipe 24 to the end wall 15 of the chamber C, through which liquid oxygen is delivered through spray openings 26.

Any usual provision, such as a spark plug 27, may be provided for igniting the mixed combustion elements.

In order to produce a limited amount of steam

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direct from the combustion chamber C, the jacket casings 10 and 20 are spaced far enough apart axially to admit a pair of volutes 30 and 32. These volutes are U-shaped in general cross section, with their inner faces open, and are welded or otherwise firmly secured to the outside of the chamber C, as clearly shown in Fig. 1. Water is supplied to the volute 30 through an intake pipe 34 as indicated in Fig. 2, and steam is discharged from the volute 32 through a discharge pipe 36.

The cylindrical wall 40 of the combustion chamber C has an annular series of outwardly displaced portions 42 having openings 44 (Fig. 4) facing reversely to the direction of flow in the volute 30. The chamber wall 40 also has a second series of outwardly displaced portions 50 having openings 52 facing in the direction of flow in the volute 32. The portions 42 and 50 are covered by the volutes 30 and 32 respectively.

The operation of the improved means for producing steam is as follows:

When the combustion chamber C is in active operation, combustion gases produced in the inner or left-hand end of the chamber C travel rapidly toward the discharge nozzle N, and these gases are at relatively high temperatures. If water is now supplied under pressure to the volute 30, jets of water will be injected tangentially through the openings 44 and will be immediately exposed to the direct heat of the stream of hot combustion gases. The jets of water will thus be immediately changed to a mass of steam which will travel toward the nozzle N with the combustion gases. At the same time, the mass of steam will be in rapid rotation, due to the tangential injection of the water.

When this annular mass of rotating steam reaches the plane of the volute 32, the greater portion of the steam, together with some very small amount of combustion gases, passes through the openings 52 (Fig. 5) into the volute 32, from which it is discharged through the pipe 36. A continuous flow of steam is thus obtained for any desired purpose, while the combustion chamber continues to operate normally and without substantial interference.

The combustion gases are not removed in any quantity from the combustion chamber, except usefully through the nozzle N, and all portions of the side walls of the chamber C and nozzle N are effectively jacketed.

A slight modification is shown in Fig. 6, in which the chamber wall 60 is provided with holes 61 for removal of the steam, with the edges of the holes slightly and oppositely displaced as indi-

cated at 62 and 63, and with the edges 63 projecting slightly into the chamber C' and being thinned down or sharpened to reduce interference with the normal flow of combustion gases.

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 combustion apparatus, an elongated combustion chamber having a discharge nozzle, means to supply liquid fuel and oxidizer to said combustion chamber, a volute encircling said chamber in a plane transverse to the longitudinal axis of said chamber, means to supply water under pressure to said volute, said volute having tangential ports facing inward of said chamber and effective to introduce jets of water from said volute tangentially into said combustion chamber, a second and reversed volute encircling said chamber adjacent said first volute and on that side of said first volute which is toward the chamber nozzle, said second volute having ports facing outward of said chamber and positioned to abstract a mixture of steam and combustion gases from the rotating and axially moving mass of steam and gases in said combustion chamber, and means to discharge said mixture from said second volute.

2. The combination in combustion apparatus as set forth in claim 1, in which the combustion chamber and nozzle are jacketed at both sides of said pair of volutes, and in which means is provided to supply cooling liquids to the jacket spaces.

3. The combination in combustion apparatus as set forth in claim 1, in which the combustion chamber and nozzle are jacketed at both sides of said pair of volutes and in which means is provided to conduct the combustion liquids through the jacket spaces to the combustion chamber.

4. The combination in combustion apparatus as set forth in claim 1, in which the ports associated with the two volutes are located in outwardly displaced portions of the combustion chamber wall.

5. The combination in combustion apparatus as set forth in claim 1, in which the ports for said second volute are formed as holes in the combustion chamber wall, with the opposite edge portions thereof displaced outwardly and inwardly respectively, and with the edge portion which is displaced inwardly with respect to the combustion chamber made thin and sharp.

6. In a combustion apparatus, an elongated combustion chamber having a discharge nozzle, means to supply liquid fuel and oxidizer to said combustion chamber, jacket members enclosing longitudinally spaced portions of the side wall of said combustion chamber, a pair of annular casing members encircling said chamber between said jacket members, means to supply water under pressure to the casing member which is remote from said discharge nozzle, and means to remove a mixture of steam and combustion gases from the second casing member, said combustion chamber having a plurality of tangential ports in said first casing member to direct water into said chamber and having a plurality of ports in said second casing member to abstract said mixture from said chamber.

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

No references cited.