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R. H. GODDARD
LIQUID COOLED BAFFLES BETWEEN MIXING AND
COMBUSTION CHAMBERS
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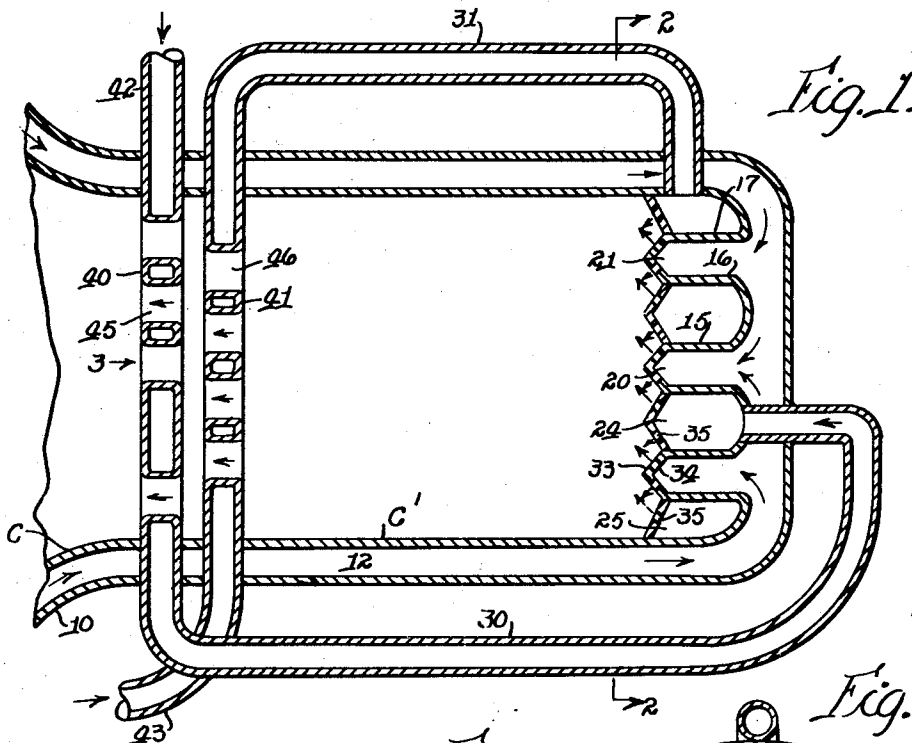


Fig. 1.

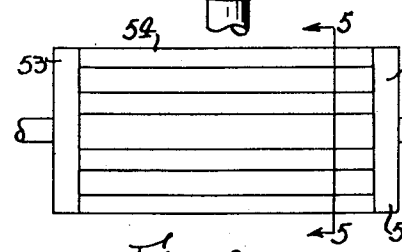
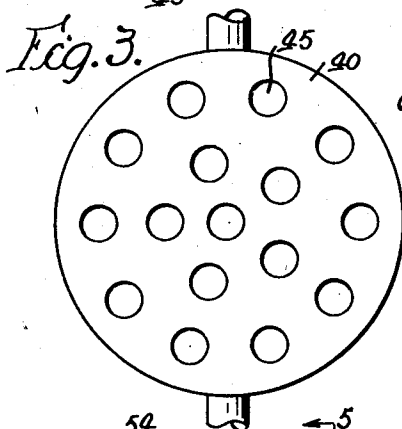


Fig. 4.

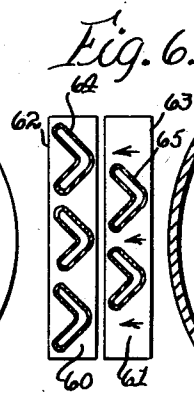


Fig. 6.

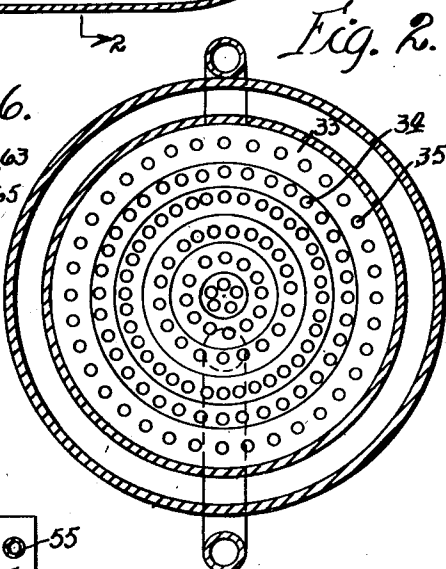


Fig. 2.

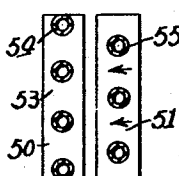


Fig. 5.

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LIQUID COOLED BAFFLES BETWEEN MIX-
ING AND COMBUSTION CHAMBERS

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2 Claims. (Cl. 60—44)

1

This invention relates to combustion chambers as used in rockets and rocket craft, and relates more particularly to devices for feeding liquid fuel and a liquid oxidizer thereto.

It is the general object of the invention to provide feeding devices so designed and constructed that the flow of combustion liquids and gases will be at all times in a rearward direction and toward the discharge nozzle and that conflicting paths of flow will be avoided.

A further object is to provide a liquid-cooled baffle structure to intercept drops of liquid fuel or liquid oxidizer which may have passed through and beyond the focal mixing area.

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 partial sectional side elevation of a combustion chamber having the improved feeding devices incorporated therein;

Fig. 2 is a transverse sectional elevation, taken along the line 2—2 in Fig. 1;

Fig. 3 is a side elevation of a baffle plate, looking in the direction of the arrow 3 in Fig. 1;

Fig. 4 is a side elevation of a modified baffle plate construction;

Fig. 5 is a sectional view of a pair of baffle plates as taken along the line 5—5 in Fig. 4; and

Fig. 6 is a view similar to Fig. 5 but showing a further modification.

Referring to Figs. 1, 2 and 3, portions of a combustion chamber C are shown, to the left-hand end of which is attached a discharge nozzle (not shown). The general shape of the chamber may be similar to the combustion chamber shown in the prior patent to Robert H. Goddard, #2,183,313.

The combustion chamber C is provided with an extension constituting a mixing chamber C', and both chambers C and C' are surrounded by a jacket casing 10 which provides a jacket space 12 to which a liquid fuel, as gasoline, is fed under pressure. This fuel acts as a coolant for the thin walls of the combustion chamber, and the temperature of the liquid fuel is thereby substantially raised before delivery to the mixing chamber C'.

At its closed end, the mixing chamber C' is provided with concentric annular partitions 15, 16 and 17 which define an axial recess 20 and an annular recess 21, both communicating with the jacket space 12 and receiving liquid fuel therefrom. The partitions 15 and 16 also define an

2

annular passage 24, and the partition 17 coacts with the casing of the chamber C' to define an outer annular passage 25. The passages 24 and 25 receive a liquid oxidizer from feed pipes 30 and 31.

The front ends of the recesses 20 and 21 and the annular passages 24 and 25 are closed by annular conical plates 33 having spray openings 34 for fuel and 35 for oxidizer. These spray openings are angularly disposed in such manner that the injected sprays of liquid fuel and oxidizer intersect in annular focal areas near the closed end of the mixing chamber C'.

Baffle plates 40 and 41 are mounted between the combustion chamber C and the mixing chamber C'. These baffle plates are of hollow construction and receive a liquid oxidizer under pressure through feed pipes 42 and 43. After passing through the baffle plates, the liquid oxidizer is delivered into the feed pipes 30 and 31 previously described and is thus conveyed to the annular passages 24 and 25, from which it is sprayed into the mixing chamber C'.

The baffle plates 40 and 41 are provided with numerous cross passages 45 and 46 respectively. It will be noted that the passages 45 and 46 are placed out of alignment with each other to prevent unobstructed straight-line flow from the mixing chamber C' to the combustion chamber C.

The operation of the described construction is as follows: Liquid fuel, as gasoline, is fed under pressure through the annular jacket space 12 and the recesses 20 and 21 to the spray openings 34, and a liquid oxidizer under pressure is fed through the hollow baffle plates 40 and 41 and the pipes 30 and 31 to the annular passages 24 and 25, from which it is sprayed through the spray openings 35.

The sprays of fuel and oxidizer mix and are intermingled in concentric annular focal areas, from which the combustible mixture then travels to the combustion chamber C and toward the discharge nozzle (not shown).

Any drops of either of the liquids which are not intermingled and vaporized before leaving the mixing chamber C' will impinge on the baffle plates 40 and 41 and will form superposed films of the two liquids which will thus be effectively intermingled. Straight-line passage of the drops from the mixing chamber C' to the combustion chamber C is obstructed by the staggered arrangement of the openings 45 and 46 in the associated baffle plates.

In Figs. 4 and 5 a modified construction is shown in which the baffle plates 40 and 41 are re-

placed by grids 50 and 51, each comprising headers 52 and 53 connected by a plurality of cross tubes 54 and 55. It will be noted from Fig. 5 that the tubes 54 and 55 are staggered similarly to the openings 45 and 46 in the baffle plates 40 and 41. This grid construction is desirable where extremely high temperatures are encountered at the entrance of the combustion chamber.

In Fig. 6, a further modification is shown, in which grids 60 and 61 comprise headers 62 and 63 connected by L-shaped cross tubes 64 and 65, which tubes are staggered as in the form previously described. The tubes present streamlined convex surfaces to the combustion mixture, while their recessed opposite sides facilitate the formation of vortices which increase the effectiveness of the mixing.

In all three described forms, the baffle plates or grids are liquid-cooled and they effectively prevent passage of unmingled drops of liquid from the mixing chamber C' to the combustion chamber C.

It will also be noted that the outer row of spray openings 35 from the oxidizer recess 25 is directed away from the wall of the mixing chamber C', while the outer row of spray openings 34 from the gasoline recess 21 is directed toward the wall of the chamber. Any drops of fuel which may pass through the outer row of fuel spray openings 34 will engage the wall of the mixing chamber C' and form a protective liquid film thereon but drops of oxidizer will be directed away from the wall.

Any usual device, such as a sparkplug, may be provided for igniting the intermingled combustibles in the mixing chamber C'.

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. In a combustion apparatus, a casing enclosing a combustion chamber and having an extension enclosing a mixing chamber having a closed end, means to feed liquid fuel under pressure and a liquid oxidizer under pressure to said

mixing chamber, and hollow liquid-cooled baffle devices positioned between the mixing chamber and the combustion chamber to intercept drops of liquid fuel and liquid oxidizer, each baffle device having a plurality of openings therethrough for passage of combustion gases and mixed combustion vapors and the openings in adjacent parallel baffle devices being staggered and being out of alignment with respect to the path of flow of said gases and vapors.

2. In a combustion apparatus, a casing enclosing a combustion chamber and having an extension enclosing a mixing chamber having a closed end, means to feed liquid fuel under pressure and a liquid oxidizer under pressure to said mixing chamber, and hollow baffle devices positioned between the mixing chamber and the combustion chamber to intercept drops of liquid fuel and liquid oxidizer, each baffle device comprising a grid having headers connected by a plurality of liquid-cooled tubes of L-shaped cross section, and with the convex surface of each tube directed toward the approaching gases.

ESTHER C. GODDARD,

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

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