May 1, 1951 R. H. GODDARD 2,551,114

TWO-LIQUID FEEDING DEVICE FOR COMBUSTION CHAMBERS

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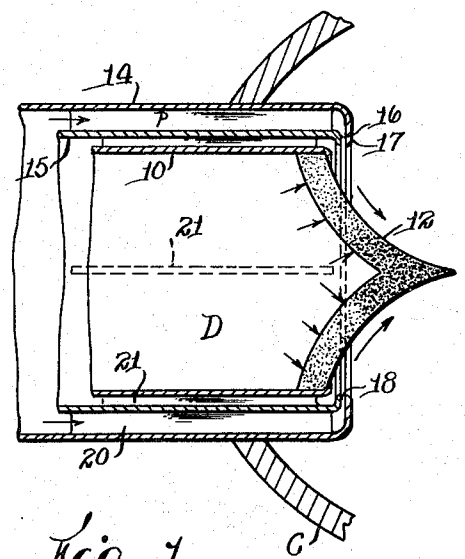

Fig. 1.

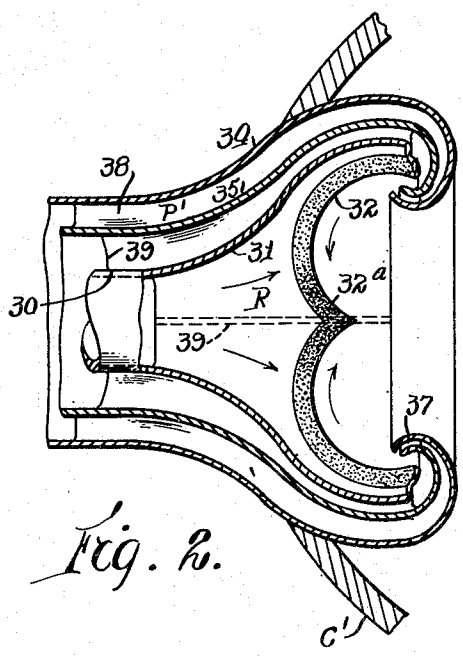

Fig. 2.

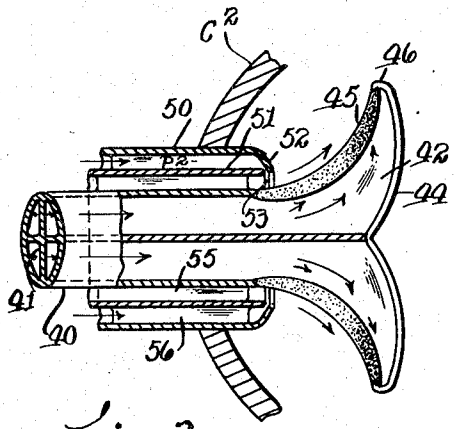

Fig. 3.

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TWO-LIQUID FEEDING DEVICE FOR COMBUSTION CHAMBERS

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3 Claims. (Cl. 60—44)

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This invention relates to combustion chambers as used in propulsion apparatus. The present invention relates particularly to combustion chambers in which two combustion liquids, as gasoline and liquid oxygen, are intermingled and consumed.

It is the general object of the present invention to provide an improved feeding device for such a combustion chamber through which two different liquids may be fed to the combustion chamber and by which they may be effectively intermingled therein.

The invention relates more specifically to a feeding device in which one liquid, as gasoline, is fed through a porous or permeable member, and in which the other liquid is applied as a thin film to the outer surface of said permeable member.

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 side elevation showing one form of the improved feeding device; and

Figs. 2 and 3 are views similar to Fig. 1 but showing modified constructions.

Referring to Fig. 1, a two-liquid feeding device D is shown as mounted axially in a combustion chamber C. The device D comprises an inner pipe or tube 10 supporting a pointed or conical porous member 12 in its inner end. The member 12 is of rigid and heat-resistant material and is preferably formed of porous or sintered metal.

One combustion liquid, as gasoline, is supplied under pressure to the pipe or tube 10 and is forced through the porous member 12 in the form of a very fine mist or spray.

An annular passage P is provided between an outer tubular member 14 and inner tubular member 15. The projecting ends of the annular members 14 and 15 are inwardly displaced to provide annular flanges 16 and 17 which are positioned to define an annular port 18. The pipe 10 and tubular members 14 and 15 are held in spaced relation by axially extending vanes or partitions 20 and 21.

A second combustion liquid, as liquid oxygen, is supplied under pressure to the passage P and is delivered through the slot 18 and against the outer surface of the member 12 as an annular sheet or spray. The liquid oxygen forms a thin film along said outer surface and becomes intimately intermingled with the mist or spray of gasoline. This film of oxygen not only mixes effectively with the gasoline but also acts as a cooling agent for the outer surface of the member 12.

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As the surface area of the member 12 is reduced toward the axis thereof, the film of oxygen tends to become thicker, as it is concentrated in a smaller area. For this reason, it is desirable that the porosity of the member 12 be increased toward its axis to maintain the desired ratio between the two combustion liquids.

In Fig. 2, one combustion liquid, as gasoline, is fed under pressure through a pipe 30 to a recess R within its enlarged end portion 31, and is forced against the inner surface of a porous or permeable member 32, clamped in the enlarged pipe portion 31. The member 32 is cup-shaped, as shown in Fig. 2, but with an outwardly projecting conical axial portion 32*a*.

The second combustion liquid, as liquid oxygen, is supplied under pressure through a passage P' between an outer casing or wall 34 and an inner casing 35. The projecting ends of the casings 34 and 35 are inwardly offset and reversely curved to provide an annular slot 37 through which the liquid oxygen is sprayed against the adjacent surface of the porous member 32 and forms a cooling film thereon, as well as mixing with the gasoline spray or mist.

In this construction also the axial portion 32*a* of the member 32 is preferably made more porous to offset its decreased surface area. The parts 31, 34 and 35 are held in spaced relation by vanes or partitions 38 and 39 and the whole device is mounted in a combustion chamber C'. The parts 31, 34 and 35 may be made in two parts to facilitate assembly.

In the construction shown in Fig. 3, gasoline under pressure is supplied to an axially positioned pipe 40 having an inner partition structure 41 which is outwardly extended at 42 to support a cap 44. An annular conical porous member 45 is fixed between the end of the pipe 40 and the contracted flange 46 of the cap 44. The porous member 45 is also supported by the outer portions 42 of the partition structure 41. The gasoline enters recesses R' between the parts 42 and is forced through the porous member 45 as a mist or fine spray.

A second combustion liquid, as liquid oxygen, is supplied through an annular passage P2 formed between an outer tube 50 and an inner tube 51. The outer tube 50 is inwardly contracted at 52 to provide an annular feed slot 53 at the

end of the tube 51. The parts 40, 50 and 51 are held in spaced relation by vanes or partitions 55 and 56 and the whole device is mounted in an axial opening in a combustion chamber C2.

With this construction, an annular spray, such as liquid oxygen, is directed against the outer surface of the porous member 45 at its smaller diameter and spreads outward against the expanding and substantially conical surface thereof, while a mist or fine spray of the second combustion liquid, as gasoline, is forced through the porous member 45 and intermingles with the spray of liquid oxygen.

In this form of the invention, the area of the member 45 increases outwardly, and the porosity of said member may be correspondingly reduced outwardly to supply relatively less gasoline as the film of liquid oxygen becomes thinner.

In all three forms of the invention, a very effective interminging of two combustion liquids is effected and the exposed surfaces of the feeding devices are all adequately liquid cooled.

Having thus dscribed 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 two-liquid feeding device for a combustion chamber comprising an axial porous feeding member, means to force one combustion liquid through said porous member to issue as a fine mist at its outer surface and annular means to supply a converging film of a second combustion liquid to the outer surface of said porous member at its periphery for intermingling with said fine mist of said first combustion liquid, that improvement which comprises a porous member which is cup-shaped and outwardly concave and which has an axial raised projection.

2. The combination in a two-liquid feeding device for a combustion chamber as set forth in claim 1, in which the annular means directs the second combustion liquid against said porous member in a reverse direction and away from the discharge end of said chamber and toward the axis of said member.

3. The combination in a two-liquid feeding device for a combustion chamber as set forth in claim 1, in which the porosity of said feeding member is increased towards its axis.

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