July 12, 1949. R. H. GODDARD 2,476,185

COMBUSTION CHAMBER WITH REFRACTORY LINING

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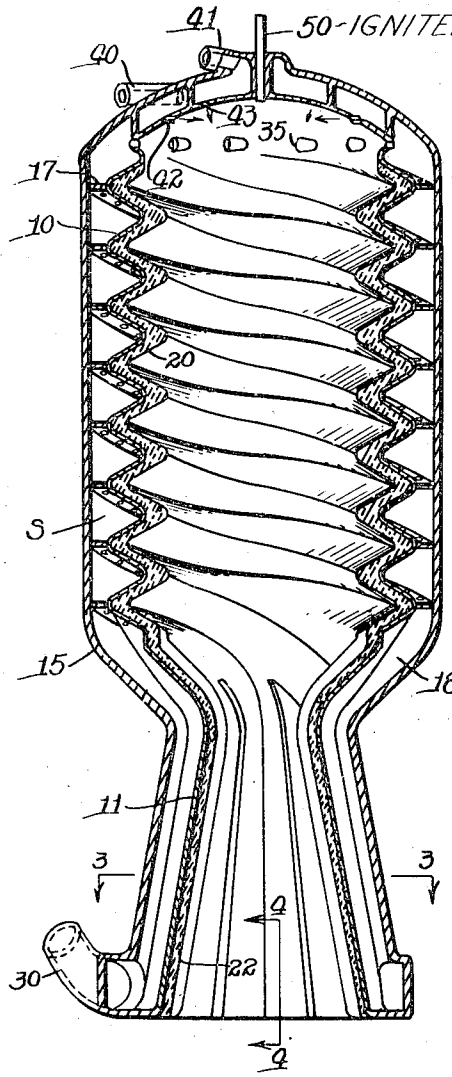

Fig. 1.

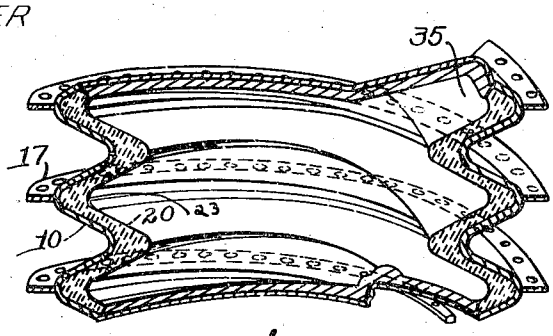

Fig. 2.

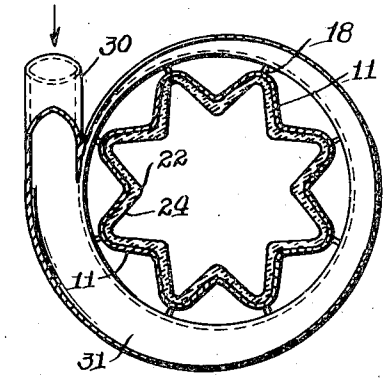

Fig. 3.

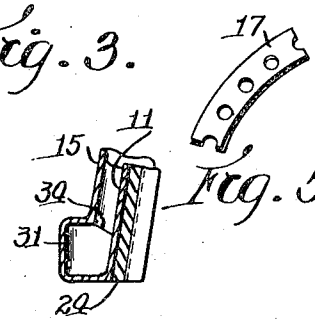

Fig. 5.

Fig. 4.

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COMBUSTION CHAMBER WITH REFRACTORY LINING

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7 Claims. (Cl. 60—35.6)

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This invention relates to a combustion chamber adapted for use in propulsion apparatus and comprising an elongated and generally cylindrical body portion and an associated discharge nozzle portion.

It is the general object of the present invention to provide a combustion chamber having a refractory lining with helical corrugations in the body portion and with longitudinally extending grooves arranged in a circumferential series in the nozzle portion.

In the preferred form, the helical corrugations of the body portion increase in pitch and merge gradually into the longitudinal grooves of the nozzle portion.

A further object of the invention is to provide a combustion chamber having a metal wall or casing with similar corrugations and grooves in the body and nozzle portions. This metal casing supports and positions the refractory lining. Provision is also made for cooling the outer surface of said metal casing.

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 transverse sectional elevation of a combustion chamber embodying this invention;

Fig. 2 is an enlarged sectional elevation of a portion of Fig. 1;

Fig. 3 is a transverse sectional plan view of the nozzle structure, taken along the line 3—3 in Fig. 1;

Fig. 4 is a fragmentary vertical section of a portion of the nozzle structure, taken along the line 4—4 in Fig. 1; and

Fig. 5 is a fragmentary view of a portion of a supporting brace or partition.

Referring to the drawing, a combustion chamber is shown having a relatively thin metal casing providing a body portion 10 and a discharge nozzle portion 11. The combustion chamber is mounted within an outer jacket 15 and is firmly held in spaced relation thereto by perforated partitions 17 (Figs. 1 and 5). The nozzle portion 11 is similarly supported by longitudinally extending ribs or partitions 18 (Fig. 3).

A refractory lining 20 is provided in the body portion 10, and a similar refractory lining 22 is provided in the nozzle portion 11. The lining portion 20 is provided with corrugations 23 (Fig. 2) which preferably form a continuous helix. The helix preferably increases in pitch at its

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lower end, so that the corrugations 23 merge gradually into longitudinal grooves 24 in the nozzle lining 22. The walls of the chamber and nozzle are of thin metal and are preferably similarly corrugated and grooved.

The lining portions 20 and 22 may be formed of any suitable refractory material, such as carbon, a carbide or a high refractory oxide.

A suitable cooling liquid is supplied to the jacket space S through a pipe 30 and a volute passage 31 (Fig. 3). Openings 34 (Fig. 4) connect the volute 31 with the lower end of the jacket space S. The cooling liquid then flows upward through the perforated partitions 17 and preferably enters the upper end of the combustion chamber through tangentially disposed nozzle elements 35 (Figs. 1 and 2).

Combustion liquids, such as gasoline and liquid oxygen, may be fed to the upper end of the combustion chamber through pipes 40 and 41 and spray openings 42 and 43. A suitable ignition device is also provided, indicated generally by the numeral 50.

The thickness of the refractory lining material in the lining portions 20 and 22 is preferably such that the material is slightly below its softening or melting point at its inner surface when the chamber is in operation, while the outer surface which is in contact with the metal walls of the combustion chamber and nozzle, is at a lower temperature at which injury to these walls will be avoided.

The corrugated and lined construction above described presents substantial advantages in combustion chamber operation. The chamber lining portion 20 serves to retain heat within the chamber, and prevents direct contact of the hot combustion gases with the metal wall 10, which latter element is kept relatively cool by the cooling liquid in the jacket space S.

The corrugations in the refractory lining present a relatively large area on which surface combustion may take place and furthermore, the corrugations produce eddies and vortices and thus facilitate mixing of the combustion elements.

The gradual increase in pitch of the corrugations 23 assists the combustion gases to achieve smooth flow into the axial grooves of the nozzle portion 11.

A combustion chamber constructed as above described resists wear and oxidation and may be maintained in operation over relatively long periods of time.

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 chamber having an elongated cylindrical body portion and having a nozzle portion, in combination, a refractory lining for said body portion which is provided on its inner surface with a continuous helical groove of relatively small pitch, and in its nozzle portion with longitudinally extending grooves into which said helical groove merges.

2. The combination in a combustion chamber as set forth in claim 1, in which the helical groove increases in pitch towards its lower end and merges gradually into the longitudinal grooves.

3. The combination in a combustion chamber as set forth in claim 1, in which the combustion chamber has an outer metal wall having helical and longitudinal grooves corresponding in section to the grooves of the refractory lining.

4. A combustion chamber comprising an elongated cylindrical metal body portion having a helically grooved inner surface provided with a similarly grooved refractory lining, and said chamber having a longitudinally grooved metal nozzle portion provided with a longitudinally grooved refractory lining.

5. The combination in a combustion chamber as set forth in claim 4, in which the helical lining groove increases gradually in pitch as it approaches the longitudinal grooves of the nozzle lining.

6. In a combustion chamber having an elongated cylindrical body portion and having a nozzle portion, in combination, a refractory lining for said body portion which is provided on its inner surface with a continuous helical groove of relatively small pitch, and in its nozzle portion with longitudinally extending grooves into which said helical groove merges, an outer jacket casing providing a jacket space surrounding said body portion and nozzle, and means to supply a cooling liquid to said jacket space.

7. In a combustion chamber having an elongated cylindrical body portion and having a nozzle portion, in combination, a refractory lining for said body portion which is provided on its inner surface with a continuous helical groove of relatively small pitch and in its nozzle portion with longitudinally extending grooves into which said helical groove merges, an outer jacket casing providing a jacket space surrounding said body portion and nozzle, means to supply a cooling liquid to said jacket space, and means to discharge said liquid tangentially from said jacket space to said combustion chamber.

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

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