Oct. 7, 1952 R. H. GODDARD 2,612,746

NOZZLE STRUCTURE FOR EFFECTING STRIATED FLOW OF COMBUSTION GASES

Filed March 4, 1948

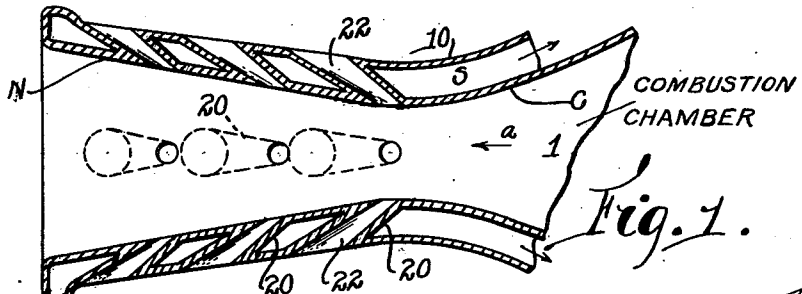


Fig. 1.

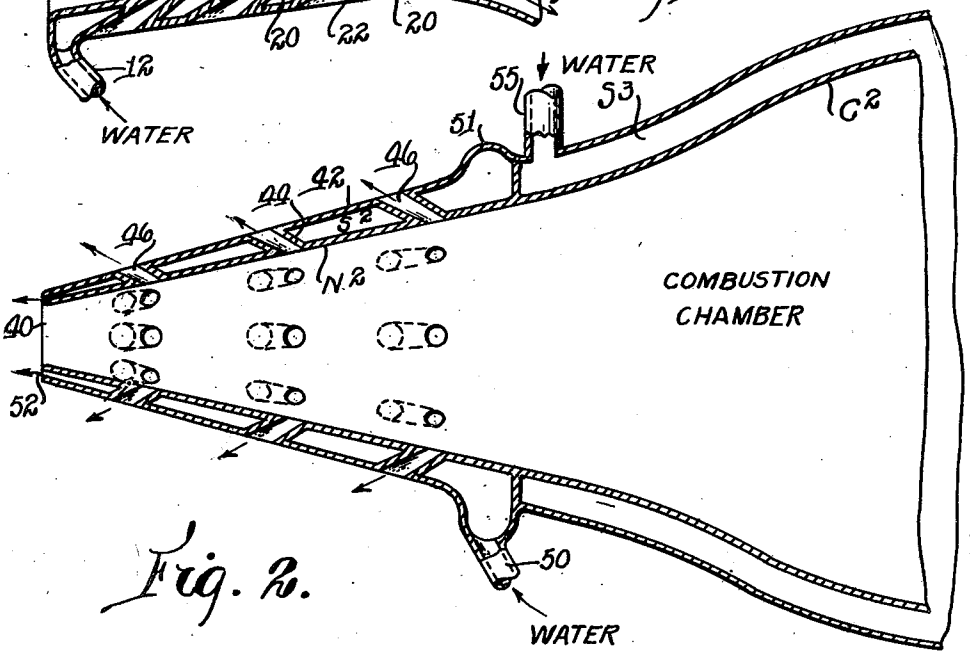


Fig. 2.

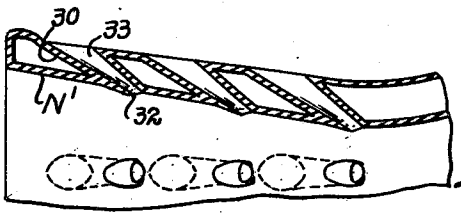


Fig. 3.

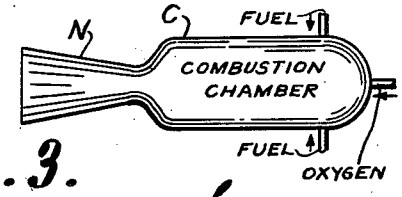


Fig. 6.

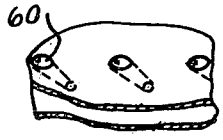


Fig. 4.



Fig. 5.

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NOZZLE STRUCTURE FOR EFFECTING STRIATED FLOW OF COMBUSTION GASES

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2 Claims. (Cl. 60—35.6)

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This invention relates to improved means for effecting striated flow of combustion gases produced in a continuously operated combustion chamber. Such striated flow facilitates entrainment of air, with an increase in the mass and a corresponding reduction in the velocity of the resultant mixture. More efficient operation is thereby attained.

It is the general object of the present invention to effect striation by providing novel and improved nozzle structures which will open out a compact stream of combustion gases to striated form.

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 elevation of a portion of a combustion chamber and nozzle embodying one form of this invention;

Fig. 2 is a similar view showing a second form of the invention;

Fig. 3 is a partial sectional elevation showing a slight modification of the construction shown in Fig. 1;

Figs. 4 and 5 are detail perspective views to be described; and

Fig. 6 is a side elevation of a complete combustion chamber.

A combustion chamber of conventional type is shown in Fig. 6.

Referring to Fig. 1, a portion of a combustion chamber C and nozzle N is shown, together with an outer casing 10 enclosing a jacket space S. Cooling liquid for the jacket space S may be provided through a supply pipe 12.

In the usual operation of this type of combustion apparatus, the hot combustion gases enter the nozzle N as indicated by the arrow *a* and are discharged from the rear open end thereof as a relatively compact and rapidly moving gas stream.

In order to open out this compact stream of gases, tubular members 20 are inserted through the jacket space S of the nozzle N and provide outwardly and rearwardly directed ports 22, through which portions of the combustion gases will be discharged.

The combustion gases entering the nozzle N from the chamber C are opened out by this new nozzle structure to produce a substantially increased mass of mixed combustion gases and air by entrainment, which mass moves at a substantially reduced speed. At the same time, the stream of combustion gases discharging directly rearwardly through the nozzle N is decreased in volume. While the theoretical efficiency of the combustion apparatus may be somewhat reduced by the increased friction losses, the practical utility of the apparatus in certain applications is substantially increased. Such applications include augmenters for air exhausters and compressors and jet-type pumps, in which entrainment of large volumes of air or liquid is essential and in which a compact and very rapidly moving gas stream has been found to produce relatively small and unsatisfactory entrainment effects.

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The proportion of gases removed from the nozzle stream may be increased by utilizing the structure shown in Fig. 3, in which tubular connections 30 have their rearward inner edges 32 projected into the nozzle N'. These projecting edges 32 deflect an increased proportion of the combustion gases into the ports 33 within the tubular connections 30.

In the construction shown in Fig. 2, the nozzle N2 for the combustion chamber C2 is contracted rather than enlarged toward its rear end or edge 40. An outer casing 42 provides a jacket space S2 for the nozzle N2, and tubular connections 44 extend through the space S2 and provide outwardly and rearwardly directed ports 46 for such portions of the combustion gases as are diverted therethrough.

Cooling liquid for the jacket space S2 may be provided through a supply pipe 50 and volute 51, and may be discharged through openings 52 in the rear end or edge 40 of the nozzle N2. Any steam discharged through the rear openings 52 adds to the mass of the combustion gases. A separate jacket space S3 for the chamber C2 may have cooling liquid supplied through a pipe 55.

The tubular connections and ports shown in Figs. 1, 2 and 3 may be circular in cross section, as indicated at 60 in Fig. 4, or may be elongated axially of the nozzle, as indicated at 62 in Fig. 5.

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 combustion apparatus, a combustion chamber, and a discharge nozzle for said chamber, said nozzle being conical and rearwardly expanding and having a plurality of outwardly and rearwardly-directed gas-diverting ports axially distributed along the rearwardly expanding side

wall of said nozzle outwardly of the inner restricted entrance of the nozzle and progressively spaced axially from the restricted entrance of said nozzle, a casing providing a jacket space about said nozzle, and in which the gas-diverting ports constitute a plurality of tubular members mounted in said nozzle and casing and extending outwardly and rearwardly through said jacket space.

2. In combustion apparatus, a combustion chamber, and a discharge nozzle for said chamber, said nozzle being conical and rearwardly expanding and having a plurality of outwardly and rearwardly-directed gas-diverting ports axially distributed along the rearwardly expanding side wall of said nozzle outwardly of the inner restricted entrance of the nozzle and progressively spaced axially from the restricted entrance of said nozzle, a casing providing a jacket space about said nozzle, and in which the gas-diverting ports constitute a plurality of tubualr members mounted in said nozzle and casing and extending outwardly and rearwardly through said jacket space, the rearmost edge portions of said

tubular members projecting into the main axial passage of said discharge nozzle to engage and divert the combustion gases.

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

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