Nov. 25, 1952 G. F. WISLICENUS 2,618,925

FLOW CONTROL MEANS FOR PULSE JET COMBUSTION UNITS

Filed Jan. 31, 1947

FIG. 1

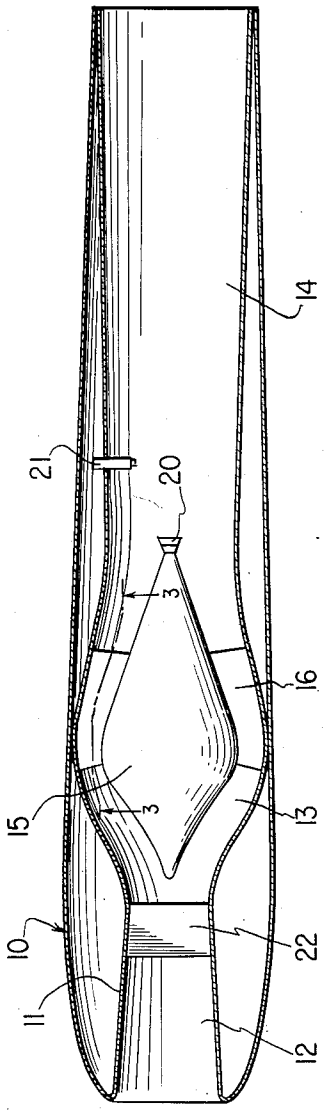


FIG. 2

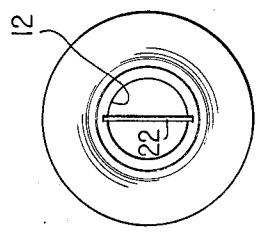
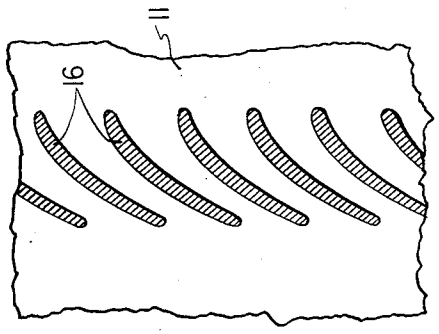


FIG. 3



Inventor
George F. Wislicenus

By
Davis, Lindsey, Smith & Shonts
Attorneys

Patented Nov. 25, 1952 2,618,925

UNITED STATES PATENT OFFICE

2,618,925

FLOW CONTROL MEANS FOR PULSE JET COMBUSTION UNITS

George F. Wislicenus, Toledo, Ohio, assignor to Packard Motor Car Company, Detroit, Mich., a corporation of Michigan

Application January 31, 1947, Serial No. 725,667

3 Claims. (Cl. 60—35.6)

1

The invention relates generally to jet propulsion units and more particularly to a combustion unit for producing a pulse jet.

The general object of the invention is to provide a combustion unit for producing a pulse jet and having a novel inlet valve.

Another object is to provide a combustion unit of the foregoing character, in which the inlet valve has no moving parts.

A further object is to provide a combustion unit of the foregoing character, in which the energy tending to create a back or reverse flow from the point of combustion is utilized to substantially prevent such flow.

Still another object is to provide a novel method of preventing reverse flow in a combustion unit for producing a pulse jet.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a combustion unit embodying the features of the invention.

Fig. 2 is an end view of the left-hand end of the unit as shown in Fig. 1.

Fig. 3 is a fragmentary developed view taken substantially on the line 3—3 of Fig. 1.

In a jet propulsion unit of the pulse jet type, air is forced into a combustion chamber where fuel is intermittently supplied and ignited, thereby producing pulsations of combustion gases tending to move in both directions from the point of combustion. The gases moving toward the tail pipe of the unit of course produce the propelling jet. The gas moving toward the air intake would produce an adverse reaction, if permitted to pass out through the air intake, and for this reason a valve is provided in the intake to prevent the passage of gas forwardly therethrough. In units of this character, the valve has heretofore usually been of the flap valve type involving moving parts which are held open when air is forced inwardly or rearwardly through the intake but which are forced closed by any flow of gas forwardly. Obviously, because of the high velocities of flow involved and, more importantly, the high temperature of the gas, a flap valve construction is not very satisfactory and may rapidly become disabled to perform its function of preventing reverse flow.

The present invention provides a structure which eliminates the difficulties encountered in the use of a flap valve and includes a valve having no moving parts. The present valve utilizes the energy of any gas tending to move reversely, to prevent the flow thereof, and the air passage leading from the intake to the combustion chamber is formed to attain this end. At the same time the passage permits a free flow of air to the combustion chamber to effect combustion therein.

2

Generally described, a device embodying the invention involves means for imparting to a reverse flow of gas a swirling movement and then confining the gas in a portion of the passage where the diameter of the swirling movement is gradually reduced. Such reduction of diameter increases the velocity of the gas and consequently the kinetic energy in the gas. This results in a resistance to flow. At the point where the passage meets the intake, means is provided for dissipating the energy and thereby preventing any major reverse flow.

In the embodiment of the invention shown in the drawings, the unit comprises a body structure indicated generally at 10 and having an inner casing 11 providing an axially positioned passage through the entire length of the body structure 10. The passage comprises an intake portion 12, an intermediate portion 13, and a combustion chamber portion 14. The intake portion 12 is centrally located and preferably converges slightly toward its downstream end. Air is adapted to be forced inwardly through the intake 12 by means of ram pressure or of an impeller or the like (not shown). If the unit shown in the drawings is to be utilized by itself as a jet unit, then such compressor means will be mounted within the intake portion 12. However, if the jet propulsion unit is to be composed of a plurality of combustion units as illustrated in the drawings by arranging such units in an annular series within a main casing, then the compressor will be positioned forwardly of the intake portion 12 and will distribute air to all of the combustion units.

Extending rearwardly from the intake portion 12 is the intermediate portion 13 which is given an annular form diverging first outwardly from the intake portion 12 and then converging to the combustion chamber portion 14, which is centrally positioned. To so shape the intermediate portion 13, an inner cone member 15 tapered toward both ends is mounted within the intermediate portion to provide the annular form for the air passage. The inner cone 15 may be supported in the position shown by a plurality of radial vanes 16. To effect combustion of the fuel in the combustion chamber 14, a burner 20 may be mounted on the rear end of the inner cone member 15 to spray fuel rearwardly in the combustion chamber portion 14. To ignite the fuel, the spark plug 21 may be mounted in the wall of the combustion chamber portion. With this arrangement, air will enter the intake 12,

pass rearwardly through the intermediate portion 13 about the inner cone member 15, and then mix with the fuel supplied by the burner 20 for combustion within the portion 14.

When combustion takes place within the portion 14, the resulting gas, of course, will tend to move in all directions from the point of combustion. The combustion gas flowing rearwardly from the combustion chamber 14 ultimately produces the jet stream. The gas moving forwardly from the combustion chamber toward the intermediate portion 13 would produce an adverse reaction unless the flow of such gas forwardly were greatly reduced. To throttle such flow, the intermediate portion is given the particular form shown in the drawing and the vanes 16 are shaped to cooperate therewith in preventing the forward flow. Thus, the vanes 16 which are located at the point of maximum diameter in the intermediate portion 13 are given a helical form, as clearly shown in Fig. 3. Such helical form imparts to any gas moving forwardly at that point a swirling motion. Forwardly from the vanes 16, the intermediate portion 13 converges toward the intake portion 12 so that the gas, as it moves forwardly from the vanes, attains a higher linear velocity because of the decreasing diameter since, in such a circumstance, the velocity of the gas multiplied by the radius at which it is spinning or swirling remains constant. The centrifugal force of the gas thus increases so that a resistance is set up which tends to prevent the gas from moving inwardly, as it must in passing to the intake portion 12. The increased velocity also increases the kinetic energy in the gas and, by dissipating such energy as the gas approaches the intake portion 12, it will be partially obstructed in passing forwardly through such intake portion. To dissipate the kinetic energy remaining in the gas at this point, a transverse partition 22 (see Figs. 1 and 2) is mounted in the rear end of the intake portion 12 so that the spinning or swirling movement of any forwardly moving gas will be abruptly stopped by the partition 22. Thus, forward movement of the gas will be hindered by the energy of the gas itself and no moving parts are required in the construction to reduce the forward flow. The structure thus eliminates the difficulties heretofore encountered with a flap valve and provides a structure which is simple in character, with the vanes 16 as well as the transverse partition 22 utilized to control the gas as well as to lend rigidity to the various parts.

I claim:

1. In a jet pulse unit the combination including a body structure having an intake portion that converges inwardly in a downstream direction, an intermediate portion that first diverges outwardly and then converges inwardly in a downstream direction, and a combustion chamber portion; a transverse partition disposed in the downstream end of the air intake portion of said body; an inner cone member generally concentrically disposed within said intermediate portion, said cone member being tapered toward both ends and being smaller than said intermediate portion whereby to provide an annular passage therearound; a plurality of helically disposed supporting vanes for fixedly holding said cone member within said intermediate portion, said vanes being fixed between said intermediate portion and said cone member substantially at the point of maximum diameter of the intermediate portion; and a fuel burner disposed adjacent the downstream end of said cone member.

2. In a jet pulse unit the combination including a body structure having an intake portion that converges inwardly in a downstream direction, an intermediate portion having a section that diverges outwardly and a downstream section that converges inwardly, and a combustion chamber portion; a transverse partition disposed in the downstream end of the air intake portion of said body; an inner cone member generally concentrically disposed within said intermediate portion, said cone member being tapered toward both ends and being smaller than said intermediate portion whereby to provide an annular passage therearound, the tapered front end of said cone diverging outwardly at a faster rate than the diverging section of said intermediate portion, and the downstream taper of said cone member converging inwardly at a faster rate than the converging section of said intermediate portion; a plurality of helically disposed supporting vanes for fixedly holding said cone member within said intermediate portion, said vanes being fixed between said intermediate portion and said cone member substantially at the point of maximum diameter of the intermediate portion; and a fuel burner disposed adjacent the downstream end of said cone member.

3. In a jet pulse unit the combination including a body structure having an intake portion that converges inwardly in a downstream direction, an intermediate portion that first diverges outwardly and then converges inwardly in a downstream direction, and a combustion chamber portion; a transverse partition disposed in the downstream end of the air intake portion of said body; an inner cone member generally concentrically disposed within said intermediate portion, said cone member being tapered toward both ends and being smaller than said intermediate portion whereby to provide an annular passage therearound; a plurality of helically disposed supporting vanes for fixedly holding said cone member within said intermediate portion, said vanes being fixed in overlapping but spaced relation between said intermediate portion and said cone member substantially at the point of maximum diameter of the intermediate portion; and a fuel burner disposed at the downstream end of said cone member.

GEORGE F. WISLICENUS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,246,159	Ricardo et al.	Nov. 13, 1917
1,329,559	Tesla	Feb. 3, 1920
1,566,862	Halterman	Dec. 22, 1925
2,007,080	Dintilhoc	July 2, 1935
2,167,303	Kadenacy	July 25, 1939
2,198,730	Kadenacy	Apr. 30, 1940
2,208,984	Jahn	July 23, 1940
2,427,845	Forsyth	Sept. 23, 1947
2,575,682	Price	Nov. 20, 1951

FOREIGN PATENTS

Number	Country	Date
386,908	Great Britain	Jan. 26, 1933
412,478	France	May 3, 1910
640,228	Germany	Dec. 28, 1936
852,971	France	Nov. 18, 1939