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DRAINAGE MEANS FOR CHEMICAL REACTION TURBINES

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Fig. 1

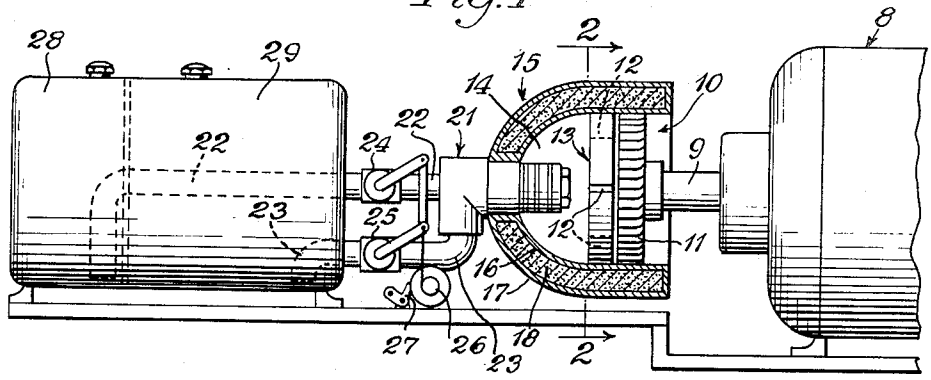
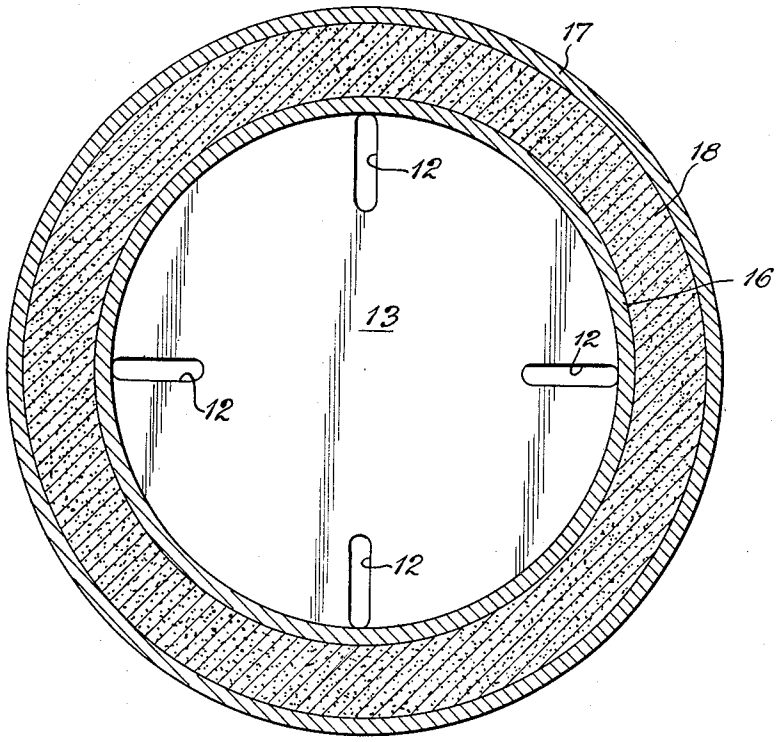


Fig. 2



Inventor
Eugene A. Maynor
by Parker & Carter
Attorneys

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DRAINAGE MEANS FOR CHEMICAL REACTION TURBINES

Eugene A. Maynor, Chicago, Ill., assignor to Maynor Research Foundation, Inc., Chicago, Ill., a corporation of Illinois

Original application May 20, 1948, Serial No. 28,208, now Patent No. 2,707,373, dated May 3, 1955. Divided and this application September 12, 1952, Serial No. 309,310

1 Claim. (Cl. 60—39.09)

My invention relates to chemical reaction turbines and particularly to drainage means for liquids used therein.

Chemical reaction turbines are those employing liquid fuels, which may be hypergolic bi-propellants, wherein no ignition is required, or which may be a mono-propellant with which ignition, normally electrical, is required to cause combustion. Combustion occurs in a combustion chamber which is sealed except for limited openings at the discharge end, known as combustion nozzles, through which the combustion gases are directed against a turbine wheel and the blades thereof to cause the wheel to rotate, substantially as shown in the drawings herein.

Jet motors of a constant volume type have been consructed which require a sealed combustion chamber and a door which is intermittently opened and closed, the door being equal in diameter to the chamber and all of any gases and materials in the chamber being thus expelled; these engines were given the name "pulse jet." The sealed chamber was required in order to obtain the pressure needed for useful work. An engine such as my chemical reaction turbine employs no such door but rather a particular gas director in the end of the combustion chamber. Chemical reaction turbines differ greatly from the more widely known gas turbines or air-gas turbines wherein air is compressed by a blower mounted on the turbine wheel shaft and the compressed air is continuously forced into one end of the combustion chambers under pressure, the opposite end of the chamber being fully open, only the blades of the turbine wheel being in alignment with the combustion chamber. The problem solved herein thus does not plague the workers in the air-gas turbine art.

In the operation of chemical reaction turbines, the liquid fuels therein, from time to time, accumulate at the bottom of the combustion chamber. There have been numerous instances wherein these accumulated liquids have exploded causing the destruction of the chemical reaction turbine and injury and death to personnel operating it.

Accordingly, it is one purpose of my invention to provide means whereby the accumulation of liquid fuels within the combustion chamber of a chemical reaction turbine is prevented.

Another purpose is to provide drainage means for chemical reaction turbines whereby the force of combustion of the fuels causes the expulsion of accumulated liquids through the drainage means.

Another purpose is to provide a drainage means for chemical reaction turbines which shall be operable to drain from the combustion chamber fuels tending to accumulate therein at all times during the operation of the chemical reaction turbine of which the combustion chamber is a part.

Other purposes of my invention will, in part, be obvious and in part appear hereinafter.

My invention disclosed herein is disclosed also in my co-pending application Serial Number 28,208, filed May 20, 1948, now Patent No. 2,707,373, of which this specification is a division.

For a more complete understanding of the nature and scope of my invention, reference may be had to the following detailed description, taken together with the accompanying drawing, in which:

Figure 1 is a view, partly in side elevation and partly in section, illustrating a chemical reaction turbine constructed generally in accordance with my invention; and

Figure 2 is a detail sectional view, on an enlarged scale, taken along the line 2—2 of Figure 1.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring now particularly to Figure 1 of the drawing, it will be observed that the reference character **8** designates, generally, a load device, such as an electric generator, having a shaft **9** which supports at one end a turbine wheel that is indicated, generally, at **10**. The turbine wheel **10** has blades **11** around its periphery which may be 42 in number and which have generally straight entrance and intermediate portions and which have curved discharge end portions against which the jet reacts to drive the turbine wheel **10** in a manner readily understood.

The gas jet for driving the turbine wheel **10** is directed against the blades **11** through discharge nozzles or orifices **12** which are located in the periphery of a gas blast director **13** which is positioned near the discharge end of a combustion chamber **14** in a housing which is indicated generally at **15**. The jet employed may be continuous or may be a rapid series of individual jets.

As shown more clearly in Figure 2 of the drawings, four radially directed nozzles **12** are provided in a director **13** which may be formed of stainless steel or other heat-resistant material and in the particular embodiment of the invention which has been constructed, has a diameter of four inches. In this construction the nozzles **12** are ⅛ inch wide and ¾ inch deep. The director **13** is positioned in the outlet end of the combustion chamber **14** so that one of the nozzles **12** is at the bottom as shown. The purpose of this will be set forth presently. It will be understood that the jet, which is generated within the combustion chamber **14**, expands outwardly through the nozzles **12** and impinges on the curved portions of the turbine blades **11** to cause the turbine wheel **10** to rotate and drive the electric generator **8** or other load device which may be connected to the turbine wheel **10** as will be readily understood. Since the fuel tanks **28, 29**, the tubing **22, 23**, the valve **24, 25**, the fuel injector **21**, the chamber and housing **15, 16, 17, 18** and the shaft **9** and turbine wheel **10** form no direct part of this invention, they will not be further described herein except to mention that the insulation blanket **18** may be composed of a suitable refractory material or insulation such as carbon, as illustrated.

It will be understood that the liquids which through the process of combustion are to form the force required to drive the wheel **10** are injected into the chamber from the nozzle **21** and that these liquids have a tendency to accumulate at the bottom of the chamber. When even a small amount of these liquids is permitted to so accumulate, the critical ratio of the fuels and oxidizers used in the combustion process is disturbed and the desired ratio is exceeded. As combustion continues these accumulated liquids are ignited and a "hot spot" is created at the point of accumulation causing a burning of the combustion chamber liner **16** at that point. Moreover if the accumulation is sufficient, as has happened in such structures, an explosion ensues which is of tremendous intensity, causing the destruction of the machine and the injury and death of operating personnel nearby.

The use and operation of my invention are as follows:

It should be thoroughly understood that a chemical reaction turbine, as disclosed herein, differs materially from the normal constant pressure gas turbine in which air is first compressed and then directed into a combustion chamber or into a series of combustion chambers having openings surrounding the combustion chamber through which the air enters. A single liquid, such as kerosene, is there injected into the combustion chamber and the liquid, having mixed with the incoming air, is ignited by electrical ignition. In such mechanisms the combustion chambers are wide open at the far end and only the blades of the turbine wheel are located in alignment with the completely open end of the combustion chamber. Since air is entering the combustion chamber adjacent the nozzle under pressure and since the end of the chamber is fully open, the force of the combustion gases is exerted through such open end. In a chemical reaction turbine, on the other hand, a sealed combustion chamber, having only the minimum required openings at its far end, is necessary, since the pressure is built up within this sealed chamber by the burning of the liquid and no air is injected into the chamber under pressure. Consequently the size, number and location of the discharge openings in the combustion chamber of a reaction turbine become of critical and important significance. If they are too large or too many in number, the amount of pressure which can be built up in the chamber is diminished accordingly. If they are too small or too few in number, the maximum amount of pressure generated in the chamber will not be properly utilized. The lowest nozzle, in accordance with my invention, must be of sufficient size to permit drainage of the accumulated liquids. Experimenters placed the discharge nozzles in this type of machine near the top of the gas director and thus near the top of the combustion chamber since heated gases tend to rise and in view of the fact that the fuel injector was likewise near the top of the chamber and it was thought desirable to have the director nozzle in alignment with the fuel injector. As will be observed in Figure 1 of the drawings herein, I provide a particular fuel injector which is described and claimed in my United States Letters Patent Number 2,575,824. This fuel injector permits the impingement, mixture and combustion of the fuel in a generally flat, circular disc-shaped spray which is generally in conformity with the circular combustion chamber, the fuel injector being inserted in the center of the chamber in general alignment with the center of the gas director **13**.

As will be seen in Figure 2 I provide a gas director nozzle or discharge nozzle **12** at the very bottom of the

combustion chamber and at the very bottom of the gas director **13**. Since this orifice or gas director nozzle is located at the lowest point in the combustion chamber, no liquids are permitted to accumulate in the bottom of the chamber, but on the contrary are expelled by the force of the combustion gases as the gases flow through the orifices in the gas director **13**. It is important to realize that, though my invention is effective to drain excess liquids which may have accumulated, I provide a means whereby the accumulation itself is prevented as the turbine is operated.

I have shown in numerous tests that a chemical reaction turbine employing a gas director or nozzle diaphragm constructed and arranged in accordance with the disclosure herein provides a highly satisfactory performance. Thus there has been provided a complete solution to several difficulties which have heretofore confronted those working in this branch of this art and the same has been advanced correspondingly.

Since certain changes can be made in the foregoing construction and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matters shown in the accompanying drawing, described hereinbefore and claimed hereinafter, shall be interpreted as illustrative and not in a limiting sense.

I claim:

In a chemical reaction turbine, in combination, a combustion chamber, said chamber being sealed against entrance of air except for a liquid fuel injector nozzle at one end and a gas director at the other end thereof having discharge nozzles extending axially therethrough, a turbine wheel having blades positioned to be acted on by the gases issuing from said discharge nozzles, the discharge nozzles comprising radially directed openings spaced peripherally about the gas director and including at least one opening in line with the lowest point in said chamber, said one opening constituting drainage means through which excess liquid tending to accumulate in the combustion chamber can be discharged.

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