

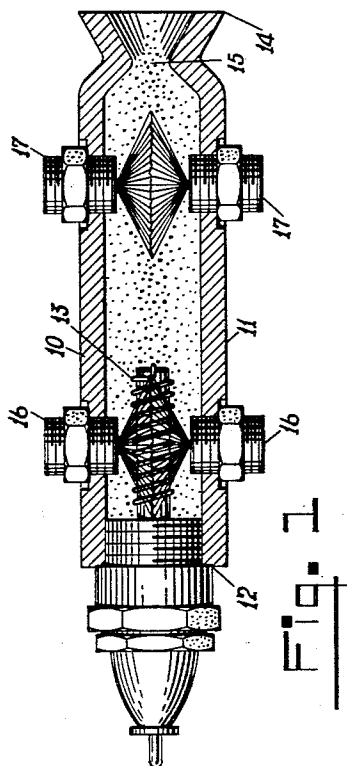
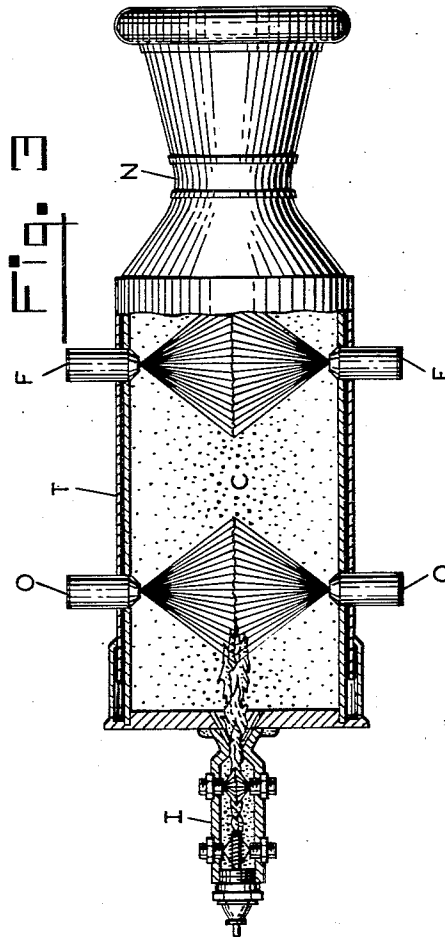
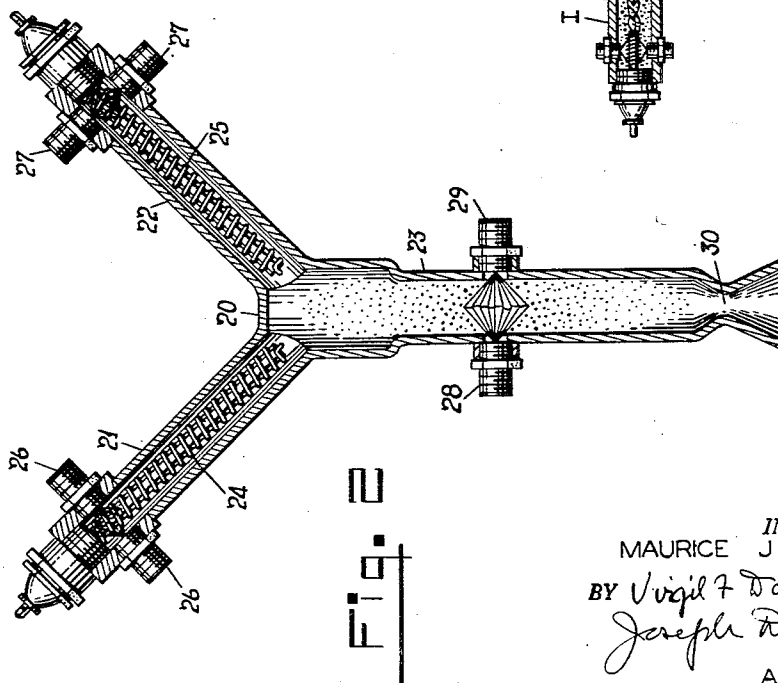
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METHOD OF USING A HOT VAPOR IGNITER

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## METHOD OF USING A HOT VAPOR IGNITER

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1 Claim. (Cl. 60—39.06)

This invention relates to a hot vapor igniter and more specifically concerns an improved method for the ignition of non-hypergolic propellant components used in jet propulsion and similar devices, employing this type of igniter.

In previous methods for igniting fluid propellant components (e. g. an acid and a hydrocarbon), both were injected simultaneously against a source of ignition, such as a glow plug igniter, usually a platinum resistance element wound on a ceramic core. The disadvantage of this method is that combustion occurs on the resistance element and burns it out, particularly when the igniter operates in a high pressure chamber, as necessarily happens when it is used to initiate a reaction in a rocket combustion chamber or gas generator operating at 300–400 p. s. i. chamber pressure.

The novel method of this invention includes the separate heating of either, or both, of the propellant components, usually an oxidizer and a fuel, to such a temperature that they will ignite spontaneously when brought into contact with each other. The propellant components are admitted into the vaporizer stage of the igniter as liquids and enter the burner stage as vapors. In this manner, combustion on or adjacent the heating element can be avoided.

The use of propellant components in a vapor state is attractive in that a flame, for further ignition purposes, may be obtained with the injection of very small quantities of propellant components into the reaction chamber of the igniter. In case of malfunction, the danger of violent explosion to equipment and personnel is decreased considerably, since the accumulated mass of propellant components will be small.

The overall object of this invention is the application of an improved method for the ignition of fluid propellant components, which are not self-reactive at normal ambient temperatures, in a jet propulsion or similar structure.

Another object of this invention is to apply a novel method for igniting a plurality of fluid propellant components by using hot vapor ignition so that their combustion does not occur on or in the vicinity of the heating means.

Still another object is to apply a method of ignition of two or more fluid propellant components which is reliable and where danger of violent explosion is virtually eliminated, thereby safeguarding personnel and equipment.

These and other objects and advantages of this invention will become apparent from the following description of a preferred embodiment thereof, as illustrated in the several figures of the accompanying drawing in which:

Fig. 1 is a diagrammatic view of a simple form of igniter structure in which the method of this invention can be practiced.

Fig. 2 is a diagrammatic view of a modified igniter structure wherein the method also can be practiced; and

Fig. 3 is a diagrammatic view of a structure particu-

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larly suitable for the practice of the method of ignition of this invention.

Referring to Fig. 1 of the drawing, the igniter 10, disclosed therein, consists of a reaction chamber comprised of a substantially cylindrical hollow body 11, with a closed end 12, upon which is centrally mounted an electrically heated glow plug 13, to serve as a source of heat. At the opposite end 14, there is an outlet or restricted opening 15, through which the flame, arising from the reaction of the propellant components, issues. At 16 and 17, there are disclosed propellant component injectors for the respective admission of an oxidizer, such as an acid, and a fuel, such as a hydrocarbon. These injectors are located at right angles to the longitudinal axis of the igniter body, with the oxidizer injectors located so that this fluid propellant component is sprayed as a liquid directly onto the glow plug 13, to heat and vaporize it as it proceeds toward the outlet of the igniter. When the fuel is sprayed into the hot oxidizer vapor, a reaction or spontaneous ignition occurs and the resulting flame and combustion products pass through the restricted opening for further utilization as desired.

Fig. 2 is a modification of the structure disclosed in Fig. 1 and shows a Y-shaped igniter at 20 composed of heating and vaporizing legs 21 and 22, leading to a manifold or flame chamber 23. The Y-shape is not critical as a parallel leg structure will produce similar results. In each of the legs, there are inserted glow plugs 24 and 25, against which the fluid propellant components e. g. an oxidizer and a fuel, are directed as liquids by injectors 26 and 27, for heat transfer and vaporization. As compared with the structure of Fig. 1, these glow plugs are longer and are inserted in smaller diameter chambers which form the legs, in order to provide for more extensive heating of the injected propellant components. The heated vapors are led into flame chamber 23, where reaction occurs and where additional propellant components can be selectively admitted through injectors 28 and 29 for stabilizing and augmenting the flame, which, with the combustion products resulting from the ignition, emerges from the restricted opening 30 of the igniter outlet.

Referring now to Fig. 3, there is disclosed a structure suitable for the practice of the method of ignition revealed in the structures diagrammed in Figs. 1 and 2. An igniter I, similar to that of Fig. 1, as shown attached to a thrust cylinder T, which consists of the combustion chamber C, restricted throat or nozzle N, and injectors O and F, used for the admission of the same or similar type fluid propellant components used in the igniter. The flame from the igniter issues into the combustion chamber C of the thrust cylinder T. Into this flame, fluid propellant components are directed from injectors O and F in such quantities necessary to the desired thrust reaction. It should be evident that the flame from the igniter can initiate the combustion of large quantities of fluid propellant components, irrespective of their phase, i. e. either liquid or vapor, and can be used with any desired number of stages as determined by the size of the propellant component flow.

It is obvious to those skilled in the art that various modifications of this disclosure may be accomplished within the scope of the appended claim. It is intended that all matter contained in the above description and shown in the accompanying drawing shall be interpreted as illustrative and not limitative.

What is claimed is:

The method of obtaining a propulsive thrust which includes the admission of one of a plurality of liquid propellant components into an igniter chamber, raising the temperature of said admitted liquid propellant component

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to change its state from liquid to vapor, admitting another of said plurality of liquid propellant components into said igniter chamber to contact the vapors therein for substantially instantaneous reaction therewith, directing the resulting flame and combustion products into a main combustion chamber and admitting selected quantities of each of said liquid propellant components into said flame to achieve further reaction and to obtain a desired propulsive thrust.

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