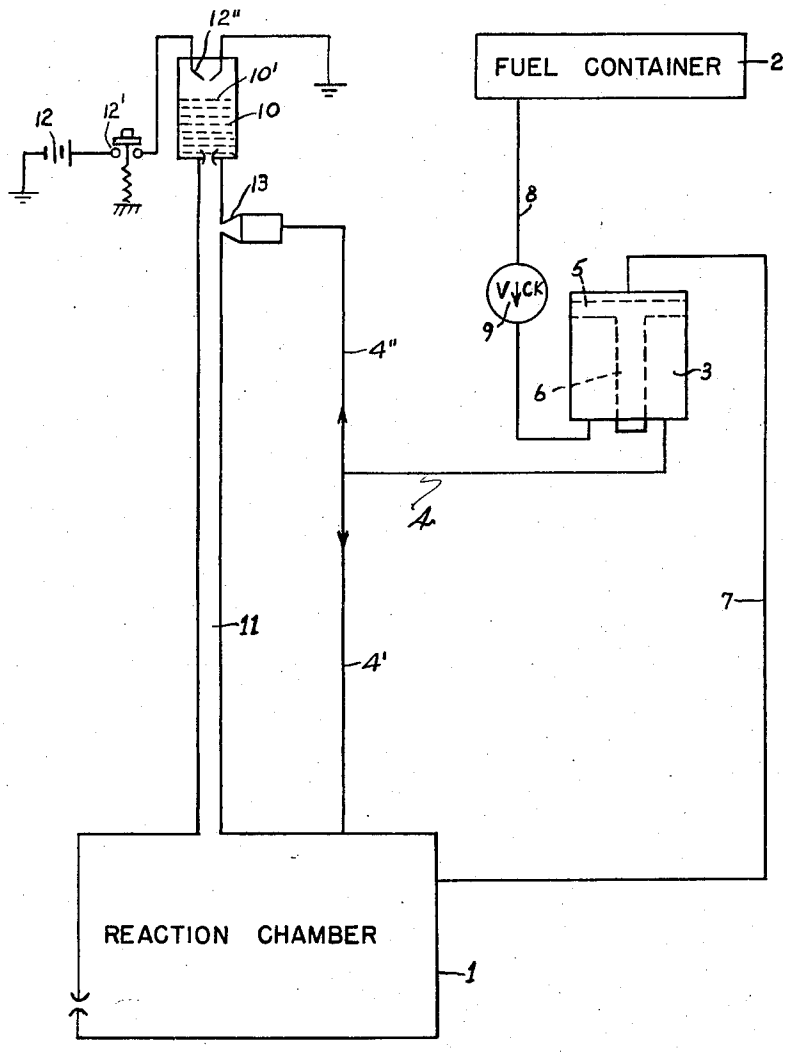
Nov. 4, 1958 A. GRIEVE ET AL 2,858,670

IGNITION AND FUEL SUPPLY SYSTEM FOR REACTION CHAMBERS

Filed Jan. 16, 1956



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United States Patent Office 2,858,670 Patented Nov. 4, 1958

2,858,670

IGNITION AND FUEL SUPPLY SYSTEM FOR REACTION CHAMBERS

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Application January 16, 1956, Serial No. 559,383

Claims priority, application Great Britain January 26, 1955

2 Claims. (Cl. 60—39.14)

This invention relates to apparatus for the production, by the decomposition of a monofuel in a reaction chamber, of a flow of gaseous working fluid for supply to a prime mover, such as a turbo-starter for a gas turbine or other internal combustion engine.

In such apparatus, it is required to initiate the decomposition of the monofuel by producing minimum conditions of heat and pressure in the reaction chamber. One known means for producing the said conditions is to employ a charge of deflagrant, such as cordite, located in a container, hereinafter referred to as a breech, which is connected with the reaction chamber, the charge being fired by any suitable means, e. g. an electric spark, whereby to produce a flow of heated gaseous products of combustion of the deflagrant which is led into the reaction chamber and there ignites the monofuel, the continuing flow of which thereafter decomposes to maintain its own combustion.

When, in using such a means for initiating decomposition of the monofuel, the breech is located remotely from the reaction chamber there arises a loss of heat of the gaseous products of combustion of the charge of deflagrant as they flow along the conduit leading from the breech to the reaction chamber with the result that a delay occurs in producing the desired conditions within the reaction chamber.

According to the invention these disadvantages are removed by arranging for the supply to the conduit leading from the breech of monofuel the combustion of which is initially effected by the heated gaseous products of combustion of the deflagrant emerging from the breech whereby to supplement the gaseous products of combustion of the deflagrant by decomposed monofuel.

Thus in carrying out the invention the conduit leading from the breech is provided in the neighborhood of the breech with an inlet for the admission of monofuel thereto, at least a priming supply of monofuel being supplied to the conduit during the initiating stages of combustion within the reaction chamber. When decomposition of monofuel within the reaction chamber is established the supply of monofuel to the conduit may be cut off and only the fuel supply to the reaction chamber maintained.

The fuel supply to the conduit and to the reaction chamber is conveniently maintained by supplying the pressure developed within the reaction chamber to a differential pressure-producing device as described in prior application Serial No. 482,330, of Douglas Francis Welch, filed January 17, 1955, the high pressure side of the differential pressure-producing device from which the fuel supply emerges being connected to a fuel supply line which leads both to the reaction chamber and to a priming jet located on the wall of the conduit preferably near to the breech containing the supply of deflagrant for initiating combustion within the reaction chamber. The outflow from the differential pressure-producing device may be connected to a common fuel supply line for the priming jet and the reaction chamber inlet nozzle at a point intermediate between them.

The invention will be better understood by reference to the following description of the accompanying diagrammatic drawing showing a fuel system arranged to operate in accordance with the invention.

Referring to the drawing, the reaction chamber **1** is supplied with fuel from a fuel container **2** by way of a differential pressure-producing device **3** and a passageway or fuel pipe **4**. The differential pressure-producing device is arranged similarly to the device disclosed in the copending application above referred to, and consists of a cylinder having a piston **5** therein, the piston having an extension or rod **6** which causes the effective area on the lower side of the piston to be less than the effective area on the upper side of the piston. Pressure is supplied to the upper side of piston **5** by way of a pressure pipe **7** leading from the reaction chamber **1**, so that the pressure developed within the reaction chamber is caused to act on the upper face of piston **5**. As a result of the difference in the effective areas on either side of the piston, a pressure greater than that developed within the reaction chamber is applied to fuel located in the space below the piston, so that fuel is forced into the reaction chamber by way of passageways **4** and **4'** at a pressure greater than that existing within the reaction chamber. Fuel within the container **2** is led to the lower side of piston **5** by a fuel pipe **8** containing a non-return valve **9**.

In order to initiate combustion of monofuel within the reaction chamber **1** a supply of deflagrant **10'** is provided within a breech **10** which is connected with the reaction chamber by means of a conduit **11**. Means such as a source of electrical supply **12** and a push button type switch **12'** may be provided for igniting deflagrant in the breech **10** by an ignitor **12''**, such as a spark gap.

On the ignition of deflagrant issuing from the breech **10**, a supply of heated gaseous medium flows through the conduit **11** into the reaction chamber **1**, the pressure developed therein being applied to the differential pressure-producing device **3** to cause monofuel to be injected into the reaction chamber **1**, where its combustion is initiated by the heated gaseous products arising from the decomposition of the deflagrant.

In many installations, the breech **10** may have to be located at a distance from the reaction chamber **1**. Such a case arises where the reaction chamber **1** is designed to supply gaseous working fluid to a turbo-starter for an aircraft engine, the breech being located at a place remote from the engine convenient for its re-charging with a supply of deflagrant. In such cases, a considerable pressure drop may occur in the conduit **11**.

In accordance with the invention, this pressure drop is minimized by supplying to the conduit **11** monofuel from the passageway **4**. To this end, the passageway **4** is branched and one branch **4''** leads to an injection nozzle **13** provided in the conduit **11** in the neighborhood of the breech **10**, whereby a priming supply of monofuel is supplied to the conduit during the initiating stages of combustion within the reaction chamber. The heat and pressure supplied to the conduit by the decomposition of monofuel injected through nozzle **13** is sufficient to compensate for the pressure drop occurring within the conduit **11** and thereby to permit effective initiation of combustion of monofuel within the reaction chamber **1**.

It is to be understood that a sufficient quantity of monofuel may be contained within the device **3** for a single operation of a turbo-starter, or of an equivalent device.

If desired we may provide within the conduit **11** in the neighborhood of the breech a nozzle orifice of reduced cross section and admit the priming supply of

monofuel to the conduit on the reaction chamber side of the nozzle.

The priming supply of fuel to the conduit may be maintained during the time in which the reaction chamber is in operation, but the disadvantage then arises that the conduit will reach a possibly undesirably high temperature.

It will be evident that changes may be made to the apparatus shown in the drawing without departing from the scope of the invention as set forth in the appended claims; for example, the differential pressure-producing device is not an essential feature of the apparatus and may be replaced by a pressure-producing device operated by an external source.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In apparatus for producing a supply of gaseous working fluid for operation of a prime mover and utilizing a reaction chamber in which monofuel is adapted to be decomposed, means for initiating combustion of monofuel supplied to said reaction chamber comprising a breach containing a deflagrant, conduit means leading from said breech to said reaction chamber, means for igniting and releasing deflagrant from said breech to cause a flow of heated decomposed deflagrant by way of said conduit means into said reaction chamber, a container for monofuel, a passageway leading from said container to said reaction chamber, means operable by pressure produced in said reaction chamber to produce pressure in said container to cause monofuel to be injected into said reaction chamber by way of said passageway, and means connecting said passageway with said conduit means whereby to enable monofuel to be injected into said conduit means to be decomposed therein by heated gaseous products of said deflagrant and thereby to compensate for the pressure drop in said conduit of the heated gaseous products which flow therein.

2. Apparatus for producing a supply of gaseous working fluid for operation of a prime mover comprising a reaction chamber in which monofuel is adapted to be decomposed and means for initiating decomposition of monofuel supplied to said reaction chamber comprising a breech containing a deflagrant, conduit means leading from said breech to said reaction chamber, means for igniting and releasing deflagrant from said breech to cause a flow of heated decomposed deflagrant by way of said conduit means into said reaction chamber, a container for monofuel, a differential pressure-producing device, a fuel pipe leading from said container to the high pressure side of said pressure-producing device, a non-return valve in said fuel pipe, a passageway connecting the higher pressure side of said pressure-producing device with a fuel inlet nozzle in said reaction chamber, means connecting the higher pressure side of said pressure-producing device with said reaction chamber whereby pressure produced in said reaction chamber is effective to force fuel into said reaction chamber by way of said passageway, and means connecting said passageway with said conduit means whereby to enable monofuel to be injected into said conduit means to be decomposed therein by heated gaseous products of said deflagrant and thereby to compensate for the pressure drop in said conduit of the heated gaseous products which flow therein.

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