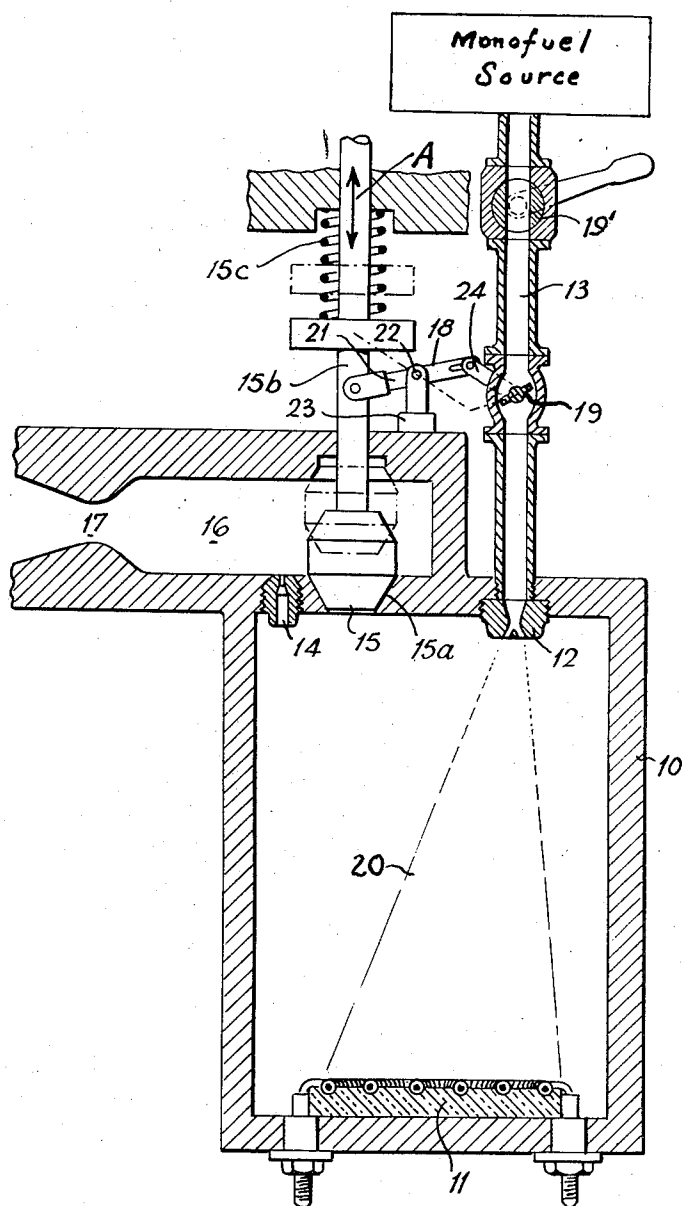


Jan. 20, 1959

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FUEL REACTION CHAMBERS

2,869,321

Filed Jan. 29, 1954



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FUEL REACTION CHAMBERS

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Application January 29, 1954, Serial No. 407,123

Claims priority, application Great Britain
February 5, 1953

7 Claims. (Cl. 60—39.28)

This invention relates to a fuel-reaction chamber for the decomposition of a monofuel. Reaction chambers of this kind have been disclosed in United States application Serial No. 291,618, dated June 4, 1952 now Patent No. 2,775,865, issued January 1, 1957. It has further been shown in the specification of the above-noted application, that a substantially closed reaction chamber may be constructed having an inlet and an outlet nozzle, self-sustained decomposition of the monofuel, sprayed into the chamber via the inlet nozzle, being induced by a heating means which causes gasification of the monofuel spray and brings it to the minimum temperature and pressure for the said decomposition to be sustained. An exothermic reaction then takes place which provides a supply of gas for a utilization device. The term "monofuel" is herein defined as a fuel which contains its own oxygen for its eventual decomposition.

It is known that such reaction chambers will only permit self-sustained decomposition of a monofuel to take place if the volume, pressure and temperature of the chamber are carefully controlled and to this end an auxiliary chamber acting as a reaction chamber of smaller volume than the main reaction chamber has been suggested.

It is the object of the present invention to combine the function of a main and auxiliary chamber in one reaction chamber.

According to the invention, we provide a monofuel reaction chamber having an inlet supply nozzle adapted to be coupled to an inlet fuel supply and an exhaust valve associated with an exhaust nozzle leading to a utilization device, the inlet fuel supply being provided with control means coupled to the exhaust valve and responsive to its movement, opening of the said exhaust valve being utilized to increase the fuel supply to the monofuel inlet nozzle.

Such a reaction chamber is arranged to provide two distinct functions within itself.

(I) that of an auxiliary chamber in which self-sustained decomposition of a monofuel supply is adapted to occur,

(II) that of a main chamber in which an increased flow of monofuel is decomposed by the conditions previously existing in the auxiliary chamber, the main chamber being now in communication with an exhaust nozzle to a utilization device.

According to another aspect of the invention we provide a substantially closed reaction chamber having an inlet nozzle for monofuel, a heating element and an exhaust valve, the reaction chamber being used initially as an auxiliary reaction chamber in which self-sustained decomposition of the monofuel is adapted to occur, the generation of pressure owing to the said decomposition of the monofuel being made to operate the said exhaust valve, which provides access to an exhaust nozzle and is associated with means to increase the supply of monofuel to the reaction chamber which now operates as a main reaction chamber.

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In carrying the invention into effect, the reaction chamber under starting conditions has a predetermined low rate of flow of atomized monofuel on to a heater (as in the auxiliary chamber suggested in the prior art) and a very small or no exhaust nozzle. When self-sustained decomposition of the monofuel occurs, pressure is generated within the chamber and this is utilized to operate a spring loaded exhaust valve which opens the chamber to an exhaust nozzle leading to a utilization device. Simultaneously, an increased rate of monofuel flow to the chamber is effected through means associated with the said spring loaded exhaust valve. During the opening of the spring loaded exhaust valve, the monofuel supply must be increased at such a rate that sufficient pressure is exerted on the said valve to cause progressive opening. This must be achieved in a number of ways, for example, by mechanical, hydraulic or electrical servo mechanism between the said spring loaded exhaust valve and a control means in the monofuel supply pipe to the reaction chamber. Alternatively, a separate pressure operated means may be arranged to increase the monofuel flow progressively to a maximum value determined by the flow of working fluid required and the consequent size of the reaction chamber. Again, it is envisaged that the monofuel flow may be accurately controlled on a time basis by utilizing a time operated fuel-flow valve.

The invention will be more clearly appreciated from the following description with reference to the figure of the accompanying drawing which shows a reaction chamber in sectional elevation. Referring now specifically to the figure of the drawing, a substantially closed reaction chamber 10 is provided with a heater 11 and an inlet nozzle 12, which atomizes monofuel fed from the supply pipe 13 and is arranged to direct a stream of atomized fuel from the nozzle 12 towards the heater 11, as shown by dot-dash lines 20 in the drawing. A spring loaded exhaust valve 15 is provided in the upper wall of the reaction chamber and this operates in the direction of the arrows A to open or close an orifice 15a giving access to an exhaust conduit or duct 16 which communicates with a main exhaust nozzle 17 to a utilization device. Attached to the stem 15b of the exhaust valve, spring loaded at 15c, is a link mechanism 18, which is mechanically connected to a fuel supply valve 19 such as a butterfly valve situated in the supply pipe 13. A manually controlled valve 19' is provided in fuel supply pipe 13. The link mechanism 18 consists of a link 21 pivotally connected at one end to the stem 15b of the exhaust valve 15, and pivotally mounted intermediate its ends at 22 on a fixed support 23. The other end of link 21 is pivotally connected with the operating arm 24 of the butterfly valve 19. The operation of the reaction chamber is as follows: the heater 11 is switched on and brought to the requisite temperature, monofuel is then supplied to the reaction chamber 10 by opening the manually controlled valve 19' in the fuel supply pipe 13, via inlet nozzle 12. Valve 15 being closed on its seating by spring 15c, decomposition of monofuel takes place in the reaction chamber which is now operating as an auxiliary chamber. An auxiliary exhaust nozzle 14 may be used to permit a small continuous supply of decomposed fuel to enter the duct 16. Thus, as decomposition with an initial low rate of fuel supply occurs, the fuel supply valve 19 being initially adjusted to a minimum open position, pressure is built up within the auxiliary reaction chamber to open exhaust valve 15. This increases the exhaust aperture through orifice 15a, and with the movement of the valve 15, the fuel supply valve 19 is arranged to increase the fuel supply through pipe 13 and inlet nozzle 12 which in turn increases the pressure in the chamber 10. The increased fuel supply will be decomposed owing to the conditions existing in the chamber and the chamber will

now behave as a main reaction chamber, decomposed fuel being fed directly to the exhaust nozzle 17, via the orifice 15a and the duct 16. The pressure in reaction chamber 10 then gradually builds up until the exhaust valve 15 is fully open; at this stage butterfly valve 19 is also fully open and the maximum amount of fuel is admitted to the reaction chamber 10. The reaction can be stopped by closing a manually controlled valve 25 in fuel supply pipe 13.

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

1. Apparatus for the production of a flow of gaseous working fluid for a prime mover by the decomposition of a monofuel comprising a reaction chamber, heating means in said chamber, a source of monofuel, a monofuel inlet supply conduit leading into said chamber from said source, an exhaust conduit leading from said chamber, exhaust valve means located in said exhaust conduit, means biasing said exhaust valve means toward closed position, said exhaust valve means being opened in response to predetermined fluid pressure developed in said reaction chamber by decomposition of monofuel supplied thereto, a fuel supply regulating valve in said inlet supply conduit, and means connecting said exhaust valve means to said fuel supply regulating valve to open said latter valve responsive to opening of said exhaust valve means, whereby to increase the supply of monofuel to said chamber when said exhaust valve means opens in response to the attainment of the predetermined pressure therein.

2. Apparatus for the production of a flow of gaseous working fluid for a prime mover by the decomposition of a monofuel comprising a reaction chamber, heating means in said chamber, a source of monofuel, a monofuel inlet supply conduit leading into said chamber from said source, a fuel inlet nozzle terminating said inlet supply conduit and located to direct a stream of atomised fuel from said inlet nozzle towards said heating means, an exhaust conduit leading from said chamber, exhaust valve means located in said exhaust conduit, means biasing said exhaust valve means toward closed position for closing said exhaust conduit, said exhaust valve means being opened in response to predetermined fluid pressure developed in said reaction chamber by decomposition of monofuel supplied thereto, a monofuel supply regulating valve in said inlet supply conduit, and means connecting said exhaust valve means to said monofuel supply regulating valve to open said latter valve responsive to opening of said exhaust valve means whereby to effect an increase in the supply of monofuel to said chamber when said exhaust valve means opens in response to the attainment of the predetermined pressure therein.

3. Apparatus for the production of a flow of gaseous working fluid according to claim 2 having an auxiliary exhaust nozzle of restricted area by-passing said exhaust valve means for permitting gaseous products of combustion of said monofuel to flow into said exhaust conduit.

4. Apparatus for producing a flow of gaseous working fluid according to claim 3 in which said fuel inlet nozzle and said exhaust valve means are located adjacent one another in one wall of said chamber.

5. Apparatus for the production of the flow of gaseous working fluid according to claim 2 having an auxiliary exhaust nozzle in said exhaust conduit.

6. Apparatus for producing a flow of gaseous working fluid for a prime mover by the decomposition of a monofuel comprising a reaction chamber, a source of monofuel, a monofuel inlet supply conduit leading to said chamber from said source, an exhaust conduit leading from said chamber, exhaust valve means biased to the closed position for closing said exhaust conduit, said exhaust valve means being adapted to be opened in response to a predetermined fluid pressure developed in said reaction chamber by decomposition of monofuel supplied thereto, means for initiating decomposition of monofuel supplied to said reaction chamber, a fuel supply regulating valve in said inlet supply conduit, and a mechanical linkage connecting said exhaust valve means to said fuel supply regulating valve to open said latter valve responsive to opening of said exhaust valve means whereby to control the supply of monofuel to said chamber in dependence on the pressure developed therein to increase the supply of monofuel when said exhaust valve means opens in response to the attainment of the predetermined pressure in said chamber.

7. Apparatus for the production of a flow of gaseous working fluid according to claim 6 in which said means for initiating decomposition of monofuel supplied to said reaction chamber comprises an electrical resistance heater positioned to be impinged upon by monofuel entering said reaction chamber through an atomizing nozzle terminating said monofuel inlet supply conduit.

References Cited in the file of this patent

UNITED STATES PATENTS

1,052,588	Janicki	Feb. 11, 1913
2,154,572	Lansing	Apr. 18, 1939
2,221,185	Farlow	Nov. 12, 1940
2,545,815	Klinge	Mar. 20, 1951
2,648,190	Maisner	Aug. 11, 1953