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IGNITION MEANS FOR COMBUSTION CHAMBERS

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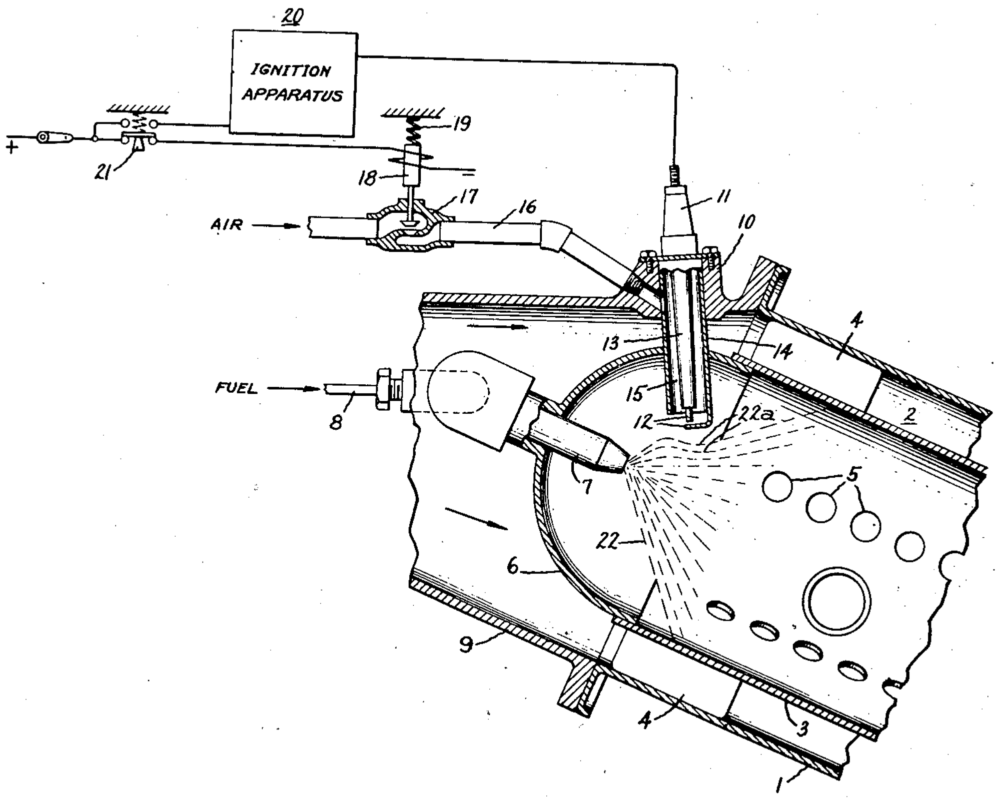


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## IGNITION MEANS FOR COMBUSTION CHAMBERS

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4 Claims. (Cl. 60—44)

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This invention relates to constant pressure internal combustion power plants, particularly to fluid insulating and cooling means for the ignition devices of such power plants.

The invention is well adapted for use in connection with gas turbine power plants, and it is this application of our invention which we have elected specifically to illustrate and describe. It is to be understood, however, that the invention is not limited thereto necessarily.

It has been found that a serious limitation is imposed upon the permissible power rating, operating temperature limits, and maximum interval between overhauls of thermal power plants of the type described, because of the inability of the igniting device to withstand exceedingly high temperatures. Accordingly, it is an object of this invention to provide a novel arrangement for cooling the igniting device.

It is also an object of the invention to minimize the fouling of the igniting device resulting from the deposition of unburned fuel or carbonized particles on the electrodes, insulator or other exposed parts of the igniting device, which might provide a current leakage path or otherwise adversely effect ignition of the fuel by the spark.

Other objects and advantages will be apparent from the following description taken in connection with the accompanying drawing, in which 1 indicates an outer casing defining an air supply space or plenum chamber 2, in which a cylindrical inner wall or "liner" 3 is co-axially supported, as for instance by a plurality of radially extending fins or baffles 4. These baffles may be welded to the outer surface of liner 3 and arranged to slide freely into the outer housing 1. The closed end of the combustion space is formed by the end dome 6 which supports a fuel nozzle 7, which is preferably of a type which produces a conical spray of fuel particles, as indicated by the spray pattern 22. A conduit 8 serves to conduct fuel to the nozzle from a suitable fuel supply (not shown). The fuel supply means forms no part of this invention and is therefore not shown.

For the purpose of illustration, the combustor shown is similar to that disclosed in a copending application of Anthony J. Nerad, Serial No. 501,-106, filed September 3, 1943, and assigned to the same assignee as the present application; but it should be noted that the invention may be applied to other combustion devices of the general type described. Said copending application is now abandoned, and a continuation-in-part, Serial No. 750,015, was filed May 23, 1947.

As more particularly described in the above-mentioned application of Anthony J. Nerad,

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combustion air under pressure is conveyed by means of a duct or "air adapter" 9 from a suitable compressor (not shown) to the air supply space 2. This combustion air is then admitted to the reaction space within liner 3 through a plurality of spaced holes 5.

In order to initiate combustion in the reaction space, an igniting device, which may be a suitable electric spark-plug, is provided. Spark-plug 11 may be supported on air adapter 9 by a mounting boss 10 so as to project through the end dome 6. The design and arrangement of the spark-plug is such that the electrodes 12 defining the spark gap are located in the normal path of fuel particles sprayed from nozzle 7, that is, in the surface of the conical spray pattern 22. Surrounding the insulator 13 of spark plug 11 is a cylindrical co-axially spaced metal sleeve 14 forming an annular cooling air passage 15. The end of sleeve 14 which projects into the liner may be shaped to form one of the electrodes 12.

Cooling air under pressure is introduced into the upper portion of the passage 15 by means of a conduit 16, which conducts air from a suitable source to cooperating passages provided in mounting boss 10 and sleeve 14. This cooling air may be obtained from the same compressor which serves as the source of combustion air. This arrangement is feasible because in the ordinary operation of a combustor of the type described there will be an appreciable pressure drop from the space 2 to the reaction space within liner 3. This pressure drop is therefore available to effect the flow of cooling air through conduit 16 and passage 15. Of course a separate auxiliary source of the cooling air, at any desired pressure, may be employed. A valve 17 is provided in the conduit 16 for interrupting the flow of cooling air to the spark plug. As illustrated in the drawing, valve 17 is positioned by means of a solenoid 18 and a spring 19. Compression spring 19 biases the valve to closed position, and solenoid 18 is arranged to hold the valve open when energized.

Suitable ignition apparatus represented diagrammatically at 20 for energizing the spark plug 11 is provided. Electrical energy for ignition and for operation of the solenoid 18 is derived from a suitable source (not shown). For simultaneously controlling the ignition apparatus 20 and the valve solenoid 18, switch 21 is provided. With switch 21 in the position indicated in the drawing, solenoid 18 is energized and therefore holds valve 17 in open position against the bias of spring 19. Thus cooling air is caused to flow through conduit 16 and the cooperating passages provided in mounting boss 10 and sleeve 14, then through the passage 15 over and across the insulating body 13 and the electrodes 12 of spark plug 11.

With this arrangement, cooling and insulating air is supplied through space 15 during the normal operation of the combustion device. Thus the insulator 13 is cooled and the air issuing from the open end of sleeve 14 forms a jet which cools electrodes 12 and also tends to blow fuel particles away from the electrodes so as to prevent the deposition of carbonized particles thereon, as represented diagrammatically in the drawing by the deflected flow lines 22a. Thus the vulnerable electrodes are cooled and insulated from partly burned fuel particles during the combustion process. The cooling air also supplies extra oxygen so as to insure complete combustion in the neighborhood of the spark-plug, thereby reducing the amount of unburned fuel, which might otherwise carbonize and be deposited on the comparatively cool spark-plug parts.

When it is desired to initiate combustion, switch 21 is depressed to engage the upper set of contacts in the drawing. This causes the electrical current to flow through the ignition apparatus 20 and thence to spark plug 11. Simultaneously the circuit to solenoid 18 is opened, thereby deenergizing the solenoid and allowing valve 17 to close under the action of spring 19. Thus the flow of cooling air to spark-plug 11 is interrupted. The fuel spray is now free to impinge on the exposed end of the spark-plug, so that an ignitable fuel-air mixture is supplied to the space adjacent the spark, which thereupon initiates combustion.

Thus it will be seen that our invention provides a simple yet effective arrangement for cooling the igniting device of a combustor, and also preventing fouling by carbonized fuel particles, so that the permissible power rating and operating temperature limits are raised and the time interval between overhauls is increased.

While a particular embodiment of the invention has been illustrated and described, it will be apparent to those familiar with the art that various changes and modifications may be made without departing from the invention, and it is intended to cover in the appended claims all such changes and modifications as come within the true spirit and scope of the invention.

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

1. In a combustion apparatus, the combination of walls defining a combustion chamber, nozzle means adapted to inject fuel into the combustion chamber, an igniting device having an end portion projecting into the combustion chamber, means for energizing the igniting device to initiate the combustion process, means for supplying cooling fluid under pressure, shroud means surrounding the igniting device and spaced therefrom to form a cooling passage, said shroud having an end portion defining a nozzle adapted to project a jet of fluid for cooling the projecting end portion of the igniting device and for preventing the impingement of fuel particles thereon, conduit means for supplying cooling fluid from said supply means to said cooling passage, valve means for controlling the flow of cooling fluid through said conduit, and means for controlling said energizing means and valve whereby the supply of cooling fluid to the igniting device is discontinued when the igniting device is energized.

2. In a combustion apparatus, the combination of walls defining a combustion chamber, nozzle means adapted to inject fuel into the combustion chamber with a substantially conical spray pattern, an igniting device having an end portion projecting into the combustion chamber and substantially in the surface of the spray pattern, means for energizing the igniting device to initiate the combustion process, means for supplying cooling fluid under pressure, shroud means surrounding the igniting device and spaced therefrom to form a cooling passage, said shroud having an end portion defining a nozzle adapted to project a jet of fluid for cooling the projecting end portion of the igniting device and for preventing the impingement of fuel particles thereon, conduit means for supplying cooling fluid from said supply means to said cooling passage, valve means for controlling the flow of cooling fluid through said conduit, means for controlling said energizing means to effect ignition, and means adapted to simultaneously close said valve to discontinue the supply of cooling fluid when the igniting device is energized, whereby fuel particles are prevented from reaching the igniting device except when said device is energized.

3. In a combustion apparatus, the combination of walls defining a combustion chamber, nozzle means adapted to inject fuel into the combustion chamber, an igniting device having an end portion projecting substantially in the path of the fuel injected into the combustion chamber, means for energizing the igniting device to initiate the combustion process, means for supplying cooling fluid under pressure, shroud means surrounding said projecting end portion and spaced therefrom to form a cooling passage and having an end portion adapted to form one electrode for the ignitor, conduit means for supplying cooling fluid from said supply means to said cooling passage, and valve means for controlling the flow of cooling fluid through said conduit during periods when the igniting device is energized.

4. In a combustion apparatus, the combination of walls defining a combustion chamber, nozzle means adapted to inject fuel into the combustion chamber with a substantially conical spray pattern, an igniting device having an end portion projecting into the combustion chamber and including electrodes defining a spark gap located substantially in the surface of the spray pattern, means for energizing the igniting device to initiate the combustion process, means for supplying cooling fluid under pressure, shroud means surrounding the igniting device and spaced therefrom to form a cooling passage, said shroud means defining a nozzle adapted to project a jet of fluid for cooling the electrodes and deflecting the spray pattern so that fuel particles do not reach the spark gap, conduit means connecting said supply means with the cooling passage, valve means adapted to interrupt the supply of cooling fluid from said supply means through said conduit, and means for simultaneously energizing the igniting device and actuating the valve to stop the flow of cooling fluid, whereby fuel particles in the spray pattern are permitted to approach the spark gap only during the ignition process while the igniting device is cooled and protected from the impingement of fuel particles during the combustion process.

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