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COMBUSTION CHAMBER WITH FUEL VAPORIZING PIPES FOR INTERNAL-COMBUSTION TURBINE PLANTS

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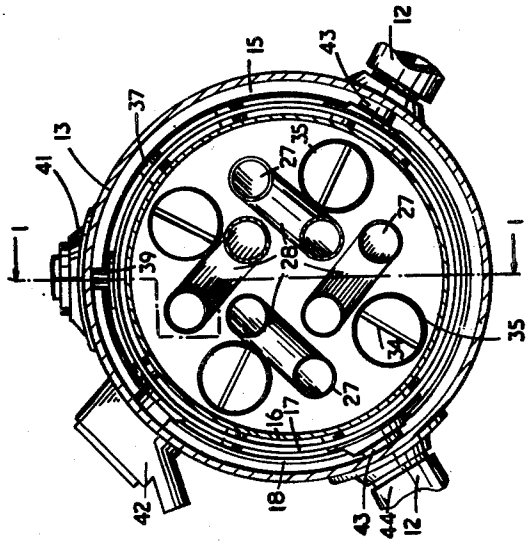


FIG. 2

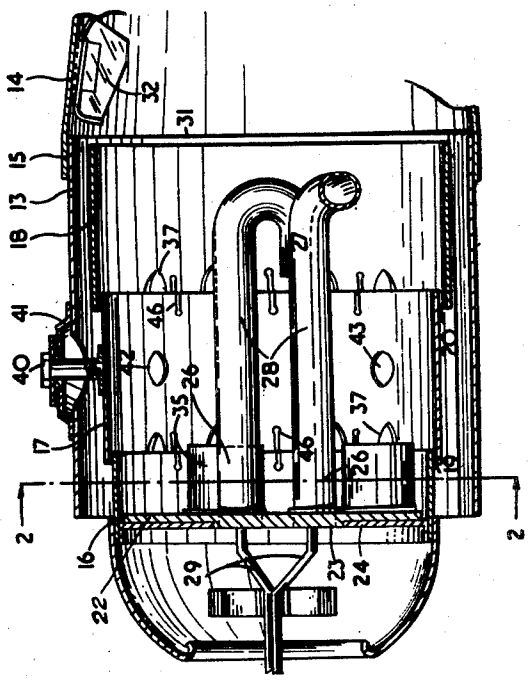


FIG. 1.

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COMBUSTION CHAMBER WITH FUEL VAPORIZING PIPES FOR INTERNAL-COMBUSTION TURBINE PLANTS

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6 Claims. (Cl. 60—44)

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This invention relates to a combustion chamber, for an internal-combustion turbine plant, for burning paraffin, diesel oil or other high flash-point liquid fuel, of the kind comprising a casing within and along which the compressed air travels and an inner casing within which combustion takes place.

Our main object is to provide a chamber of this kind which, whilst being relatively short in the direction of the flow, will ensure the completion of combustion without any of the parts becoming overheated in an unsatisfactory manner.

According to the invention, the inner casing comprises over-lapping elements spaced from one another so as to allow of some of the air, passing between the inner and outer casing, to travel inwardly of and adjacent the elements to heat-insulate them from the flaming mixture, and the inlet end of the inner casing carries a baffle having primary air holes communicating with the inlet ends (into which the liquid fuel is injected for combustion with the primary air) of J-like pipes with their curved ends extending forwardly and directed towards parts of the baffle between other holes each having a slit-type burner or nozzle through which enters the main portion of the secondary air necessary for combustion to be substantially completed within the inner casing, the planes of the air jets through the burners being arranged so that each will be substantially at right angles to the line joining the centres of the outlets of the two adjacent J-like pipes.

Preferably an internal-combustion turbine plant has a combustion chamber unit comprising a circle of axially-extending elongated combustion chambers each arranged as aforesaid and communicating with one another by lateral passages, each chamber being of generally circular cross-section. The J-like pipes within the inner casing of each combustion chamber preferably have their curved ends extending outwardly of their inlet ends and disposed to be substantially mid-way between the slit-type nozzles, substantially to form a circle therewith in axial view, the planes of the burner slits being substantially radial.

In the accompanying drawing:

Figure 1 is a fragmentary sectional elevation through one form of cumbustion chamber according to the invention, the section being taken on the line 1—1 of Figure 2; and

Figure 2 is a cross-section thereof taken on the line 2—2 of Figure 1.

In the construction shown there is a single combustion chamber forming one of a combustion

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chamber unit as aforesaid, the chamber being connected by lateral passages 12, 12 with the adjacent combustion chambers (not shown).

The drawing shows part 13 of the outer casing, this part being cylindrical and connected at its outlet end to a converging tubular portion 14 within the interior of which the substantially-completed products of combustion mix with diluent air flowing along the annular passage 15 between the outer casing 13 and the inner casing. The latter is shown as being built up of three overlapping annular elements 16, 17, and 18, the element 17 being outside and spaced from the element 16 to allow of some of the air (passing along the annular passage 15) entering the annular opening 19 and passing within and alongside the interior of the element 17. In like manner some of the air from the passage 15, entering through the annular opening 20, passes alongside and within the interior of the element 18. By these means these elements are heat insulated from the flaming mixture within the interior of the inner casing.

The inlet end of the inner casing is closed by a baffle which is shown as comprising a disc 22 having a central portion 23 spigotally entered into an annular disc 24 welded or otherwise secured to the adjacent end of the first element 16 of the inner casing. The spigotal portion 23 has in it a circle of four holes which receive the inlet ends 26, 26 of J-like pipes 28, 28 the outlet ends 27, 27 of which extend forwardly.

Liquid fuel such as kerosene is injected into the inlet openings 26, 26, being led thereto under pressure by fuel supply pipes 29, 29. This liquid fuel, injected into the primary air taken in by the inlet ends of the J-like pipes 28, 28, causes a flaming mixture to issue from the outlet ends 27, and in the space round the pipes 28 this flaming mixture receives secondary air sufficient for combustion to be substantially completed before the products leave the outlet end 31 of the inner casing to mix with the diluent air from the passage 15. Mixing devices may be secured to the interior surface of the extension 14, one such device being illustrated diagrammatically at 32. A series of these may be arranged round the interior of the extension 14.

In the present instance the secondary air is brought in through slots 34 of slit-type nozzles 35 mounted in openings in the discs 22, 24 constituting the baffle at the inlet end of the inner casing. The openings for the nozzles 35 are disposed to be substantially between (in axial view, as shown by Figure 2) the adjacent outlet ends

27 of the J-like pipes 28, substantially forming therewith a circle. By bringing the secondary air in this way (i. e., spread out like a fan between adjacent outlets 27) into the flaming mixture of primary air and liquid fuel substantially complete combustion is ensured in a combustion chamber which is of quite short length in an axial direction, and the J-like pipes are prevented from becoming overheated in a satisfactory manner. The heat in the space round the J-like pipes serves for raising these to a temperature at which the liquid fuel will be sufficiently vaporised to ensure the thorough mixing thereof with the primary air, which is another feature contributing to accelerating combustion.

In the present instance, the intermediate element 17 of the inner casing is connected to the other elements 16 and 18 by means of spacers indicated at 37, 37 which, for convenience, are welded thereto. The intermediate element 17, in the exampie shown, is supported from the outer casing 13 at four places. At one of these places there is an internally-threaded radially-extending tube 39 which receives a locating screw 40 engaged with a housing 41 secured to the outer surface of the outer casing portion 13. At another place the intermediate element 17 is secured to the outer casing 13 by means of a combustion starting device, indicated at 42. This may take the form of a torch igniter (as is actually illustrated at 42 of Figure 2) or of an auxiliary fuel spray device.

The two other points of the support comprise the later passages 12, 12. These, in particular, include an internal tube 43 for carrying the flaming gases from the interior of one inner casing to the interior of the inner casing of an adjacent combustion chamber, and an external tube 44 spaced from and surrounding the inner tube 43 and serving for connecting the diluent air space 15 of one combustion chamber with that of the next adjacent one.

It will be observed that the annular elements 16, 17 and 18 are slit, as shown at 46, in order to provide flexibility and prevent distortion from occurring in working conditions where they are secured together.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. A combustion chamber, for an internal-combustion turbine plant, for burning a high flash-point liquid fuel, comprising a casing within and along which the compressed air travels and an inner casing within which combustion takes place, the inner casing comprising overlapping elements spaced from one another so as to allow of some of the air passing between the inner and outer casings to travel inwardly of and adjacent the elements to heat insulate them from the flaming mixture, the inlet end of the inner casing carrying a baffle with primary air holes in it, J-like pipes communicating with the holes and with their curved ends extending forwardly and directed towards parts of the baffle between other holes, and, communicating with said other holes, slit-type nozzles through which enters the main portion of the secondary air necessary for combustion to be substantially completed within the inner casing, the planes of the air jets through said nozzles being arranged so that each will be substantially at right angles to the line joining the centres of the outlets of the two adjacent J-like pipes.

2. A combustion chamber, according to claim 1, in which the J-like pipes have their curved ends extending outwardly of their inlet ends and disposed to be substantially midway between the slit-type nozzles, substantially to form a circle therewith in axial view, the planes of the slit-type nozzles being substantially radial.

3. A combustion chamber, for an internal-combustion turbine plant, for burning a high flash-point fuel such as kerosene, including an elongated outer casing of substantially circular cross-section, a coaxial inner casing spaced radially therefrom and built up of a plurality of axially-spaced tubular elements of different diameters, so that an intermediate element is of less diameter than one of the adjacent elements and of greater diameter than the other adjacent element, a baffle means at the free end of the smallest element, a plurality of J-like pipes supported within the inner casing with the free ends of their main portions engaged with a circle of holes in said baffle means, the curved ends of said pipes being directed towards places in said baffle means between other holes in said baffle means, nozzles, communicating with said other holes, which supply the main portion of the secondary air necessary for combustion to be substantially completed within the inner casing, and means for injecting the liquid fuel into the said free ends of the said main portions.

4. A combustion chamber, for an internal-combustion turbine plant, for burning a high flash-point liquid fuel such as kerosene, including an elongated outer casing of substantially circular cross-section, a shorter elongated inner casing spaced radially therefrom, a baffle means at one end of said inner casing, a plurality of J-like pipes supported within said inner casing with the free ends of their main portions engaged with a circle of holes in said baffle means and with their curved ends outwardly of said free ends and directed towards places in said baffle means substantially midway between another circle of holes in said baffle means, slit-type nozzles in said other circle of holes respectively, and means for injecting the liquid fuel into said free ends.

5. A combustion chamber, for an internal-combustion turbine plant, for burning a high flash-point liquid fuel such as kerosene, including an elongated outer casing of substantially circular cross-section, a shorter elongated inner casing spaced radially therefrom, a baffle means at one end of said inner casing, a plurality of J-like pipes supported within said inner casing with the free ends of their main portions engaged with a circle of holes in said baffle means and with their curved ends outwardly of said free ends and directed towards places in said baffle means substantially midway between another circle of holes in said baffle means, slit-type nozzles in said other circle of holes respectively, and means for injecting the liquid fuel into said free ends, said nozzles arranged with their slits in substantially radial planes.

6. A combustion chamber, for an internal-combustion turbine plant, for burning a high flash-point liquid fuel such as kerosene, including an elongated outer casing of substantially circular cross-section, a shorter elongated inner casing spaced radially therefrom, a baffle means at one end of said inner casing, a plurality of J-like pipes supported within said inner casing with the free ends of their main portions engaged with a circle of holes in said baffle means

and with their curved ends outwardly of said free ends and directed towards places in said baffle means substantially midway between another circle of holes in said baffle means, annular stub nozzles in said other circle of holes respectively, said annular stub nozzles having slots through the further end thereof for restricting air flow therethrough, and means for injecting the liquid fuel into said free ends, said nozzles arranged with their slits in substantially radial planes.

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