

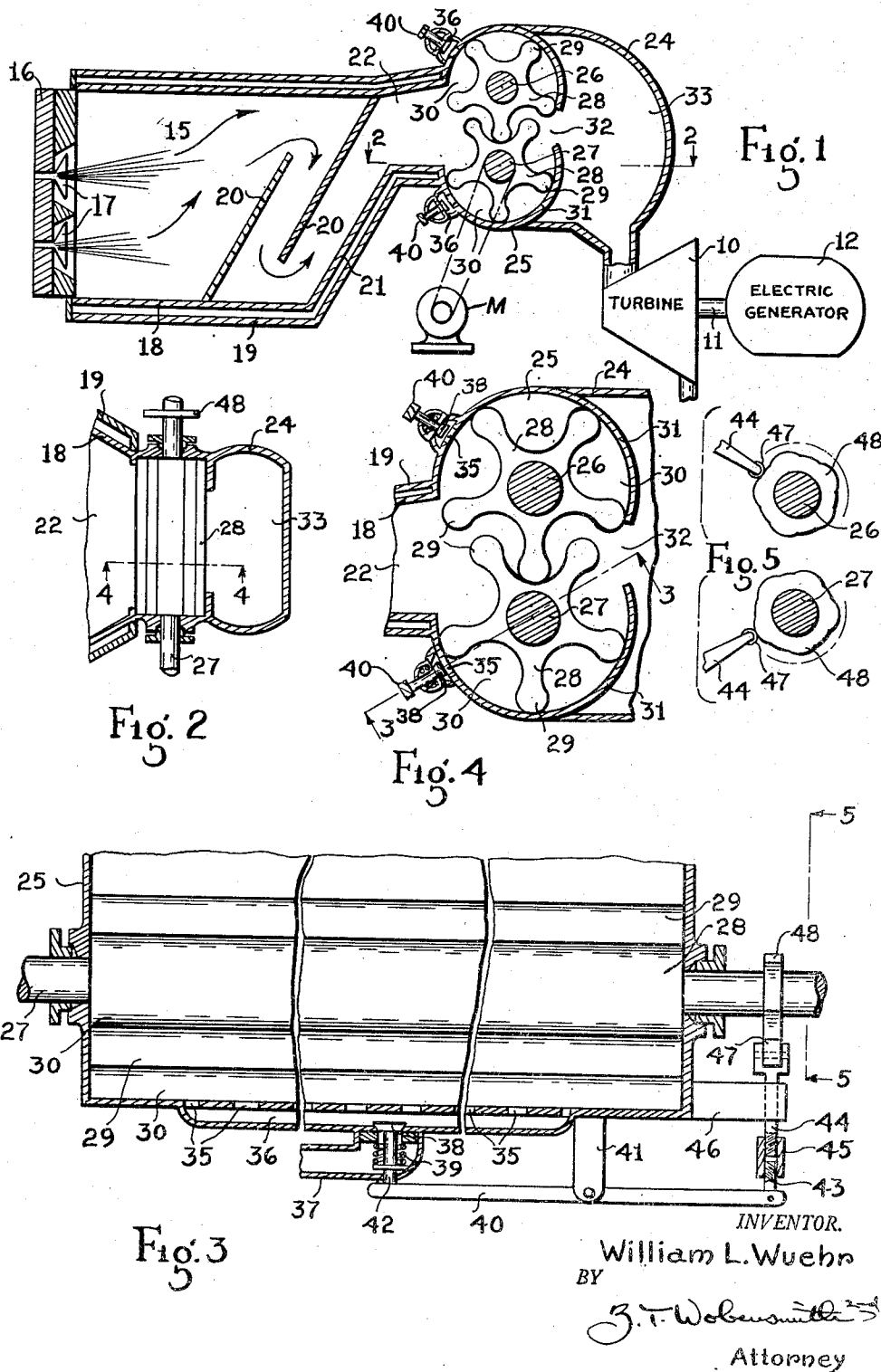
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GAS TURBINE

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GAS TURBINE

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This invention relates to gas turbines, and more particularly to turbines operated by combustion products and steam.

It has heretofore been proposed to provide gas turbines having associated therewith combustion chambers for the generation of products of combustion under pressure for operating the turbine. It has also heretofore been proposed to introduce steam or water vapor into the products of combustion for cooling the gases and for utilizing the energy in the steam for operating the turbine. In such gas turbines as heretofore proposed, the steam or water vapor was, in many instances, introduced in a manner which interfered with the combustion, or the steam or water vapor was introduced in such a manner that it did not come into intimate contact with the gases and did not mingle therewith.

In accordance with the present invention, a gas turbine is provided having improved means for introducing steam or water vapor into the products of combustion after the completion of the combustion.

In accordance with the present invention also, a gas turbine is provided in which the steam or water vapor is introduced into measured charges of the combustion gases and in timed relationship.

In accordance with the present invention also, a pump is interposed between the combustion chamber and the turbine rotor for the regulated delivery of the combustion gases to the turbine rotor.

In accordance with the present invention also, a gas turbine is provided having a pump interposed between the combustion chamber and the turbine rotor, the pump being provided with controlled mechanism for introducing steam or water vapor into the gases during their passage through the pump.

Other objects and advantageous features of the invention will be apparent from the specification and claims.

The nature and characteristic features of the invention will be more readily understood from the following description, taken in connection with the accompanying drawing forming part hereof, in which:

Figure 1 is a diagrammatic sectional view illustrating a gas turbine in accordance with the present invention;

Fig. 2 is a horizontal sectional view taken approximately on the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view, enlarged, taken approximately on the line 3—3 of Fig. 4;

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Fig. 4 is a vertical sectional view, enlarged, taken approximately on the line 4—4 of Fig. 2; and

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 3.

It should, of course, be understood that the description and drawing herein are illustrative merely, and that various modifications and changes may be made in the structure disclosed without departing from the spirit of the invention.

Referring more particularly to the drawing, in which a preferred embodiment of the invention is illustrated in diagrammatic form, a turbine 10 is provided of any preferred type having a rotor (not shown) carried on a turbine shaft 11. The turbine shaft 11 may be connected to any desired mechanism to be operated, but is preferably connected to an electric generator 12.

A combustion chamber 15 is provided of any desired type, preferably having an end wall 16 provided with suitable fuel inlet devices 17 of any preferred type for the introduction, under pressure, of gaseous fuel, liquid fuel or powdered coal, together with the requisite air required for combustion under pressure. The combustion chamber 15 is preferably provided with an enclosing wall 18 which may have a suitable water jacket 19 for cooling. The combustion chamber 15 is preferably provided in the interior thereof, and spaced from the fuel and air inlet devices 17, with a plurality of baffles 20 of refractory material. The combustion chamber 15 at the end opposite the wall 16 preferably has an end wall 21 shaped to provide a gas outlet duct 22 from the combustion chamber 15 of smaller cross sectional area than the main body of the combustion chamber 15.

At the end wall 21 a pump 25 is provided. The pump 25 may be driven in any desired manner such as by a motor M, and of any preferred type, but is preferably a gear type pump having a pair of parallel shafts 26 and 27 in a casing 24, each having mounted thereon an impeller 28. As shown the impellers 28 each has a plurality of lobes 29 which are adapted to successively interengage in recesses 30 on the other impeller 28. The impellers 28 are each mounted within casing portions 31 of cylindrical shape, the casing portions 31 being spaced at the outlet end thereof to provide a passageway 32 for the discharge of the gases into a pump discharge chamber 33 formed within the pump casing 24.

Each of the interior casing portions 31 adjacent the inlet of the pump 25, is provided with

a plurality of ports 35 in communication with a chamber 36. The chambers 36 each have a steam or water vapor supply pipe 37 connected thereto. The pipe 37 is connected to any suitable supply of water vapor or steam under pressure and if desired the supply may comprise a steam generator (not shown).

Valves 38 are provided for controlling the delivery of the steam or water vapor from the pipes 37 to the chambers 36. In order to control the movement of the valves 38, a spring 39 is provided for normally maintaining each valve 38 in closed position, and valve actuating levers 40 are provided for each valve 38, pivotally mounted in brackets 41 on the pump casing 24. The valve actuating levers 40 are adapted, at one end thereof, to engage the stem 42 of one of the valves 38 and the other end of each valve lever 40 is provided with a pivotally connected valve actuating rod. The valve actuating rods are preferably each made in two parts 43 and 44 having oppositely threaded ends, and adjusting sleeves 45 having corresponding threaded portions in engagement with the threaded ends are provided for adjustment of the length of time of opening of the valves 38. The valve actuating rods 44 are supported in brackets 46 carried by the casing 24, and are each provided with a follower roller 47 for engagement with cams 48 mounted on the rotor shafts 26 and 27. The shafts 26 and 27 of the rotor may be operated in any desired manner, but preferably by a suitable motor connected to one of the shafts which permits of operation of the pump at the desired rate of speed.

In the operation of the gas turbine in accordance with the present invention, fuel and air are supplied under pressure through the fuel inlet devices 17 for combustion in the combustion chamber 15. The combustion is effected under pressure and the gaseous products of combustion pass over and are guided by the baffles 20 and advance to the gas outlet duct 22.

Steam or water vapor under pressure is supplied through the supply pipes 37 for admission under the control of the valves 38 to the chambers 36 and through the ports 35, as hereinafter explained.

The pump 25 is driven in any desired manner and at a rate of speed to withdraw the gaseous products of combustion at the gas outlet duct 22.

The rotation of the impellers 28 of the pump 25, the upper of which moves in a clockwise direction and the lower of which moves in a counter clockwise direction, causes measured charges of gaseous products to be enclosed successively within the recesses 30 between the lobes 29 and in the casing portions 31 and advanced to the passageway 32. As charges of gas are initially enclosed in the spaces within the recesses 30 and the casing portions 31, the cams 48, through the valve rods 44 and 43 and the valve actuating levers 40, effect the opening of the valves 38 to admit steam or water vapor through the chambers 36 and the ports 37 into contact with the enclosed charges of gaseous products of combustion. The quantity of aqueous vapor introduced may be varied by adjustment of the sleeves 45. The steam or water vapor is thus brought into intimate contact with the gaseous products of combustion so that the temperature of these gases is reduced. If water vapor is introduced it is completely vaporized and may be superheated in contact with the hot gases, and if steam is introduced the steam is superheated.

The gases of combustion and the steam are discharged together at the passageway 32 and pass through the pump chamber 33 to the turbine 10. The turbine 10 is operated by the mixture of gaseous products of combustion and the steam therein for driving the electric generator 12.

I claim:

1. In a power plant including a combustion chamber for the generation of products of combustion under pressure and a turbine, a rotary pump connected to the outlet of said combustion chamber for delivering measured charges of gaseous products of combustion therefrom, a fluid connection to said pump for the delivery thereto of aqueous fluid for admixture with said measured charges of the gaseous products of combustion in said pump, and a connection between said pump and said turbine for the delivery of the products of combustion and aqueous fluid from said pump to said turbine.

2. In a power plant, a combustion chamber for the generation of gaseous products of combustion under pressure, said chamber having a gas delivery outlet, a rotary pump connected to said outlet for delivering measured charges of the gaseous products of combustion therefrom, means connected to said pump for delivering aqueous fluid thereto for admixture with said measured charge of said gaseous products of combustion, a primer mover, and a fluid connection from said pump to said prime mover for the delivery of the gaseous fluid from said pump to said prime mover.

3. In a power plant, a combustion chamber for the generation of gaseous products of combustion under pressure, said chamber having a gas delivery outlet, a rotary pump connected to said outlet for delivering measured charges of gaseous products of combustion therefrom, means connected to said pump for delivering aqueous fluid thereto for admixture with said measured charges in said pump, a prime mover, and a fluid connection from said pump to said prime mover for the delivery of the gaseous fluid from said pump to said prime mover.

4. In a power plant, a combustion chamber for the generation of gaseous products of combustion under pressure, said chamber having a gas delivery outlet, a pump connected to said outlet for successively delivering measured charges of gaseous products of combustion therefrom, timed means connected to said pump for delivering aqueous fluid thereto for admixture with said measured charges in said pump, a prime mover, and a fluid connection from said pump to said prime mover for the delivery of the gaseous fluid from said pump to said prime mover.

5. In a power plant, a combustion chamber for the generation of gaseous products of combustion under pressure, said chamber having a gas delivery outlet, a rotary pump connected to said outlet and having at least one rotor for delivering measured charges of gaseous products from said outlet, a shaft on which said rotor is mounted, timed means for delivering aqueous fluid into contact with said measured charges including a timer actuated by said shaft, a fluid connection to a source of aqueous fluid, a valve for controlling said fluid connection, operating connections between said timer and said valve, a prime mover, and a fluid delivery connection between said pump and said prime mover.

6. In a power plant, a combustion chamber for the generation of gaseous products of combustion under pressure, said chamber having a gas delivery outlet, a rotary pump connected to said

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outlet and having rotor members for delivering measured charges of gaseous products from said outlet, shaft members for supporting said rotor members, timed means for delivering aqueous fluid into contact with said measured charges including a timer actuated by said shaft members, a fluid connection to a source of aqueous fluid, a valve for controlling said fluid connection, operating connections between said timer and said valve, a prime mover, and a fluid delivery connection between said pump and said prime mover.

7. In a power plant, a combustion chamber for the generation of gaseous products of combustion under pressure, said chamber having a gas delivery outlet, a rotary pump connected to said outlet and having rotor members for delivering the gaseous products of combustion from said outlet, timed means connected to said pump for delivering aqueous fluid into contact with said gaseous products of combustion including a timer

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actuated with said rotor members, a fluid connection to source of aqueous fluid, a valve for controlling said fluid connection, operating connections between said timer and said valve, a turbine, and a fluid delivery connection between said pump and said turbine for the delivery of the gaseous fluid from said pump to said turbine.

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