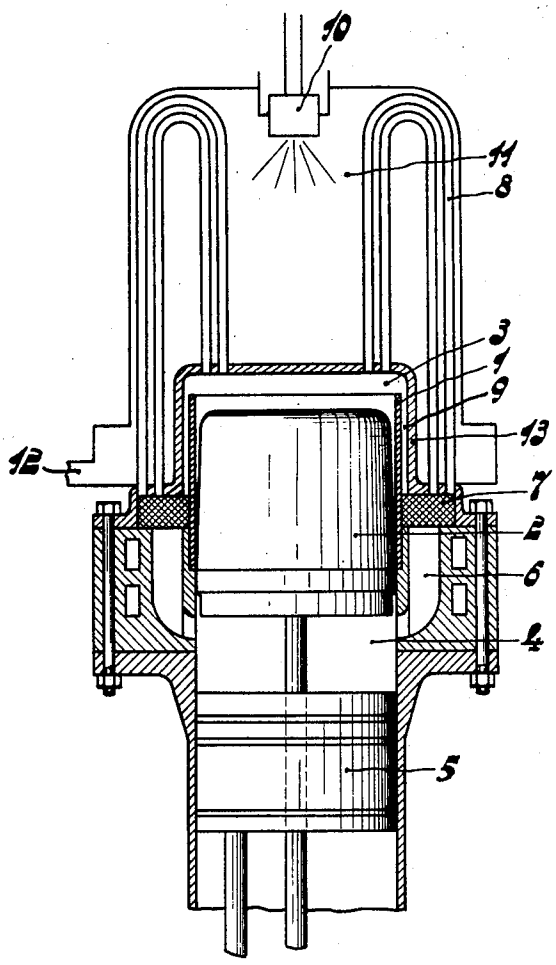
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HOT-GAS RECIPROCATING ENGINE

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## HOT-GAS RECIPROCATING ENGINE

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4 Claims. (Cl. 60—24)

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The invention relates to hot-gas reciprocating engines.

According to the invention a hot-gas reciprocating engine comprising a heater which surrounds the hot space at least in part, is characterised in that, while parts of the wall of the hot space of the engine are exposed at one side to the action of the combustion gases of the heater, they are cooled by a supply of working medium flowing along the other side of these parts of the wall directly between the hot space and the regenerator, this supply being small compared with the supply of working medium which flows between the hot space and the regenerator by way of the heater of the engine.

In a hot-gas engine, heat energy is supplied to the engine by the combustion gases of a burner. These combustion gases flow through the channels of a heat exchanger and the working medium through other channels of the heat exchanger, the heat transfer between the combustion gases and the working medium taking place through the walls by which the two channel systems are separated. A heater of construction hitherto known generally comprises a wall or parts of a wall which constitute a boundary between the hot space of the engine and the space for the combustion gases, which in some cases is or are in thermal contact with the combustion gases. It is true that working medium will generally be available on one side of the wall or parts of the wall but, since the velocity of flow of the working medium along this wall or these parts is small relative to the velocity of the working medium in the channel system of the heater, the heat transfer through this wall or these parts will be relatively small, so that in general there is a risk of excessive heating of this wall or these parts.

In a hot-gas reciprocating engine according to the invention part of the working medium does not pass through the usual channel system to and from the heat exchanger but through a second channel system along the one side of the wall or parts of the wall, the other side of which are exposed to the risk of excessive heating. This ensures firstly that the wall is cooled and secondly that the supply of working medium flowing through the heater is less than with the constructions in which working medium is not used for cooling the wall or parts of the wall. The heater may consequently be of smaller size. If an adequate passage of the channels through which the working medium flows, cooling the wall of the hot space, is chosen, this cooling

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medium may be exposed to the same temperature differences to which the other part of the working medium flowing through the usual channel system of the heater is also exposed. The amount of working medium serving for cooling purposes is small relative to the total amount of working medium used in the engine, for example, from 10 to 20% thereof.

The channels for the working medium may be provided between a bushing in which the displaced piston is adapted to move and the wall or wall parts to be cooled.

The hot-gas reciprocating engine according to the invention may advantageously comprise a heater of which the channels for the working medium are constituted by hairpin-shaped pipes. In this case the top and the entire side wall of the engine head is generally subjected to the high temperature combustion gases. It is therefore in this case particularly important to cool the engine head. This cooling may be effected if an annular space for the working medium is provided between the bushing in which the displaced piston is adapted to move and the wall of the engine head, said space communicating directly with the regenerator and with the hot space.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying diagrammatic drawing which shows one embodiment of a hot-gas engine according thereto, in which the heater comprises hairpin-shaped pipes.

Referring now to the drawing, a displacer **2** is adapted to reciprocate in a cylindrical bushing **1**. The space above the displacer **2** is the hot space **3** of the hot-gas engine. Most of the working medium flows between the cold space **4**, the volume of which is determined by a piston **5**, and the displacer **2**, and the hot space **3** through a cooler **6**, a regenerator **7** and a heater **8**. A smaller amount of the working medium flows through the annular channel **9** directly between the regenerator and the hot space. Above the engine head **13** is provided a burner **10**, of which the combustion gases flow between the groups of pipes of the heater **8**. This heater is constructed in the form of two groups of hairpin-shaped pipes arranged to surround the combustion space **11**. The combustion gases, after passing between the pipes, leave the heater at **12**, and also flow around the top and side wall of the engine head **13**. A risk of excessive heating of the engine head **13** is thus incurred.

However, since part of the working medium flows through the annular channel 9 to the hot space, this risk is mitigated. The amount of working medium, flowing directly between the hot space and the regenerator, necessary for cooling purposes, varies with the temperatures of the hot and cold spaces.

It will be obvious that the invention, which provides cooling of the wall of the hot space, may be used with other heater constructions.

What I claim is:

1. A hot gas engine comprising a cylinder enclosing a hot and cold space therein, a displacer in said cylinder separating said hot from said cold space, means connecting said hot and cold spaces, said means comprising a heater disposed around one side of the wall of said cylinder adjacent said hot space, a regenerator, and a cooler disposed about the cylinder adjacent said cold space, means also directly connecting said regenerator and said hot space, said latter means being disposed along the other side of the wall of the cylinder adjacent said hot space for the flow of a relatively small amount of working medium therethrough to cool said wall.

2. A hot gas engine comprising a cylinder enclosing a hot and cold space therein, a bushing within said cylinder and spaced from the wall of said cylinder in the hot space thereof, a displacer within said cylinder bushing separating said hot from said cold space, means connecting said hot and cold spaces, said means comprising a heater disposed around one side of the wall of said cylinder adjacent said hot space, a regenerator, and a cooler disposed about the cylinder adjacent said cold space, duct means also directly connecting said regenerator and said hot space, said duct means being formed between the other side of wall of the cylinder adjacent said hot space and the outer periphery of said bushing for the flow of a relatively small amount of working medium therethrough to cool said wall.

3. A hot gas engine comprising a cylinder enclosing a hot and cold space therein, a displacer in said cylinder separating said hot from said cold space, means connecting said hot and cold spaces, said means comprising a heater formed by hairpin-shaped pipes disposed around one side of the wall of said cylinder adjacent said hot space, a regenerator, and a cooler disposed about the cylinder adjacent said cold space, means also directly connecting said regenerator and said hot space, said latter means being disposed along the other side of the wall of the cylinder adjacent said hot space for the flow of a relatively small amount of working medium therethrough to cool said wall.



4. A hot gas engine comprising a cylinder enclosing a hot and cold space therein, a cylindrical bushing within the hot space part of said cylinder and spaced therefrom throughout part of its length to form an annular space between the wall of said cylinder and said bushing, a displacer within said cylinder and bushing separating said hot from said cold space, means connecting said hot and cold spaces, said means comprising a heater disposed around the outer periphery of the wall of said cylinder adjacent said hot space, a regenerator, and a cooler disposed about the cylinder adjacent said cold space, said annular space also directly connecting said regenerator and said hot space for the flow of a relatively small amount of working medium therethrough to cool said wall.

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