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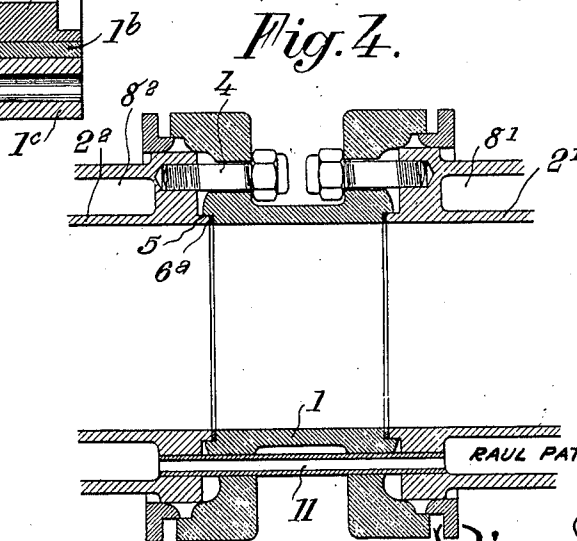
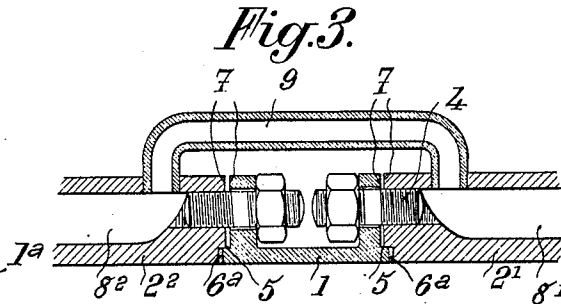
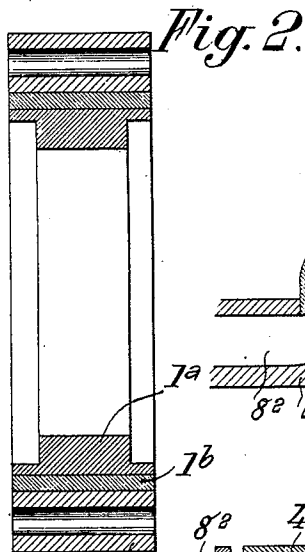
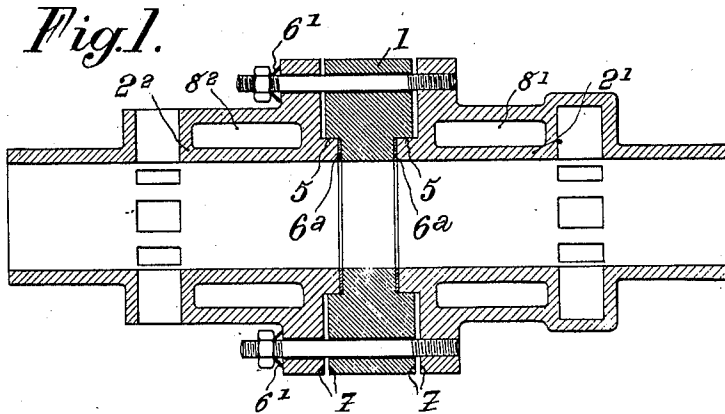
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2,144,706

CYLINDER FOR ENGINES OF THE OPPOSED PISTON TYPE

Filed March 26, 1936

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 5

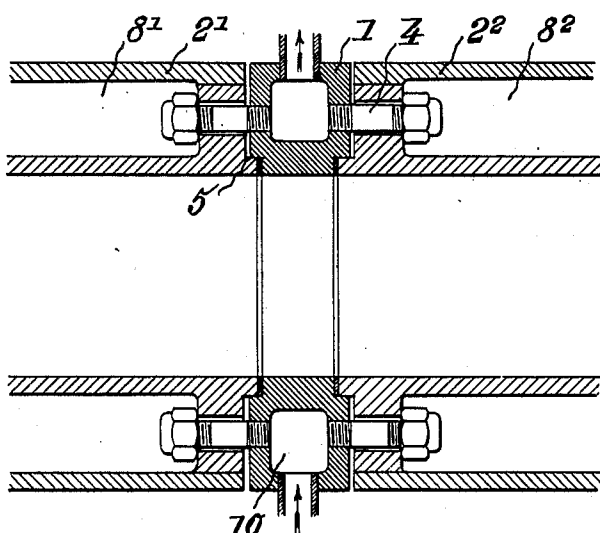
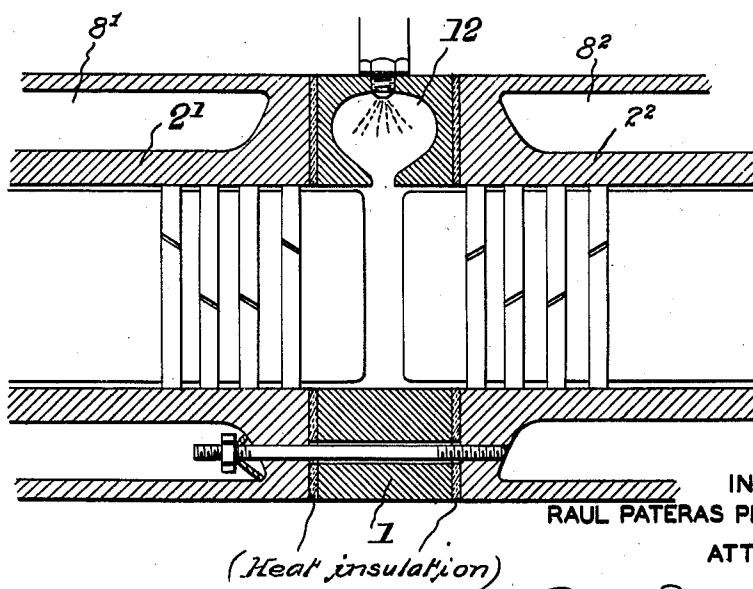


Fig. 6



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CYLINDER FOR ENGINES OF THE OPPOSED
PISTON TYPE

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4 Claims. (Cl. 123—51)

This invention relates to the design and construction of the cylinders in heat engines of the opposed-piston type, that is, engines comprising one or more pairs of pistons moving in opposite directions within a common working cylinder. It concerns more particularly (because this case appears to offer the most favorable field of application), but not exclusively, cylinders of engines of the above type which are subjected to unusually high pressures.

The principal aim of the invention is to adapt such cylinders more closely than has heretofore been achieved to the most exacting requirements of practical service.

The principal object of the invention is to build cylinders of the above type in at least three distinct longitudinal and co-axial sections, the central section forming a part of the combustion chamber, and the adjacent and co-axial sections being designed to insure the satisfactory mechanical and thermal operation of the pistons, as regards friction and cooling.

Aside from this principal object, the invention has certain other objects which are preferably associated and which will be more specifically described herebelow, as for example:

A second arrangement wherein the different cylinder sections are assembled by means of elastic connections adapted to take up differences in the heat expansion of the separate cylinder sections;

A third arrangement wherein the central section is cooled independently, thus allowing the use of said section as a means of generating steam; and

A fourth arrangement wherein a pre-combustion or ignition chamber is formed within the thickness of the wall of the central section, in which chamber combustion of the fuel is started and at least partially completed.

The invention also extends to all applications of the above designs, together with their structural details, to heat engines embodying cylinders of these designs and to machines and/or all installations embodying such engines and/or cylinders.

Other objects and advantages of the invention will appear in the course of the detailed description now to be given with reference to the accompanying drawings, which are given by way of example only. In these drawings:

Fig. 1 shows in longitudinal cross section an engine cylinder embodying this invention.

Fig. 2 is an enlarged cross section of a modification of the central element 1 shown in Fig. 1.

Figs. 3 and 4 show large-scale details of two modified means of connecting the different cylinder sections together.

Fig. 5 shows, in longitudinal cross-section, a portion of a cylinder embodying a modified form of the invention.

Fig. 6 shows, in longitudinal cross-section, a portion of a cylinder embodying a further form of execution of the invention.

In accordance with the invention, and more particularly with its preferred forms, the cylinder of a heat engine of the opposed-piston type, as for example, of a free-piston auto-compressor, may be designed as follows.

Instead of building the cylinder as one integral tubular member, said cylinder is divided into at least three longitudinal sections comprising one central section 1 enclosing a portion of the combustion chamber, and associated on either side with adjacent co-axial cylinder sections 2¹ and 2².

The central section 1 may be composed either of a ring which may advantageously be thick-walled and made of a high-resistance material such as steel, or of a plurality of concentric rings 1^a, 1^b, 1^c (see Fig. 2) shrunk upon each other, in order to insure greater mechanical strength than a single ring of the same thickness, said concentric rings being made of the same high resistance material, such as steel, or of different materials of suitable composition. For example, the innermost ring 1^a may be made of a material resistant to corrosion, one or more intermediate rings 1^b of a heat-insulating material, and the outer ring or rings 1^c of a highly resistant material such as steel.

The adjacent cylinder sections 2¹ and 2² may be formed of co-axial cylinders of equal bore, said cylinders being composed of a material, such as special grades of cast iron, having a good friction coefficient.

The three cylinder sections 1, 2¹ and 2² may be assembled by any suitable means. For example, they may be simply provided at their extremities with male and female screw threads, and screwed together; or they may be assembled by means of bolts or studs 4.

In one of my preferred designs, the different cylinder sections 1, 2¹ and 2² may be accurately centered to the common axis by means of carefully machined bearing surfaces 5 ground to a tight though sliding fit, as in Figs. 1 to 5.

The transmission of heat from the central section 1 to the adjacent sections 2¹ and 2² may advantageously be reduced by reducing to a

minimum the area of all contact surfaces between the assembled parts and by leaving a suitable clearance between such surfaces as 7 through which pass the connecting bolts 4. Materials of low heat conductivity such as at 6^a (Fig. 5) may also be interposed between said surfaces.

Under certain conditions, it may be advisable to reduce the rate of heat dissipation from central cylinder section 1 which forms the combustion chamber. This may be achieved as shown in Figs. 1 to 4, by leaving this section uncooled, and/or by incorporating in its construction materials of low heat-conductivity. If necessary, the temperature rise of the cylinder walls in the central section may be reduced by forming the inner portions of said cylinder of heat-insulating material, or in any other appropriate manner.

In cases wherein the different cylinder sections are subjected to different degrees of heat expansion, elastic connecting means may be provided to assemble said cylinder sections which allow each of said cylinder sections to expand independently of the adjacent sections.

Said elastic connecting means may be associated with expansible sealing means 6¹, Fig. 1, such as plastic washers, which take up the dimensional variations of the adjacent cylinder sections and thus insure tight joints between said sections.

The working cylinder may be cooled by means of a common water jacket, or by any other suitable cooling means; or each cylinder section may be provided with separate cooling means. In certain circumstances, it may be advisable not to cool the central cylinder portion, as shown in Figs. 1 to 4. In these cases, cylinder sections 2¹ and 2² are provided with separate water jackets 8¹ and 8², preferably interconnected by suitable connections as shown at 9 in Fig. 3 and 11 in Fig. 4.

Under certain conditions, central cylinder section 1 may be provided with a separate water jacket 10, as in Fig. 5, and the heat evacuated from that section used to vaporize the cooling water, thus forming a steam generator.

On the contrary, when central cylinder section 1 is made of a material highly resistant to corrosion and high temperatures, it may be advantageous not to cool that section, so as to avoid unnecessary loss of heat during the combustion of the fuel.

In this case, advantage may be taken of the

high temperature of this central cylinder section to combine with it an ignition and/or pre-combustion chamber, as 12, Fig. 6, in which the fuel is injected.

In general, I build the central cylinder section 1 of a material of higher mechanical strength than that used for the adjacent sections 2¹ and 2², and, as described above, in one solid ring, or in the form of concentric rings shrunk upon each other. The reason for this construction lies in the extremely high pressures which may be attained either accidentally or in regular or overload operation, in engines of this type, and particularly in generators of gas under pressure of the free opposed-piston type, in which the pistons may at times come very close together.

The above described embodiments of my invention refer to a single-cylinder engine of the opposed-piston type. But it is evident that the same construction may be applied to multi-cylinder engines of this type.

It is understood that the above description and the attached drawings are submitted by way of example only, and that my invention is not limited to any of the embodiments described, and extends to all variants thereof.

I claim:

1. A combustion engine comprising a cylinder, oppositely working pistons slidable in said cylinder, at least the inner wall of said cylinder comprising three parts, the central part being formed of a material which is resistant to mechanical stresses and corrosion and forming the combustion chamber, the two lateral parts forming the guiding surfaces for said oppositely working pistons, means for cooling said lateral parts to a greater extent than said central part and means for reducing heat transmission from the central part to said lateral parts.

2. In an engine according to claim 1, said means cooling said lateral parts only.

3. In an engine according to claim 1, said means comprising a member on said central part containing steam for cooling said central part, and members on said lateral parts containing water for cooling said lateral parts.

4. In an engine according to claim 1, means for securing together said three parts, and means for compensating the difference in the expansion of the individual parts.

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