

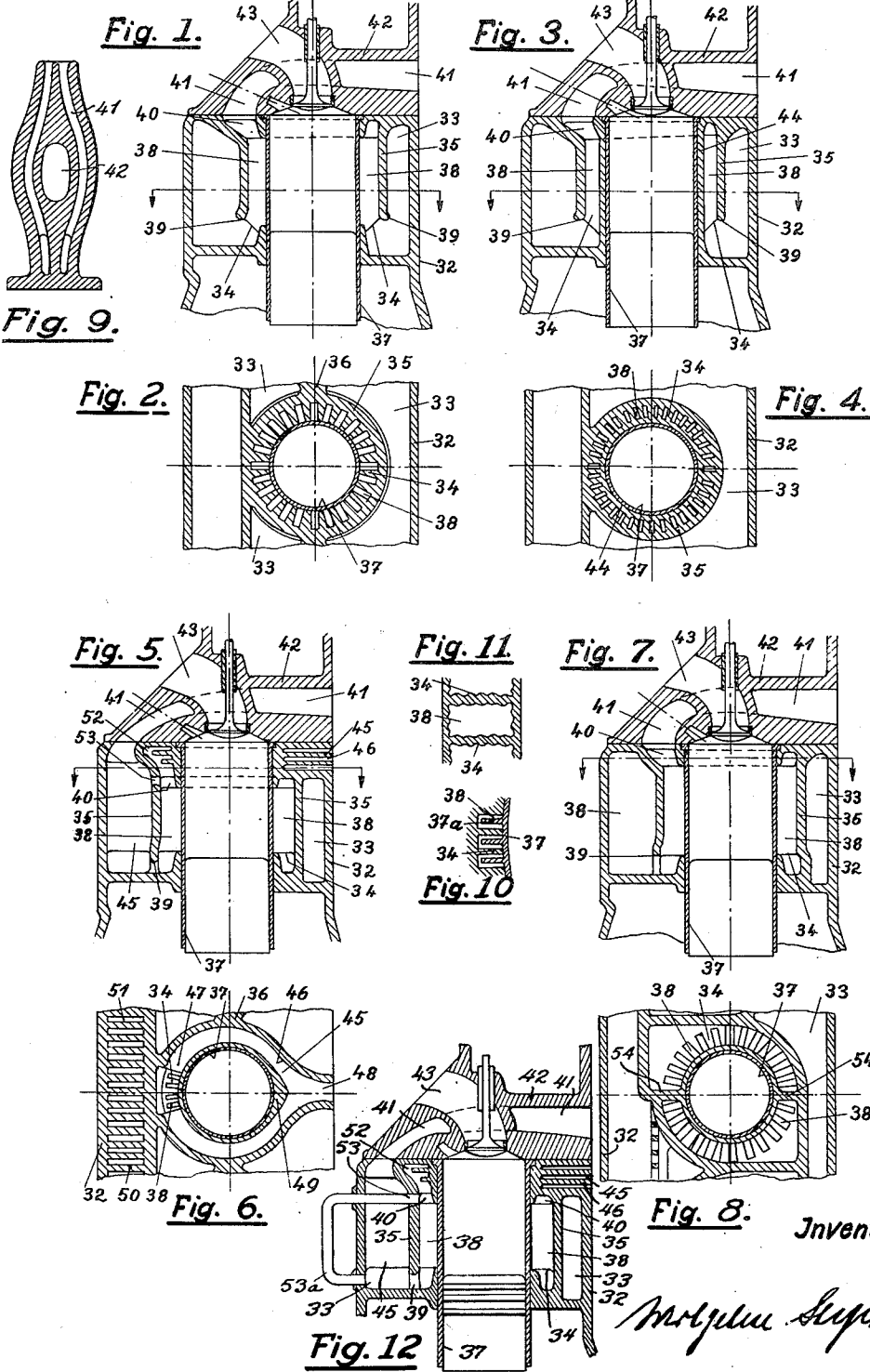
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COOLING ARRANGEMENT FOR INTERNAL-COMBUSTION ENGINES

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COOLING ARRANGEMENT FOR INTERNAL-COMBUSTION ENGINES

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5 Claims. (Cl. 123-171)

This invention relates to a cooling arrangement for internal combustion engines and more particularly, is directed to an improved construction for cooling the cylinders of an internal combustion engine. This application is a division of my co-pending application Serial No. 79,684, filed May 14, 1936.

An object of this invention is the provision of an improved and efficient arrangement for the cooling of an internal combustion engine.

Another object of this invention is the provision of improved cooling means for and in intimate contact with the cylinders of an internal combustion engine.

Still another object of this invention is the cooling of the cylinders of an internal combustion engine by passing a cooling medium longitudinally along and in close heat relationship with the cylinder walls.

A further and more specific object of this invention is the provision of an improved construction for cooling the walls of an engine cylinder wherein the cooling fluid moves transversely about said cylinder at the hottest part thereof and then flows longitudinally along the cylinder walls. Generally speaking, this invention may be defined as comprising the constructions and combinations recited in the annexed claims and illustrated in certain embodiments in the drawing accompanying and forming a part of this application wherein:

Fig. 1 is a longitudinal cross-sectional view of an engine cylinder illustrating a preferred embodiment of my cylinder cooling construction;

Fig. 2 is a transverse cross-sectional view along the line II—II of Fig. 1;

Fig. 3 is a longitudinal cross-sectional view of an engine cylinder showing another form of my construction;

Fig. 4 is a transverse cross-sectional view along the line IV—IV of Fig. 3;

Fig. 5 is a longitudinal cross-sectional view of an engine cylinder illustrating a third arrangement according to my invention;

Fig. 6 is a transverse cross-sectional view along the line VI—VI of Fig. 5;

Fig. 7 is a longitudinal cross-sectional view of an engine cylinder illustrating a fourth form of my improved cooling arrangement;

Fig. 8 is a transverse cross-sectional view along the line VIII—VIII of Fig. 7;

Fig. 9 is a transverse cross-sectional view through the cylinder head according to my invention;

Fig. 10 is a partial transverse cross-sectional

view illustrating a modified form of cooling passage; and

Fig. 11 is a cross-sectional view showing a modified form of cooling ribs.

Fig. 12 is a longitudinal section through an engine cylinder similar to Fig. 5 but with an additional conduit arranged to convey cooling fluid directly to the upper portion of the cylinder liner.

In the preferred form of my invention as portrayed in Figs. 1 and 2, the cylinder casing 32 of an internal combustion engine is preferably provided with a collecting space 33 to which a cooling medium, for example, water, air, oil, or any other suitable fluid, is adapted to be supplied. Inside of the collecting space 33 there may be positioned a plurality of ribs 34 secured in place by a web 35 preferably cylindrically shaped, which is supported in the cylinder by ledges or bridge members 36. The ribs 34 are located comparatively close to one another and extend either parallel to the axis of the cylinder or they may form a steep helical line extending along the liner 37. The liner 37 may be made either in one casting with the casing or manufactured as a separate member and later firmly attached to the casing as by shrinking. The liner 37 together with the cylindrical member 35 and its ribs 34 form a plurality of passages 38 communicating with the collecting space 33 through lower apertures 39. An upper collecting space 40 constitutes a continuation of the passages 38 and leads the cooling agent through passages 41 into the cylinder head 42. As clearly illustrated in Fig. 9, the ends of the passages 41 may be defined in the form of a nozzle and enclose a central opening 43 serving as a space for an inlet valve. In accordance with the above construction, the cooling fluid is adapted to first flow into the collecting space 33 through a suitable channel (not shown). From the collecting space 33 it flows through the apertures 39 and upward through the passages 38 into the annular channel 40. From the channel 40 the cooling medium then flows out through the passages 41 in the cylinder head.

The modified form of construction illustrated in Figs. 3 and 4 differs from that shown in Figs. 1 and 2 only in the fact that here the collars which hold the liner in place as in Figs. 1 and 2, are enlarged to form a surrounding cylindrical wall 44, thus preventing direct contact of the cooling fluid with the liner. In accordance with the terminology of this art the form of the invention illustrated in Figs. 1 and 2 may be termed the wet liner construction, while that in Figs. 3 and 4 is the dry liner construction. The rest of the ar-

rangement in Figs. 3 and 4 is identified with that shown in Figs. 1 and 2.

In the third form of my invention illustrated in Figs. 5 and 6, a plurality of transverse ribs 45 are provided in addition to the longitudinal ribs 34. These transverse ribs are preferably positioned above the longitudinal ribs between the latter and the cylinder head. The ribs 45 form cooling passages 46 surrounding the cylinder liner at its hottest portion and have a damming effect at the inlet side 47 and a diffusion effect at their exit side 48. A mass of material 49 in the shape of an eddy core is placed in the cooling passage 46 on the exit side to prevent turbulence of the streaming cooling agent, and thereby increasing the efficiency and effect of the cooling fluid. This construction is more fully explained in my said co-pending application Serial No. 79,684 filed May 14, 1936.

As therein explained, the flow of a cooling agent about the usual cylindrical cylinder form will result in the formation of eddy currents directly behind the cylinder which eddy currents will prevent proper transmission of heat from the hot cylinder to the cooling agent. If a solid mass of material forms substantially in the shape of the eddy core is placed behind the cylinder and in direct heat relationship therewith, the cooling agent will then flow smoothly and in intimate contact with this mass of material and no eddy currents will be produced.

Another feature of my modified construction as illustrated in Figs. 5 and 6 is that a portion of the collecting space 33 may be subdivided into a plurality of cooling passages 51 by means of ribs 50, thereby increasing the contact surface between the cooling fluid and the cylinder parts.

As clearly shown in Fig. 5 the upper annular channel 40 in this form of the invention communicates with a hollow space 52 positioned in front of the ribs 45, whereas the cooling passages 41 through the cylinder head communicate with the passages 51 formed by the ribs 50. Therefore, the cooling agent contained in the collecting space 33 flows, on the one hand, through the cooling passages 51 and out through the passages 41, while on the other hand, it flows from the collecting space 33 through the aperture 39, the cooling passages 38, the channel 40, the hollow space 52 and out through the transverse passages 46 formed by the ribs 45. If desired, at the upper end of the longitudinal passages 38, an opening 53 can be provided in the wall 35 so that the pressure of the cooling fluid can be equalized at this point. This opening 53 can also be used to supply cooling fluid which has not been pre-heated by the ribs 34 by connecting this opening to a separate pipe or conductor.

The space adjacent the upper portion of the cylinder liner 37 is directly cooled by the arrangement shown in Fig. 12, wherein the conduit 53a connects the stream of fresh cooling fluid with the opening 53 adjacent the top of the cylinder liner.

The fourth constructional form of my invention illustrated in Figs. 7 and 8 is substantially the same as that shown in Figs. 1 and 3 except for the fact that a separating wall 54 is provided at the exit ends of the cooling passages 38. This wall dividing the escaping cooling agent into two streams. This arrangement is advantageous for example, if the cooling passages cross one another at the head of the cylinder or extend about the liner in the form of a helical line.

It is to be understood that the nozzle-shaped

exit passages 41 may be used in the cylinder head of all of the forms of the invention shown in the previous figures.

In order to enlarge the cooling surfaces and thus increase the efficiency of the cooling fluid, the cylinder liner 37 may be provided with ribs 37a as shown in Fig. 10.

The amount of surface in contact with the cooling fluid can also be increased by forming the cooling ribs 34 with undulated surfaces or with grooves and protuberances as shown in Fig. 11.

It will thus be seen that I have provided a construction which satisfies the objects enumerated above, and while I have shown the invention in certain physical embodiments, it is to be understood that modifications of the structure shown may be made by those skilled in this art without departing from my invention as expressed in the following claims.

I claim:

1. In an internal combustion engine, a cylinder adapted to be cooled by a fluid, a jacket surrounding the cylinder for guiding said fluid along it, a cover located upon the cylinder and being likewise cooled by a fluid and taking part in guiding the same at the cylinder, a system of cooling channels provided in the cylinder jacket and in the cylinder cover and being closed on all sides, and accumulations of material in the cylinder jacket and the cover for presenting the lowest possible resistance to the flow of the cooling agent and to the heat to be abstracted, said accumulations being subdivided in the directions of flow of the cooling agent and presenting large surfaces in the subdivided portion, a storage receptacle for the said cooling fluid and longitudinal ribs and transverse ribs grouped around the cylinder, and an intermediate member separating the longitudinal ribs from said storage receptacle, the longitudinal cooling channels formed between the longitudinal ribs communicating with the transverse cooling channels of the cylinder and with the cooling channels of the cover, and a lower annular channel establishing a connection between the said storage receptacle and the channels located between the longitudinal ribs and an upper annular channel establishing a connection between the longitudinal channels and the channels in the cylinder cover.

2. In an internal combustion engine having a cylinder, a cylinder liner surrounding the main combustion space, a transverse passage about the top of the liner in heat communicating relationship therewith, a plurality of passages extending substantially parallel to and in heat communicating relationship with said liner and communicating at one end with said transverse passage, means for passing a cooling medium through all of said passages, said liner being a stream-lined mass of material connected thereto on the outgoing side of said transverse passage, thereby reducing the resistance to flow and increasing the thermal efficiency of said passage.

3. In an internal combustion engine having a cylinder, a cylinder liner surrounding the main combustion space, a transverse passage about the top of the liner in heat communicating relationship therewith, a plurality of passages extending substantially parallel to and in heat communicating relationship with said liner and communicating at one end with said transverse passage, means for passing a cooling medium through all of said passages, a storage space in said cylinder for said cooling medium, a cylinder head having a nozzle-like cooling passage therethrough, con-

duits connecting said storage space with the passages extending substantially parallel to the liner, and further nozzle-shaped passages connecting said storage space with the passage in said cylinder head.

4. In an internal combustion engine, a cylinder adapted to be cooled by a streaming cooling fluid, a first jacket spaced from and surrounding said cylinder, longitudinal ribs between said jacket and the cylinder forming longitudinal canals for the streaming cooling fluid therebetween, a second jacket spaced from and surrounding first jacket to form a collecting space for the cooling fluid therebetween, said first jacket being formed with an opening communicating with said collecting space to permit flow of the cooling fluid therefrom into said longitudinal canals, and a cover resting upon the cylinder, provided with a valve opening therethrough and having a plurality of cooling canals running at an angle to said longitudinal canals, said ribs being cut off the top of the cylinder to form an annular space acting as a cooling fluid accumulator and connecting medium between the cylinder and cover canals, transverse ribs forming cooling canals about the cylinder

5 and extending at substantially right angles to said longitudinal canals, said ribs being positioned between the annular cooling fluid collecting space and the bottom of said cylinder cover, whereby the cooling fluid flowing from the longitudinal canals will divide between the cover canals and the transverse canals about the cylinder.

10 5. In an internal combustion engine, a cylinder adapted to be cooled by streaming cooling fluid, a first jacket spaced from and surrounding said cylinder, longitudinal ribs between said jacket and said cylinder forming longitudinal canals for the streaming fluid therebetween, a second jacket spaced from and surrounding said first jacket to form a collecting space for the cooling fluid therebetween, said first jacket being formed with an opening communicating with said cooling space to permit the flow of the cooling fluid therefrom to said longitudinal canals, and a plurality of transverse ribs extending about the cylinders near the top thereof and forming with said first jacket a plurality of transverse canals communicating with said longitudinal canals.

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