June 7, 1938. K. SCHWAIGER 2,120,004

COOLING ARRANGEMENT FOR INTERNAL COMBUSTION ENGINES

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Fig. 1.

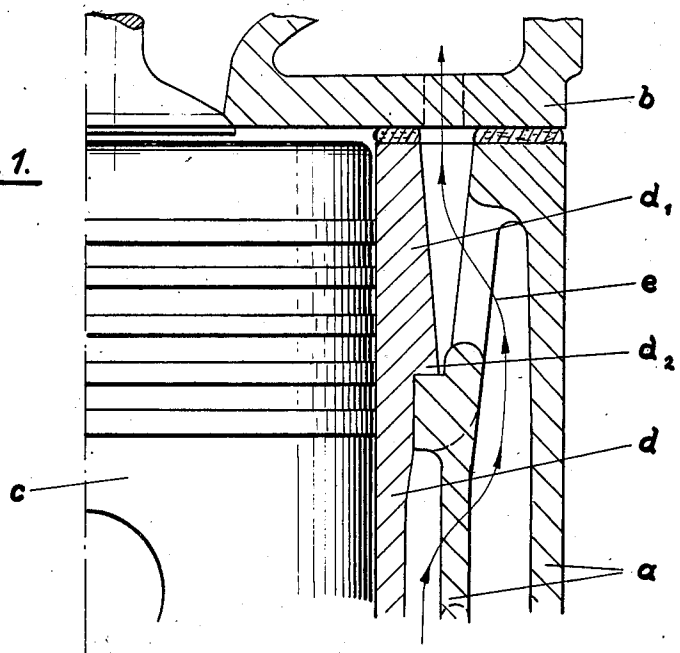
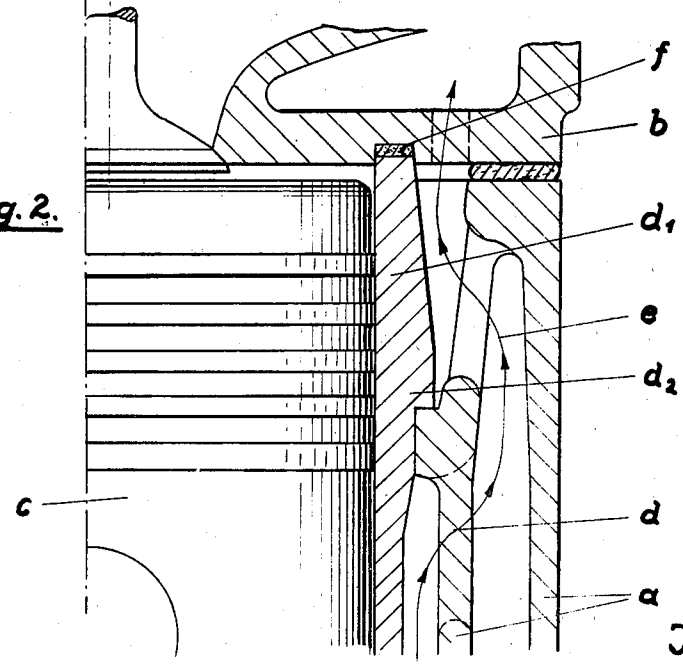


Fig. 2.



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COOLING ARRANGEMENT FOR INTERNAL COMBUSTION ENGINES

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17 Claims. (Cl. 123—173)

My invention relates to internal combustion engines and, more particularly, to an improvement of the liner which constitutes the cylinder of such an engine and is arranged to be in direct contact with the cooling liquid.

Prior to my invention it has been proposed to provide a liner of this type near its margin with a collar which is conically tapered in an axial direction and arranged in contact with the cooling water, the collar being formed with a groove in its rim and with a shoulder near its rim bearing on a similar shoulder provided on the cylinder-jacket. This prior construction leads to an objectionable accumulation of material at the point of contact between the liner and the cylinder-cover, whereby the effective cooling at this hottest point of the liner is greatly impaired. This is liable to cause the liner to be overheated, whereby carbon will be formed by residual oil and the upper end of the piston may jam within the liner. Moreover, objectionable stresses are set up in the collar of the liner, when the nuts of the cylinder-head are tightened, whereby the inner diameter of the cylinder may be reduced or the collar may even be torn off the liner under adverse circumstances. The liability of injury to the collar is enhanced by the provision of the corner situated in the hottest zone at the shoulder near the marginal rim of the liner.

The object of my invention is to avoid these disadvantages. One feature of my invention resides in the provision of the shoulder formed by the collar at a substantial distance from the end of the liner. According to another feature of my invention, the end-face of the liner is smooth and plane and the conical shape of the collar is made as slim as possible. The end-face of the liner may abut directly against the plane cover of the cylinder or the end of the liner may project into an annular groove provided in the cover. Preferably, a gasket is inserted in this groove and interposed between the end-face of the liner and the cylinder-cover.

In the accompanying drawing, two preferred embodiments of my invention are illustrated,

Fig. 1 showing an axial section through the upper part of a cylinder in which the liner bears against a plane face of the cylinder cover; whereas

Fig. 2 is a similar view of a cylinder in which the upper end of the liner projects into an annular groove of the cylinder cover.

In Fig. 1 *a* designates the cylinder jacket, *b* the cylinder-head or cover, *c* the piston, *d* the inserted liner. The liner is provided near its upper end with a collar d^1 forming a shoulder d^2 at a substantial distance from the end of the liner. The radial thickness of the collar d^1 gradually increases from the upper end of the liner towards the shoulder d^2, whereby a uniform dissipation of the heat towards the cooling jacket is ensured. The plane end-face of the liner bears against the plane face of the cylinder-head *b*, a suitable gasket being interposed. The tapered shape of the upper end of the liner has the advantage that the collar d^1 arranged in direct contact with the cooling water is more efficiently cooled near its top where it is subjected to a higher temperature than near its lower end.

The embodiment illustrated in Fig. 2 differs from that in Fig. 1 only by the relative arrangement of the liner and the cylinder-head. In this embodiment, an annular groove *f* is provided in the cylinder-head into which the upper end of the liner *d* projects, a suitable gasket being interposed. This arrangement permits the width of the end-face of the liner to be dimensioned smaller than it would be possible in the embodiment of Fig. 1. Moreover, the cooling effect is increased as the gasket is so positioned that it does not interfere with the flow of heat. A leakage past the gasket is more efficiently prevented by its inclusion in the annular groove.

The embodiment of Fig. 1 is particularly adapted for engines provided with a plurality of cylinders in a single row and for sheet-metal structures, whereas the embodiment of Fig. 2 is better adapted for engines in which each cylinder is provided with an individual cover or head.

It will be seen that I have provided a construction which satisfies the objects enumerated above and one which constitutes a valuable advance in the art. 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 claims which follow.

What I claim is:—

1. In an internal combustion engine, the combination comprising a cooling jacket provided with an inner shoulder, a cylinder-liner mounted in said cooling jacket for direct contact with the cooling liquid and provided with a plane end-face and with a peripheral shoulder which is substantially spaced from said end-face and bears on said first-mentioned shoulder, and a plane cylinder-cover abutting tightly against said end-face and said cooling jacket, said peripheral

shoulder being formed by a conical collar of the liner tapering towards said end-face.

2. In an internal combustion engine, the combination comprising a cooling jacket provided with an inner shoulder, a cylinder-liner mounted in said cooling jacket for direct contact with the cooling liquid and provided with a plane end-face and with a peripheral shoulder which is formed by a conical collar of the liner tapering towards said end-face and being of substantial axial length and which bears on said first-mentioned shoulder, and a cylinder-cover provided with an annular groove, the end of said liner projecting into said groove.

3. In an internal combustion engine, the combination comprising a cooling jacket provided with an inner shoulder, a cylinder-liner mounted in said cooling jacket for direct contact with the cooling liquid and provided with a plane end-face and with a peripheral shoulder which is substantially spaced from said end-face and bears on said first-mentioned shoulder, a plane cylinder-cover abutting against said end-face and said cooling jacket, and a gasket between said cylinder-cover and said end-face, said peripheral shoulder being formed by a conical collar of the liner tapering towards said end-face.

4. In an internal combustion engine, the combination comprising a cooling jacket provided with an inner shoulder, a cylinder-liner mounted in said cooling jacket for direct contact with the cooling liquid and provided with a plane end-face and with a peripheral shoulder which is formed by a conical collar of the liner tapering towards said end-face and being of substantial axial length and which bears on said first-mentioned shoulder, a cylinder-cover provided with an annular groove, the end of said liner projecting into said groove, and a gasket inserted in said groove.

5. In an internal combustion engine having a cylinder housing, an inner shoulder provided on the cylinder housing, a cylinder cover firmly connected to said housing, and a cooling jacket, a cylinder liner positioned at one end against the cylinder cover, a shoulder surface on the cylinder liner abutting axially against the shoulder on the cylinder housing, said shoulder surface being positioned at a considerable distance axially from the joint between the cylinder liner and the cylinder cover, and that end portion of the liner between the shoulder surface and the cylinder cover consisting of a wall the thickness of which becomes less toward said cover and presents to the cooling fluid substantially its entire outer surface.

6. In an internal combustion engine having a cylinder housing, an inner shoulder provided on the cylinder housing, a cylinder cover firmly connected with the housing and a cooling jacket, a cylinder liner positioned at one end against the cylinder cover, a shoulder surface at the cylinder liner abutting axially against the shoulder on the cylinder housing, said shoulder surfaces being positioned at a considerable distance axially from the dividing joint between the cylinder liner and the cylinder cover, and that end portion of the liner between the shoulder surface and the cylinder cover consisting of a smooth surface which diminishes toward the cylinder cover in a generally conical manner and presents to the cooling fluid substantially its entire outer surface.

7. In an internal combustion engine the combination according to claim 5 together with a circular groove in the cylinder cover in which the cylinder liner projects and tightly closes off the cylinder space.

8. In an internal combustion engine, a cylinder housing, a cylinder liner positioned in the same and surrounding the cylinder space, an intermediate wall in the cylinder housing spaced from the cylinder liner, an outside wall of the cylinder housing surrounding the same, an axially extending bearing surface positioned on the intermediate wall and which is positioned in the direction of the cylinder axis at a substantial distance from the upper end of the cylinder space, a collar on the cylinder liner which abuts axially against said bearing surface, an opening underneath the bearing surface and a further opening in the intermediate wall above the same, through which the cooling material existing in the intermediate space between the cylinder liner and the cooling canal underneath the bearing surface is admitted, and passes around the bearing surface over the outside intermediate space between the intermediate wall and the outside wall of the cylinder into the cooling space above the bearing surface.

9. In an internal combustion engine, the combination according to claim 8 in which the upper end of the cylinder liner above the said bearing surface diminishes toward the end in a generally conical manner.

10. In an internal combustion engine, the combination comprising a cooling jacket provided with an inner shoulder, a cylinder liner mounted in said cooling jacket for direct contact with the cooling liquid and provided with a peripheral shoulder which is substantially spaced from said end-face and bears on said first mentioned shoulder, a plane cylinder cover abutting tightly against said end-face, said peripheral shoulder being formed by a conical collar of the liner tapering toward said end-face, and a centering surface for the cylinder liner positioned between the shoulder and the end of the cylinder liner opposite the cylinder cover.

11. In an internal combustion engine, the combination comprising a cooling jacket provided with an inner shoulder, a cylinder liner mounted in said cylinder jacket for direct contact with the cooling liquid and provided with a plane end-face and with a peripheral shoulder which is substantially spaced from said end-face and bears on said first mentioned shoulder, and a plane cylinder cover abutting tightly against said end-face, said peripheral shoulder being formed by a conical collar of the liner tapering towards said end-face, and said cooling jacket having an intermediate inner wall which has passages for the cooling material above and below the shoulder, whereby the cooling material is conducted about the shoulder surfaces by an outside cooling canal formed by the additional inner wall.

12. The combination according to claim 2 in which said cylinder cover abuts said cooling jacket.

13. The combination according to claim 4 in which said cylinder cover abuts said cooling jacket.

14. In an internal combustion engine, the combination comprising a cooling jacket provided with an inner shoulder, a cylinder liner mounted in said cooling jacket for direct contact with the cooling liquid and provided with a plane end-face and with a peripheral shoulder which is substantially spaced from said end-face and bears on said first mentioned shoulder, a plane cylinder cover abutting tightly against said end-face,

said peripheral shoulder being formed by a conical collar of the liner tapering towards said end-face, and passages in said cooling jacket for permitting the cooling liquid to contact said liner above and below said shoulder.

15. The combination according to claim 2 including passages in said cooling jacket for permitting the cooling liquid to contact said liner above and below said shoulder.

16. The combination according to claim 5 including passages in said cooling jacket for permitting the cooling liquid to contact said liner above and below said shoulder.

17. The combination according to claim 6 including passages in said cooling jacket for permitting the cooling liquid to contact said liner above and below said shoulder.

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