Aug. 10, 1948. H. LIEBERHERR 2,446,841

CYLINDER LINER FOR OPPOSED-PISTON ENGINES

Filed May 5, 1945

Fig. 3.

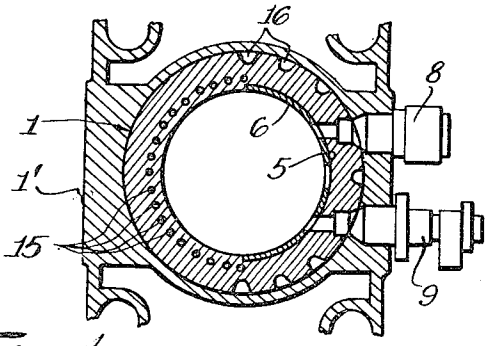


Fig. 1.

Fig. 4.

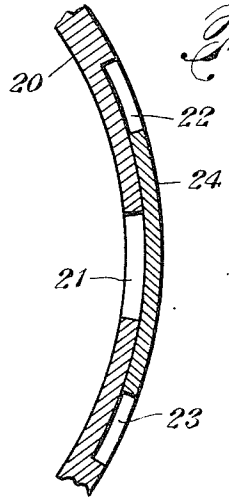
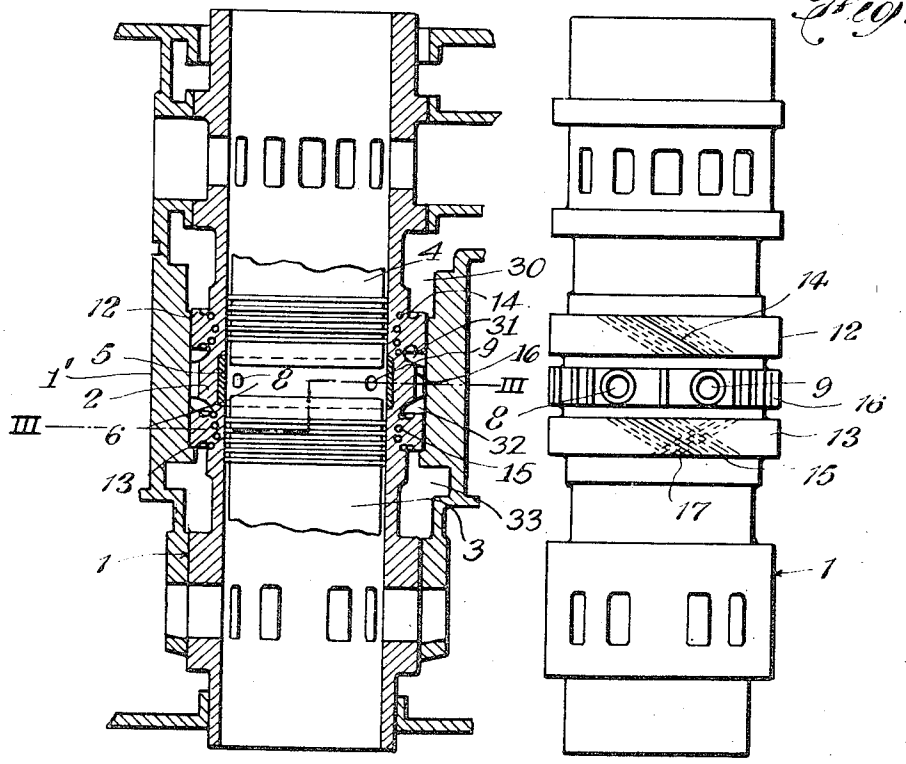


Fig. 2.



INVENTOR.

Hans Lieberherr

BY

Pennie, Davis, Marvin & Edmonds

ATTORNEYS

Patented Aug. 10, 1948

2,446,841

UNITED STATES PATENT OFFICE

2,446,841

CYLINDER LINER FOR OPPOSED-PISTON ENGINES

Hans Lieberherr, Winterthur, Switzerland, assignor to Sulzer Freres, Societe Anonyme, Winterthur, Switzerland

Application May 5, 1945, Serial No. 592,232
In Switzerland May 8, 1944

7 Claims. (Cl. 123—193)

1

The invention relates to a cylinder liner for opposed-piston engines and consists in that the middle part, in so far as it is not swept by the piston rings, is provided with a heat protective ring and the parts of the liner situated on both sides of this middle part are subjected to intensive cooling by means of cooling passages.

An arrangement of the cylinder liner of an opposed-piston engine is known in which the cooling of the middle part is effected by means of holes bored obliquely to the axis, which lie nearest to the surface of the liner in the middle plane of the liner and on both sides of this plane again retreat from the surface. A solution of this kind is inexpedient in so far as the cooling is particularly desired at the point where the piston rings lie in the upper dead centre. Further, the openings for the fuel injection valves and the starting valves are in the middle plane. Special measures must therefore be taken so that the cooling medium can flow round these valves. A very broken-up cylinder liner is thus obtained, with uncontrollable concentrations of stress. The object of the invention is on the one hand to obviate these stress concentrations and on the other to obtain better cooling of the piston rings..

One embodiment of the invention is shown diagrammatically in the drawing.

Fig. 1 is a longitudinal sectional view through a cylinder liner of a two-stroke opposed-piston internal combustion engine;

Fig. 2 is an exterior side view of a cylinder liner similar to that of Fig. 1 but including a modification;

Fig. 3 is a sectional view taken on the line III—III of Fig 1, and

Fig. 4 is an enlarged fragmentary view of a modification.

As shown in Figs. 1, 2 and 3, the cylinder liner 1 which is mounted in the jacket 1' has an enlarged middle part 2 located at a position midway between the inner dead centers of the pistons 3 and 4. An annular groove 5 is formed in the middle part and the heat protective ring 6 is mounted in the groove. The fuel valve 8 is mounted in an appropriate opening in the middle part and is inserted to extend into and through the protective ring, thereby serving to secure the ring in position especially preventing it from moving circumferentially. A starting valve 9 may also be mounted in an appropriate opening in the middle part and inserted through the protective ring. Advantage may also be taken of the starting valve to secure the protective ring in position in a manner similar to that of the fuel valve. These

2

valves may, for example, secure the protective ring in position by being connected thereto by threads. In other words, these valves may be threaded through the middle part and also into threaded engagement with the protective ring.

As best shown in Figs. 1 and 2, the cylinder liner has annular enlargements 12 and 13 longitudinally spaced from the middle part and exterior to that position which is swept by the rings of the pistons 3 and 4, and especially when those pistons are at the ends of their strokes, as when they are at inner dead center. In each of the rings 12 and 13, a plurality of relatively small passageways 14 and 15 are formed for the circulation therethrough of a suitable cooling fluid such as water, for instance flowing from the cooling space 30 to the passageways 14 to the space 31, to the transition ducts 16 into the space 32 and to the passageways 15 to the cooling space 33. These passageways 14 and 15 may be formed by boring holes through the rings and especially at an angle oblique to the longitudinal axis of the liner as shown in Fig. 2, to the end that they may be brought very close to the inner bearing surface of the cylinder and thereby effect a rapid dissipation of heat.

The liner is preferably so formed that the exteriors of the annular rings 12 and 13 may be covered with a close fitting jacket 1', and in order to effect a circulation of the cooling fluid through the passageways 14 and 15, the enlarged middle part 2 is provided with a number of longitudinal exterior transition ducts 16.

As shown in the modification illustrated in Fig. 2, the cooling passages 14 and 15 may be formed at one angle oblique to the longitudinal axis of the cylinder liner 1 and an additional set of cooling passages 17 may be formed, in either or both rings 12 and 13 at a different angle oblique to the longitudinal axis.

In the modified form of the invention illustrated in Fig. 4, the protective ring 20 is flexible and resilient and is held in position in the annular groove in the middle part permitting it to expand into position. This expansion leaves a space 21 between the ends of the ring. To provide a covering for this space 21 which permits expansion and contraction of the ring, the end portions of the ring are chamfered at 22 and 23 to receive the arcuate ring 24.

The heat protective ring may be formed of any suitable heat resistant metal, such as a steel alloy, for example, a vanadium steel having the following analysis, about 20% chromium, 15% nickel, and 1% vanadium; a molybdenum steel having

the following analysis, about 18% chromium, 8% nickel, and 0.5% molybdenum; or a chromium steel having about 20% chromium.

Other metals, such as Nichrome, an alloy of nickel and chromium, may be used.

The improvements of the invention give the advantages that, in the middle part, which is not swept by or contacted with the piston rings, high temperatures may be attained due to the relatively low dissipation of heat therefrom, and that those parts of the liner swept by the piston rings, especially when the pistons are at their inner dead centers, may be subjected to a rapid dissipation of heat to effect an intensive cooling.

I claim:

1. In a cylinder liner for a two-stroke opposed-piston internal combustion engine fitted in a jacket having a middle part of said liner which is not swept by the rings on the pistons, the improvement which comprises a heat-protective ring mounted in the interior of the middle part, and means for cooling a part of the liner on each side of the middle part which is swept by the piston rings.

2. In a cylinder liner for a two-stroke opposed-piston internal combustion engine fitted in a jacket having a middle part of said liner which is not swept by the rings on the pistons, the improvement which comprises an annular interior groove in the middle part, an annular heat-protective ring mounted in the groove, means for securing the ring in position, and passage means in the cylinder zones at each side of the middle part and exterior of the part swept by the piston rings of each piston for the circulation therethrough of a cooling fluid to effect a rapid cooling in those parts of the liner.

3. A cylinder liner according to claim 1 which comprises a heat-protective ring formed of a heat resisting alloy.

4. A cylinder liner according to claim 1 which comprises a fuel valve mounted in the liner, and means connected to the fuel valve to secure the heat-protective ring in position.

5. A cylinder liner according to claim 1 which

comprises passageways in the form of a plurality of small holes formed in the liner at least a part of which extend at an angle oblique to the longitudinal axis of the liner.

6. In a cylinder liner for a two-stroke opposed-piston internal combustion engine having a middle part which is not swept by the rings on the pistons, the improvement which comprises a relatively thick part of the liner which is not swept by the rings on the pistons and which is midway between the inner dead centers of the pistons, an annular groove in the middle part, a heat-protective ring formed of heat resistant metal mounted in the annular groove, means for securing the ring in position, a separate annular enlargement on the liner on each side of and longitudinally spaced from the middle part, said enlargements being exterior of that part of the liner swept by the rings on the pistons when at inner dead center, and a plurality of passageways in each annular enlargement for the circulation therein of a cooling fluid.

7. A cylinder liner according to claim 6 which comprises passageways bored through said enlargement at such angles that they approach very closely to the inner bearing surface of the cylinder liner which is swept by the piston rings.

HANS LIEBERHERR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
958,905	Bryen	May 24, 1910
1,819,759	Valetta	Aug. 18, 1931
1,930,786	Witkiewicz et al.	Oct. 17, 1933

FOREIGN PATENTS

Number	Country	Date
177,885	England	Apr. 10, 1922
409,579	England	May 3, 1934
193,724	Switzerland	Jan. 17, 1938