

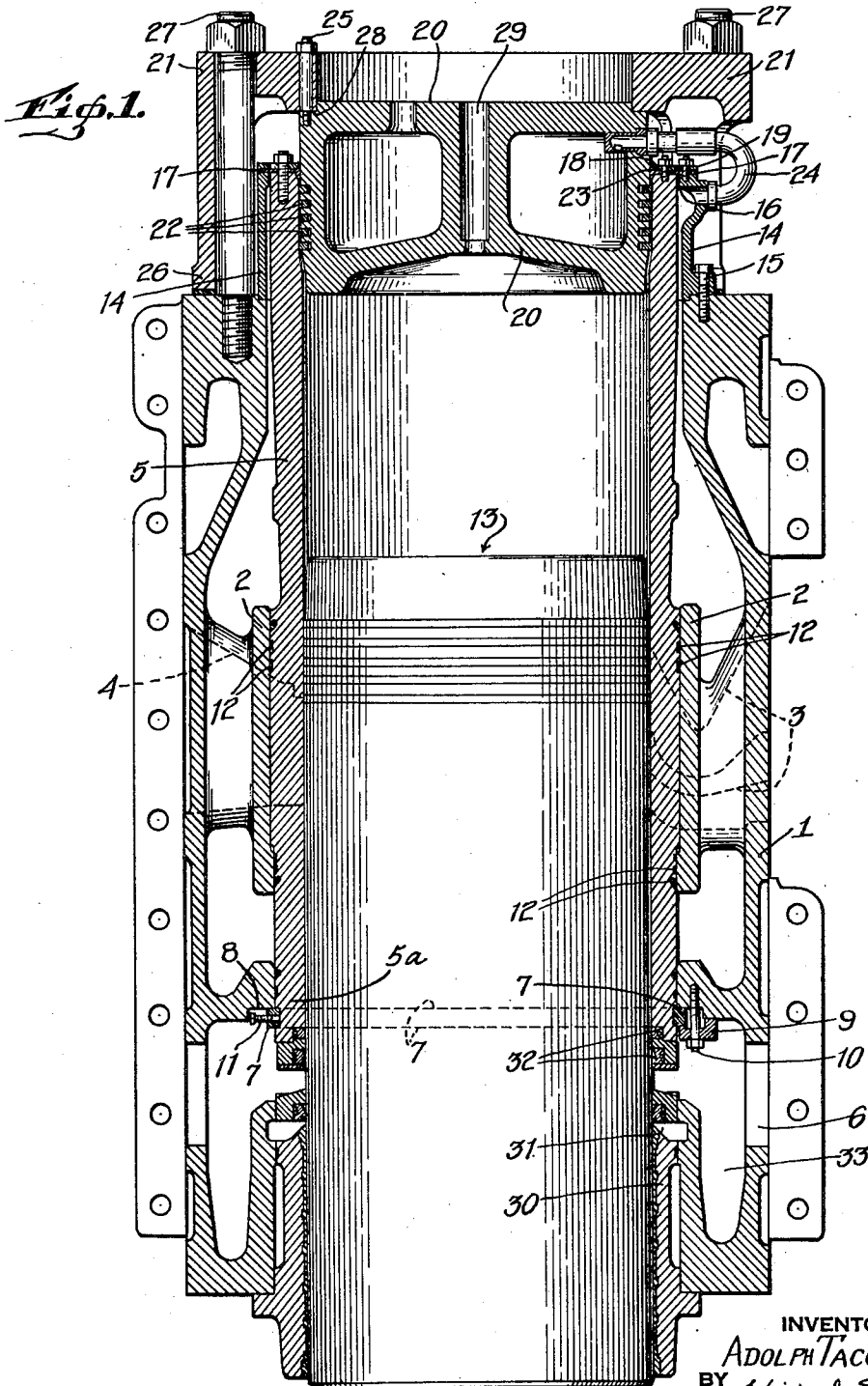
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A. TACCHELLA
ENGINE CYLINDER

2,458,447

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2 Sheets-Sheet 1



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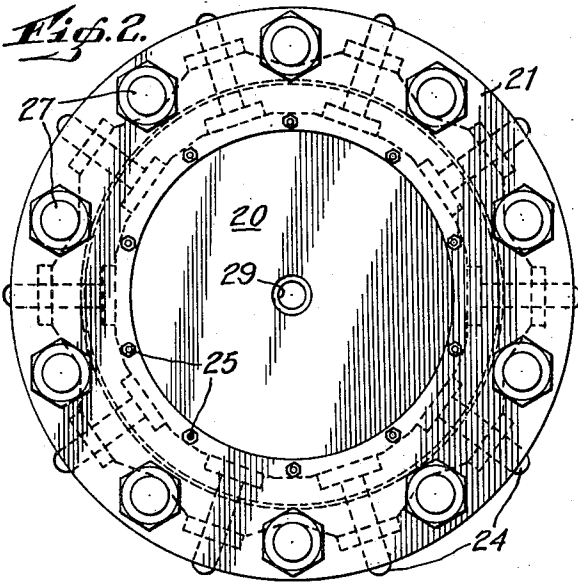
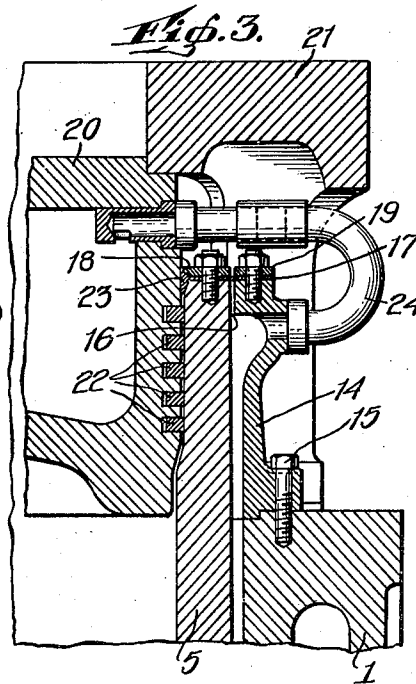
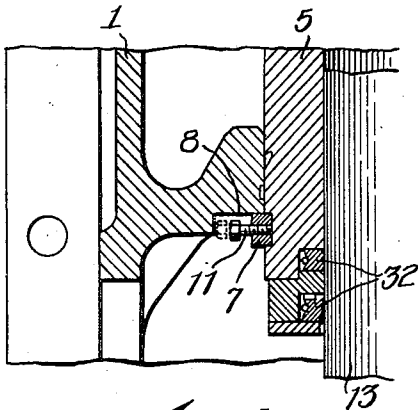
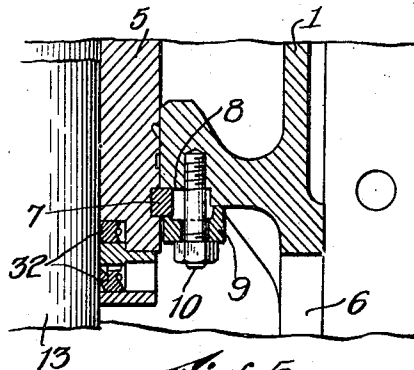


Fig. 4.

Fig. 5.

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ENGINE CYLINDER

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10 Claims. (Cl. 123-173)

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The invention is an improvement in engine cylinders being specially concerned with the organization of the cylinder liner with the water-jacket and cylinder-head, the object being a more efficient accommodation of relative thermal expansions and contractions in those parts so as to eliminate the causes of occasional liner failure.

To this end the invention consists in the principles of construction below explained and exemplified in the accompanying drawing wherein Fig. 1 is a longitudinal section through a preferred style of engine cylinder, two-cycle type, Fig. 2 a top plan thereof, Fig. 3 an enlarged section of the head-end of the liner and Figs. 4 and 5 are enlarged details of the liner locking means.

The new construction comprises as its largest part the exterior water-jacket casting marked 1, and which will be understood to be secured to some appropriate base or crankcase structure, not shown in the drawing, and in most cases to be so designed as to accommodate several cylinder liners as in multi-cylinder engines. In the case of a two-cycle engine it is provided at mid-height with a belt or ring 2, containing passages 3 on one side for combustion and scavenging air, and passages 4 on the other side for the exhaust. The belt is snugly engaged to the surface of the liner 5 so that these passages register respectively with continuation ports formed in the liner proper, according to customary practice. The ports are indicated in dotted lines.

Below the port belt the jacket casting has, in the present case, another opening marked 6 constituting part of an annular chamber in which oil-sludge is collected and through which the piston skirt may be observed, but this part of the structure is outside of the present invention.

Contrary to conventional design, the liner 5 in the new construction is secured to the jacket casting 1 by its lower end or foot 5a, while its upper end or head, is free to expand upwardly under thermal change relatively to the casting. While the manner of its connection is a matter of choice the preferred attachment within this invention is made by seating a split ring or key 7 in an annular groove cut into the external surface of the liner near its foot. When this key is in place it becomes virtually a flange on the liner and has sufficient radial projection to enable it to be used as a flange and to be clamped upwardly against the lower face 8 of a circular rebate in the jacket casting 1. It is so clamped by a series of bridge-clamps 9 and bolts 10, such clamps being spaced at appropriate intervals

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around the perimeter of the liner, and only one such clamp being shown in the drawing.

The key or split flange-ring 7 can be snapped into its groove in the liner after the manner of fitting piston rings, but should be firmly seated therein and for this purpose, and before assembly, it is provided with several flat-headed bolts 11, threaded in it radially as indicated in Fig. 4, annularly spaced around the ring between the locations of clamps 9. When these bolts 11 are backed off, their heads thrust against the vertical face of the rebate 8 in the casting 1, and thereby force the key fully and firmly into its seat on the liner, retaining it there while it is being clamped to the casting by the bolts 10. It thus constitutes the full equivalent of an integral flange as stated.

Before the liner is pressed, from above, into the jacket casting it is provided, as usual, with one or more copper bands 12 to make watertight contacts with the port belt 2 and lower part of the jacket casting 1. The space between the casting and the liner is the cylinder water-jacket through which water is circulated as customary for absorbing the excess heat in the liner. The piston for the cylinder, trunk-type, is marked 13.

Also contrary to conventional design, the head-end of the liner 5 is flangeless and projects above the top of the jacket casting 1, where it is surrounded by a water space of its own, constituting an extension of the water space just referred to and formed by the surrounding water-jacket ring 14, bolted at 15 to the top face of the jacket casting 1. The latter member and this ring 14, together constitute what may be called the jacket casing. They could be made in one piece, but are preferably separate, as described.

The top edge of the liner and the top edge of the water ring or jacket casing may be understood to be normally about flush with each other and are spaced apart from each other by a vertical annular crevice 16. An annular gasket 17, made of some pliable heat-resistant material is clamped upon these faces, bridging the crevice 16 and thus obstructing any out-flow of water from the jacket at this point. The flexible gasket is clamped to the liner by an inner clamp ring 18, and to the water ring 14 by an outer clamp ring 19 with bolts as indicated. A suitable material for bridging the crevice is neoprene, or its analogues, but any means which will close the crevice, and at the same time accommodate unequal expansion of the jacket casing and liner, will be the equivalent, it being noted that the accom-

modation is in two senses, that is to say, with respect to longitudinal changes of position and radial changes.

The cylinder is completed by the cylinder head, which, particularly for convenience in manufacture, is formed in two parts, the head proper marked 20 and the clamp ring therefor marked 21. The head proper is a hollow casting, so as to be water-cooled, which penetrates telescopically into the upper end of the liner, being sealed to it by a set of piston ring packings 22, as well as by a soft packing 23, asbestos, for example. This is held in place by the inner clamp ring 18 of the neoprene gasket. The head is thus capable of some movement of adjustment axially of the liner, when that is desired, and being only frictionally engaged to the liner allows the latter to move axially under thermal expansion with relation to it. Also, since the packing members 22 and 23 are somewhat resilient the thermal contraction in diameter of the liner imposes no undue strain on itself or on the head.

Part only of the cylinder head penetrates the liner. The portion above the liner is thus available for accommodating the water connections to the head. One such connection is indicated in Figure 1, being a transfer connection between the cylinder jacket and the hollow head and composed of a tubular fitting, such as indicated at 24, the detail of which is not important to this invention further than to say that in this construction there is room for many such water connections without encroaching on space required for other parts. The purpose of course is to make an easy flow path for cooling both the liner and the head.

The hollow part 20 of the cylinder head is attached to the other head part or clamp ring 21 by means of a series of bolts 25. The ring 21 is formed with legs 26 by which it rests through shims, or adjusting the head, on the top edge of the casting 1 round about the water ring 14. The cylinder head bolts 27 pass through or alongside these legs and take the strain incident to internal pressures. The fact that the member 21 is a ring and engages the head proper only by the narrow rebate 28 therein, leaves the interior of the head 20 available for such connections to it as may be desired. For instance, the bore 29 is to accommodate a fuel injection valve in the present case, and the adjacent hole is for a water connection.

The parts appearing below the foot of the liner comprise a liner extension 30 appropriately fitted to and held on the main casting 1 and lined with babbett, or the like to serve as a guide or auxiliary bearing for the piston. At its upper end it is provided with a scraper ring 31, cooperating with similar rings 32, secured to the foot of the liner for diverting oil sludge from the piston into the collecting chamber 33. The action of these parts is well understood and it is not involved in the present invention.

It will be understood that if the liner is to be removed it is removed upwardly, after having unclamped the flange or key 7 from the casting 1, and separating it from the liner.

I claim:

1. Engine cylinder construction comprising a water-jacket casing, a cylindrical liner fitted therein to form a water space therewith and rigidly attached thereto by its foot, and free to expand linearly at its head, and a flexible water-retaining member forming a connection between

the liner head and the jacket casing adapted to accommodate such expansion.

2. Engine cylinder construction of claim 1 in which the head part of the liner is free to expand both linearly and radially and is separated from the jacket casing by an annular crevice to accommodate the radial expansion and said flexible member bridges said crevice.

3. Engine cylinder construction comprising a water-jacket casing, a liner rigidly attached by its foot thereto and cooperating therewith to form the water-jacket space, water-retaining means connecting the head of the liner to said casing adapted to permit unrestrained radial expansion of the liner head, and a cylinder head closing the head of the liner adapted to permit linear expansion of the liner.

4. Engine cylinder construction comprising a water-jacket casing, a liner rigidly attached thereto by its foot, a cylinder head closing the head end of the liner without restraining its linear expansion, the liner head being separated by an annular crevice from the casing and an annular flexible gasket engaging the liner head and casing, closing the crevice between them.

5. Engine cylinder construction comprising a jacket casing, a liner rigidly secured by its foot thereto and free to expand at its head end, a hollow cylinder head telescopically closing the head end of the liner and a water connection radially entering the cylinder head above the liner head, said water connection forming a transfer communication between the head and the liner jacket space.

6. Engine cylinder construction comprising a jacket casing, a liner therein and means for securing the liner thereto comprising an annular groove cut in the outer liner surface, a key seated in the groove and projecting from said surface and means for clamping said projecting key to said casing.

7. The construction of claim 6 wherein the key is provided with screws thrusting on the casing to seat it in its liner groove.

8. Engine cylinder construction comprising a member providing a water-jacket casing, a liner supported by said member at a portion of the liner remote from the head of the liner and cooperating with said casing to form the water-jacket, the head end of said liner being substantially out of contact with said casing, means closing the water-jacket space at the head end of the liner and permitting substantially unrestrained linear and radial movement of the head end of the liner, a cylinder head extending into the head end of the liner, and means to connect the cylinder head to said member and hold the head substantially fixed with respect thereto, the head end of the liner being free to expand linearly along the cylinder head.

9. The subject matter of claim 8 characterized by the fact that the liner is out of contact with the cylinder head, and means, permitting radial movement of the liner with respect to the cylinder head are provided to close the space between the cylinder head and liner the head end of the liner substantially floating between the cylinder head and the casing.

10. Engine cylinder construction comprising a jacket casing, a liner therein, and means for securing the liner to said casing at a portion of the liner remote from the head end thereof, characterized by the facts that the diameter of said liner everywhere is such that the liner can be removed from the jacket casing by movement

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through the head end of the jacket casing, and that said securing means incorporates a device removably seated in the external surface of a portion of the liner remote from the head end thereof and means clamping said device to the jacket casing.

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