

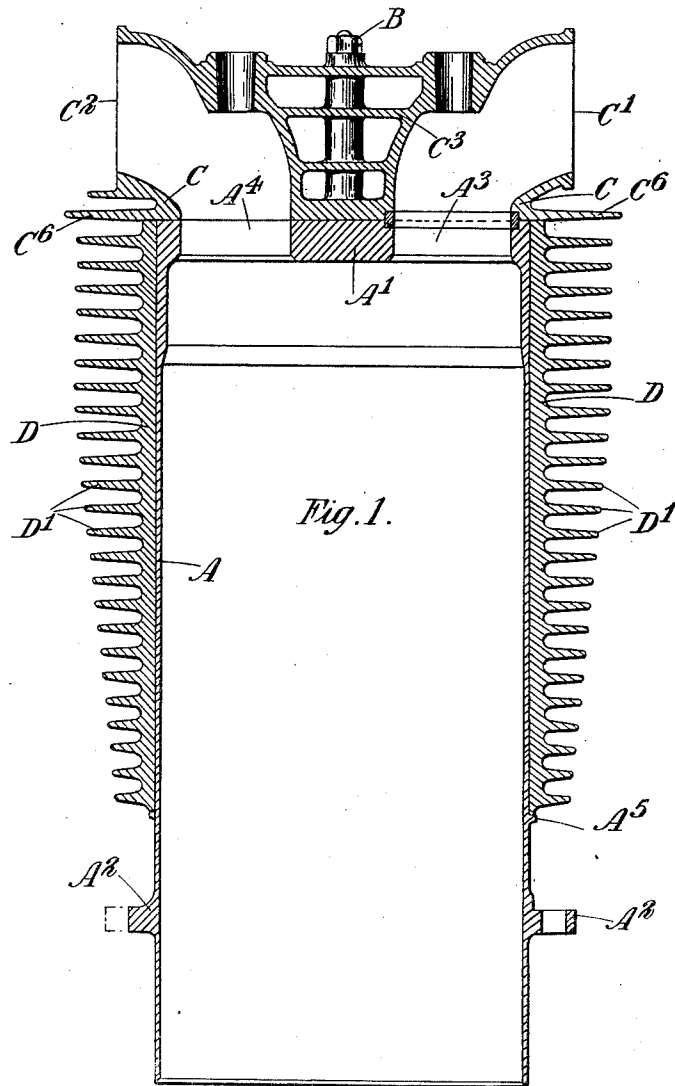
A. H. R. FEDDEN AND L. F. G. BUTLER.  
CYLINDER FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JULY 3, 1919.

1,346,535.

Patented July 13, 1920.

2 SHEETS—SHEET 1.



*Inventors*

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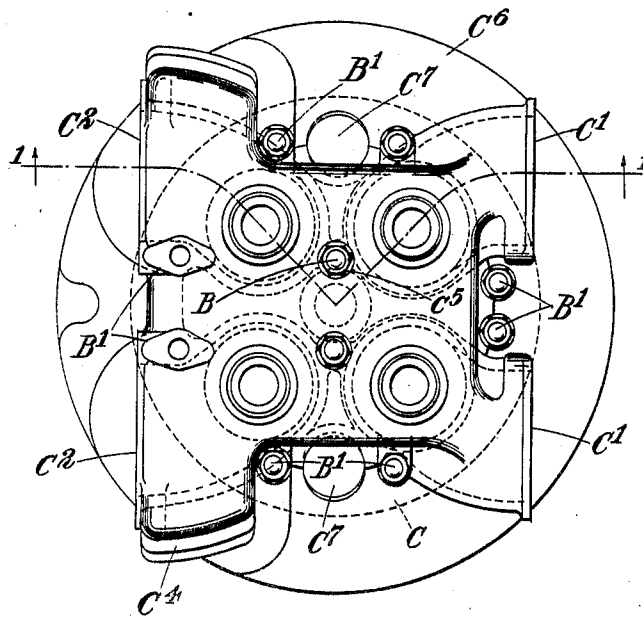
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*Fig. 2.*



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# UNITED STATES PATENT OFFICE.

ALFRED HUBERT ROY FEDDEN AND LEONARD FREDERICK GEORGE BUTLER, OF BRISTOL, ENGLAND, ASSIGNORS OF ONE-THIRD TO THE COSMOS ENGINEERING COMPANY LIMITED, OF BRISTOL, ENGLAND.

## CYLINDER FOR INTERNAL-COMBUSTION ENGINES.

1,346,535.

Specification of Letters Patent.

Patented July 13, 1920.

Application filed July 3, 1919. Serial No. 308,639.

*To all whom it may concern:*

Be it known that we, ALFRED HUBERT ROY FEDDEN and LEONARD FREDERICK GEORGE BUTLER, subjects of the King of England, residing at Fishponds, Bristol, Gloucester, England, and St. Andrews Park, Bristol, Gloucester, England, respectively, have invented certain new and useful Improvements in Cylinders for Internal-Combustion Engines, of which the following is a specification.

This invention is for improvements in or relating to the cylinders of air-cooled internal-combustion engines and has for its object to provide an improved construction of cylinder of the type described in the specification accompanying patent application Serial No. 263,590, filed November 21, 1918.

According to the said prior specification, a cylinder is formed with the highest portion of its head integral with it and devoid of upstanding projections, and there is combined with it a cap which is stiffened against buckling by hoods and pillars all tied together by parallel radiation fins. This cap is flat on its underside and is secured on the flat upper surface of the head by studs disposed both centrally and around the periphery.

In the particular embodiment of the invention described in the said prior specification, the cylinder was made of steel and integral cooling fins were formed on it over the greater parts of its length. The cap was made of aluminium and arranged, as shown in the drawings, to provide for three valves in the cylinder-head.

According to the present invention, a cylinder for an internal-combustion engine comprises a cylindrical steel barrel having smooth outer walls and a flat end, an aluminium or other cap similar to that above-mentioned secured on the flat end, and a sleeve formed with radiating fins surrounding and secured on the outer curved face of the barrel.

Preferably the sleeve is made of aluminium or other material having a high thermal conductivity, and it is preferably secured in place by shrinking it on to the steel barrel after both sleeve and barrel have been ground perfectly smooth. By this means, good contact and therefore good

thermal conductivity from the steel to the aluminium is insured.

In the preferred construction, the cooling fins are machined on the aluminium sleeve after it has been shrunk on to the steel barrel.

In the accompanying drawings:—

Figure 1 is a longitudinal section on the line 1—1—1 of Fig. 2, and

Fig. 2 is a plan of the complete cylinder.

Like reference characters indicate like parts in both figures.

Referring to these drawings, the steel cylinder A is formed with a flat head A<sup>1</sup> having two inlet ports and two exhaust ports formed in it. The outer surface of the cylinder is ground smooth, being flat on top and cylindrical over the rest of the surface except for a flange or lugs A<sup>2</sup> whereby the cylinder is secured to the crank-case of the engine.

An aluminium cap, similar to that described in the above-mentioned earlier specification, is secured on the flat cylinder-head A<sup>1</sup> by pairs of studs B disposed near the center and studs B<sup>1</sup> disposed around the periphery in pairs symmetrically about diametral lines 90° apart in the plan of the cap. The cap is formed without projections on its under face and is ground flat, and this arrangement of studs insures that it is held in intimate contact with the cylinder-head, whereby good thermal conductivity is obtained, and the heat generated in the cylinder is rapidly conveyed to the cap where it is dissipated.

The cap is formed as a flat plate C which is reinforced and stiffened against buckling by the hoods C<sup>1</sup> C<sup>2</sup>, which also constitute the inlet and outlet passages communicating with the inlet and outlet ports A<sup>3</sup> A<sup>4</sup> respectively. The plate C is located on the head A<sup>1</sup> by dowel-members comprising rings of copper or other metal of high thermal conductivity let into recesses in both the head A<sup>1</sup> and the plate C around the inlet ports. The various hoods are connected together by cooling fins cast integral with them as shown at C<sup>3</sup> in Fig. 1, and the hoods C<sup>2</sup> for the exhaust gases are also provided with special cooling fins C<sup>4</sup> (Fig. 2) to insure that they shall not become overheated.

Further means of stiffening the cap and

dissipating the heat consists of the pillars C<sup>5</sup> which also receive the studs B. A special circumferential cooling fin C<sup>6</sup> is formed around the periphery of the plate C as close to its lower face as convenient. Two openings C<sup>7</sup> are provided in the cap C to accommodate the sparking plugs for the cylinder.

The cooling of the body of the cylinder A is effected by an aluminum sleeve D having a series of fins or ribs D<sup>1</sup> formed on it. The sleeve is ground smooth internally and shrunk on to the cylinder and it may, if desired, be pegged in position. A good fit of the sleeve on the barrel is essential in order that a high thermal conductivity may be insured. It is preferred to form the fins D<sup>1</sup> by machining them after the sleeve has been secured on the cylinder A. A small rib A<sup>5</sup> may be provided on the outside of the cylinder A to locate the sleeve D, which is located at the other end of the cap C. In order to allow for the unequal expansions of the steel and aluminum, the length of the sleeve D is made slightly less than the length between the rib A<sup>5</sup> and the end of the cylinder.

It will be seen that in the above described cylinder all the explosion forces are taken by the steel barrel and head, which is much stronger than aluminum, but that the advantages of aluminum for heat dissipation are fully retained. Further the attachment of the cylinder of the crank-case offers no special difficulties since the feet A<sup>2</sup> are integral with the steel barrel which takes the stresses.

What we claim as our invention and desire to secure by Letters Patent is:—

1. For an internal-combustion engine, a cylinder comprising in combination a barrel provided with radiating fins and having an integral flat head devoid of upstanding projections, and a cap having four hoods serving as inlet and outlet ports, flat as to its underside, secured on the said flat head by

pairs of studs disposed centrally (as at B) and symmetrically about diametral lines 90° apart (as at B<sup>1</sup>), as illustrated in Fig. 2 of the accompanying drawings.

2. For an internal combustion engine, a cylinder comprising in combination, a cylindrical steel barrel having a smooth outer wall and a flat end, an aluminum cap stiffened against buckling by hoods and pillars all tied together by parallel radiation fins secured on the said flat end, and a sleeve formed with radiating fins surrounding and secured in intimate contact with the outer curved surface of the barrel.

3. For an internal combustion engine, a cylinder comprising in combination, a cylindrical steel barrel having a smooth outer wall and a flat end, an aluminum cap stiffened against buckling by hoods and pillars all tied together by parallel radiation fins secured on the said flat end by pairs of studs disposed centrally and symmetrically about diametral lines 90° apart, and a sleeve formed with radiating fins surrounding and secured in intimate contact with the outer curved surface of the barrel.

4. For an internal combustion engine, a cylinder comprising in combination, a cylindrical steel barrel having a smooth outer wall and a flat end, an aluminum cap stiffened against buckling by hoods and pillars all tied together by parallel radiation fins secured on the said flat end, and a sleeve formed of aluminum and shrunk onto said barrel, and provided with radiating fins machined on it after it is secured on the barrel.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ALFRED HUBERT ROY FEDDEN.

LEONARD FREDERICK GEORGE BUTLER.

Witnesses:

C. W. GOLDEN,

R. TREGASKI.