

## PATENT SPECIFICATION

545,669

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Complete Specification Accepted : June 8, 1942



## COMPLETE SPECIFICATION

### Improvements in Liquid Cooling Systems for Internal Combustion Engines

I, FRANK METCALF ASPIN, a British subject, of 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to liquid cooling systems for internal combustion engines.

It has been proposed to provide a liquid cooling system in which the liquid is circulated through the cylinder head for the required cooling thereof and to concentrate the cooling effect at the required points whilst the fluid in the cylinder jacket communicates with the fluid in the cylinder head as a "backwater" to the main stream with limited cooling effect and relying wholly or mainly on thermosyphonic action for the movement of the fluid in the cylinder jacket.

It is also known in liquid cooling systems for internal combustion engines having a rotary valve to provide liquid cooling jackets inside and outside the valve and relatively overlapping, and it has also been proposed in an internal combustion engine to provide a liquid cooling space both inside and outside of a cylinder exhaust port or around the exhaust valve of a side valve engine as well as in the cylinder head and cylinder jacket and no claim *per se* is made to any of such constructions.

The object of the invention is an improved fluid cooling system particularly suitable for internal combustion engines with rotary valves according to Patent No. 463,412.

The invention comprises, in an internal combustion engine having a cylinder jacket and a cylinder head jacket for cooling liquid and a circulating system therefor, and wherein the cylinder head jacket forms part of the circulating system whilst the cylinder jacket is relatively a "backwater," the construction providing a liquid supply duct supplementary to but adjacent to the cylinder and cylinder head jackets and forming part of the fluid circulating system to the cylinder head, such liquid supply duct having a main flow passage to the cylinder

head and being arranged for heat interchange through its wall, between the liquid in the cylinder jacket and the liquid in the supply duct.

In the accompanying drawing:—

Fig. 1 is a sectional side elevation of one example of an internal combustion engine made in accordance with this invention and having a rotary valve according to Patent No. 463,412.

Fig. 2 is a diagrammatic plan of the invention showing two cylinders at the front end of an engine constructed according to Fig. 1.

As illustrated, the fluid in the cylinder jacket space *a* of the engine cylinder block communicates only through ducts *b* with the fluid in the jacket space *c* of the detachable cylinder head. There are no other entrances or exits for fluid to or from the cylinder jacket space *a* which is therefore in "backwater" arrangement with the cooling system. Around the cylinder jacket at the end and along the sides of the engine is provided a fluid supply duct *d* common to all the cylinders and forming a secondary fluid jacket space having passages *e* which lead to registering apertures in the cylinder head to admit cooling fluid to the cylinder head jacket through passages *c*<sup>1</sup>. The passages *c*<sup>1</sup> are arranged immediately below the sparking plug, and immediately below the exhaust port, these being normally the two hottest regions of the engine, and have outlets *f* to the cylinder head jacket space. At the rear end of the engine (not shown) the supply duct may terminate at the end of the cylinder block or may extend round the end cylinder. The outlet for the cooling fluid is arranged above the cylinder head and the fluid flows thereto from a suitable part or parts of the cylinder head jacket space. This outlet for the cooling fluid may be constructed in accordance with existing practice and carried to the forward end of the cylinder block for the convenience to connect to the radiator or other part of the fluid circulating and cooling system.

In operation, the fluid in the supply duct *d* forms a secondary fluid jacket out-

side the cylinder jacket *a* and operates by heat interchange through the mutual dividing wall, to cool the fluid in the upper part of the cylinder jacket *a* around the hottest part of the combustion ends of the cylinders, but such cooling is obviously of limited extent. The cooling fluid therefore, whilst still relatively cool, enters the cylinder head jacket space *c* through passages *c'* at points immediately in the vicinity of the sparking plugs and exhaust ports of each cylinder so that maximum cooling effect in such localities is obtained. Thereafter the fluid disperses through openings *f* into the cylinder head jacket space, displacing the fluid already there which will have become relatively heated and which will pass out through openings to the outlet on top of the cylinder head. The additional but restricted cooling of the "backwater" in the cylinder jacket *a* proper, by reason of the secondary jacket provides optimum cooling conditions for reducing cylinder wear to a minimum, whilst preventing overheating, and the flow of the fluid directed to the hottest parts of the cylinder head further assists to control and keep down the temperature where such control is most required.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In an internal combustion engine having a cylinder jacket and a cylinder head jacket for cooling liquid and a circulating system therefor and wherein the cylinder head jacket forms part of the circulating system whilst the cylinder jacket is relatively a "backwater," the construction providing a liquid supply duct supplementary to but adjacent to the cylinder and cylinder head jackets; and forming part of the fluid circulating system to the cylinder head, such liquid supply duct having a main flow passage to the cylinder head and being arranged for heat interchange through its wall, between the liquid in the cylinder jacket and the liquid in the supply duct.

2. In an internal combustion engine according to Claim 1, the construction wherein the liquid supply duct is

arranged as a secondary jacket to the cylinder jacket.

3. In an internal combustion engine according to Claim 2 the construction wherein the cylinder head is detachable and the liquid supply duct and the cylinder jacket communicate with the cylinder head jacket through separate registering apertures between the cylinder and cylinder head.

4. In an internal combustion engine according to Claim 1, 2 or 3, the construction wherein the liquid supply duct is formed in the cylinder casting.

5. A method of liquid cooling for internal combustion engines having a cylinder jacket and a cylinder head jacket, wherein a liquid circulation system is provided for the cylinder head jacket with liquid communication for the cylinder jacket in "backwater" arrangement and wherein secondary cooling for the cylinder jacket is provided by heat interchange through a wall of the cylinder jacket to liquid in a supply duct for the circulating system to the cylinder head jacket.

6. An internal combustion engine according to Patent No. 463,412, and having a fluid cooling system characterised according to any of the preceding claims.

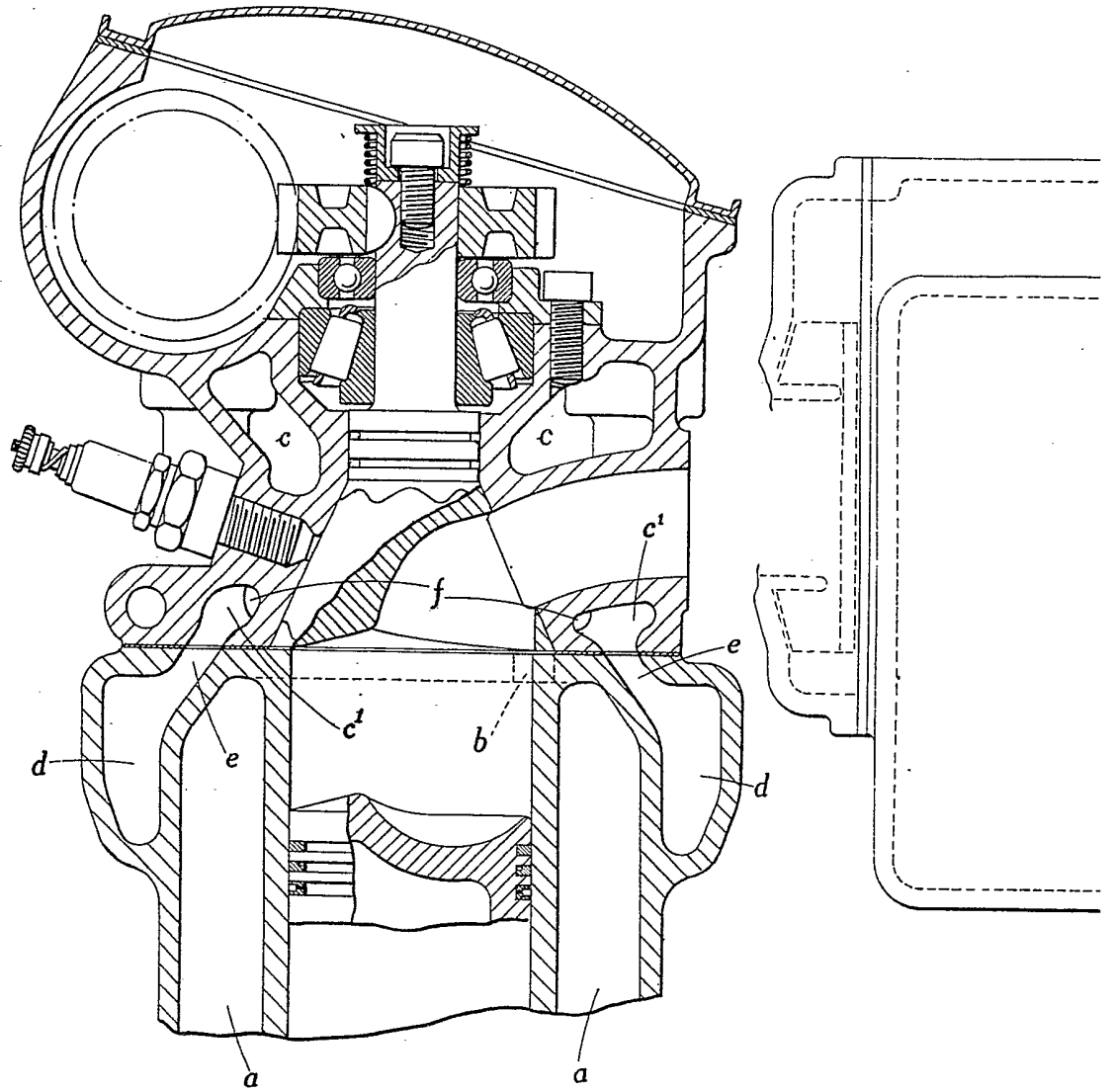
7. A multi cylinder internal combustion engine having liquid cooling jackets for the cylinders and for the cylinder head, and a liquid supply duct for liquid circulation to the cylinder head arranged as a jacket outside the cylinder jackets according to either of the preceding Claims 2 or 3, characterised in that the said duct is common to all the cylinder jackets.

8. An internal combustion engine characterised by a fluid cooling system constructed and arranged substantially as herein described and shown.

Dated this 19th day of December, 1940.

For the Applicant.  
**WILSON, GUNN & ELLIS,**  
 Chartered Patent Agents,  
 54/56, Market Street,  
 Manchester, 1.

Fig. 1.



*[This Drawing is a reproduction of the Original on a reduced scale.]*

Fig. 2.

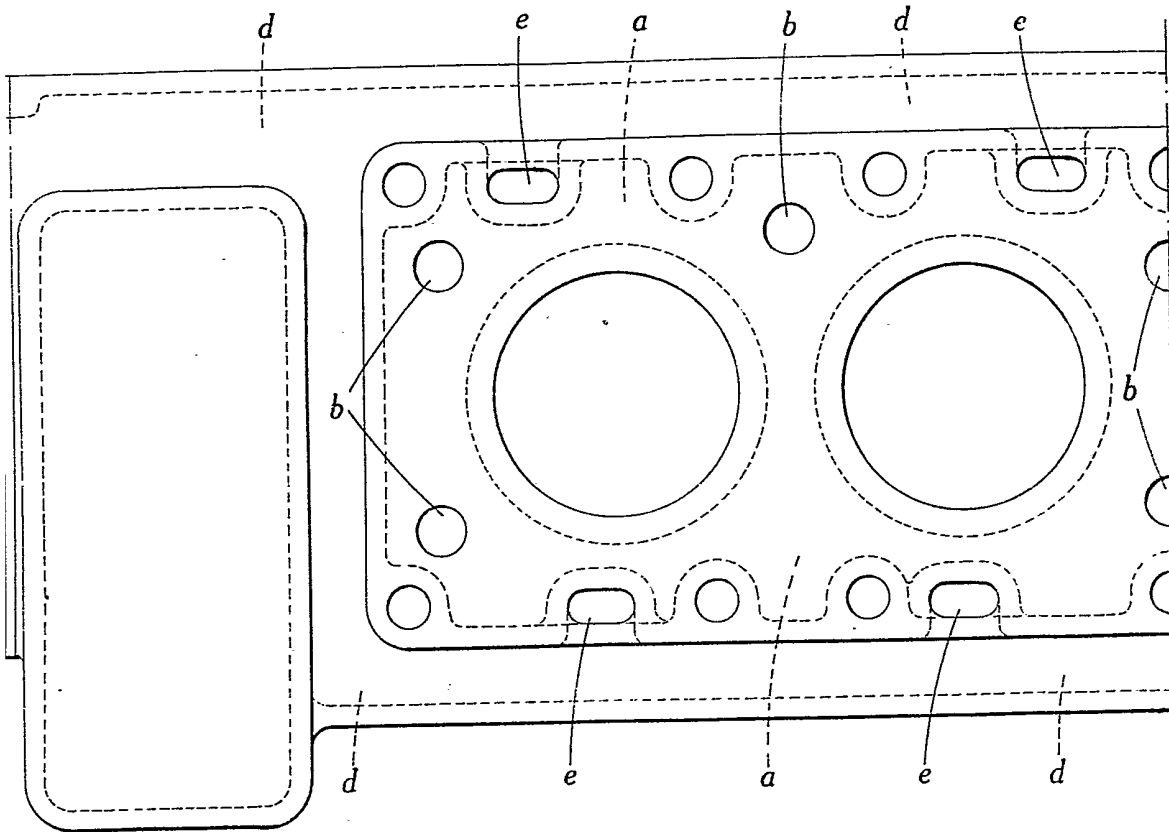


Fig. 1.

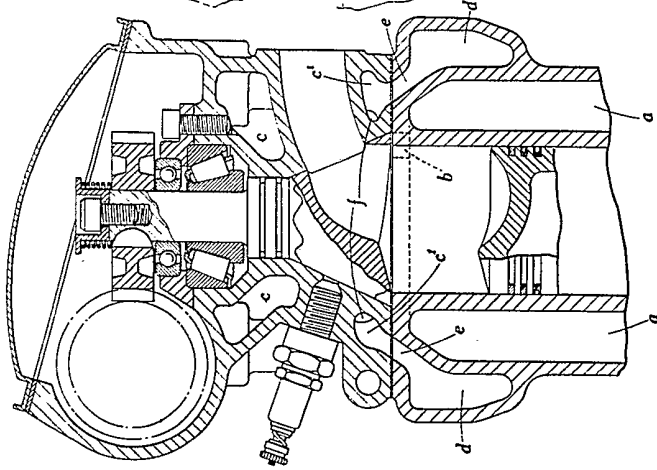
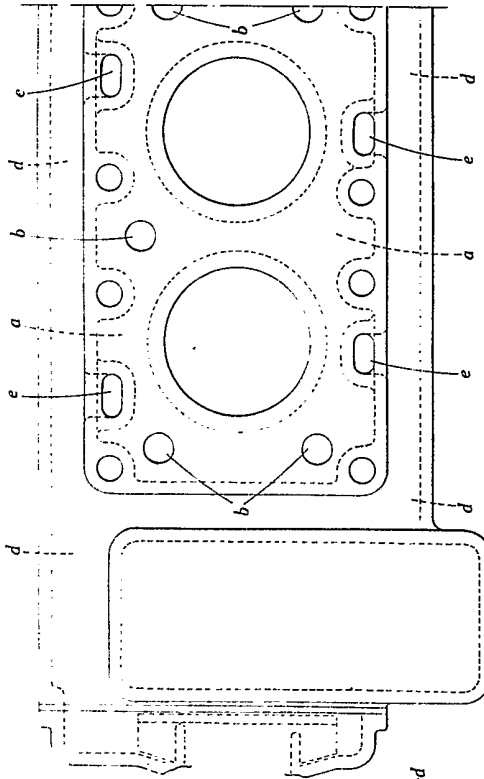


Fig. 2



[This Drawing is a reproduction of the Original on a reduced scale.]