PATENT SPECIFICATION

Convention Date (Germany) : June 29, 1937.
Application Date (In United Kingdom) : June 29, 1938.
Complete Specification Accepted : June 7, 1939.

506,967
No. 19363/38.

COMPLETE SPECIFICATION

Improvements in or relating to Rotary Valves for Internal Combustion Engines

We, AUTO UNION AKTIENGESELLSCHAFT, of 110, Scheffelstrasse, Chemnitz, Germany, a Company organised under the laws of Germany, 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 rotary valves for internal combustion engines.

Such rotary valves, and more particularly the exhaust valves, are subjected to considerable heat stresses for which reason, if they are to be kept in working condition, they require to be well cooled, the more so because if the valve body is of any appreciable length it tends to get distorted at high temperatures, thus causing it to jam.

In liquid cooled internal combustion engines it is known, on the one hand, to include the rotary valve in the cooling medium circuit; as however the rotary valve rotates relatively to the other engine parts through which the cooling medium flows, the question of sealing at the places of transition from the stationary to the rotating cooling jacket creates considerable difficulties, resulting in a complicated and expensive engine construction. On the other hand, the art of poppet valve controlled engines has taught the use of a salt which will melt at high temperature, such as sodium salt, and with which the hollow valve stems and heads are filled. However, the salt assumes a lower specific gravity as it melts with increasing heat. Now, the poppet valve being a reciprocating member, this fact can be tolerated, and does not constitute a serious disadvantage, as the reciprocating movements shake the salt filling and keep the molten and unmelted parts thereof thoroughly mixed, so as to be able to conduct the heat from the highly heated to the cooler parts of the poppet valve.

In the case of rotary valves, however, the possible success of such a salt filling was not obvious, as indeed a satisfactory cooling action was not to be expected, for on rotation of the rotary valve the hotter and, hence, lighter parts of the filling will accumulate near the axis of rotation, i.e., in the centre of the valve body, whilst only the cooler parts of the salt filling will come into contact with the peripheral parts of the valve body, and no such mixture as described above will take place.

A proposal has, however, been previously made for filling the entire hollow interior of a rotary valve with a cooling salt, but the above disadvantage is still liable to obtain.

The object of the present invention is to provide an improved internally cooled rotary valve for internal combustion engines.

According to the present invention, an internally cooled rotary valve for internal combustion engines comprises a hollow valve body filled with a salt adapted to melt at a high temperature, the valve body being extended into a reduced neck-like portion which is surrounded by the engine cooling jacket and communicates with the hollow of the valve body for the purpose of enabling the hotter parts of the salt filling to be urged into said neck-like portion during rotation of the valve.

One embodiment of the invention will now be described with reference to the accompanying drawing, which shows a sectional side elevation of a cylindrical rotary exhaust valve having curved gas passages and mounted in position in the cylinder head.

In the drawing 1 denotes the head of a cylinder 2 of an internal combustion engine in which a cylindrical rotary valve 3 is rotatably mounted in a manner well known per se. The cylinder 2, like the cylinder head 1, is provided with a cooling jacket 4 in which circulates a cooling medium—in the present case cooling water—which in turn is cooled in any desired manner. Resilient packings 6 are used to seal the sliding faces 5 of the rotary valve against the cooling jacket 4 of the engine. Similar packings 7 are provided on the driving side of the valve in order to protect the ball bearing 8 against ingress of cooling water from the cooling jacket 4. The rotary valve 3 has several gas passages 9, 10, which end in

[Price 1/-]

a common axial passage 11 and form curved passage therewith.

The rotary valve body 3 is extended into a reduced portion constituting a neck 12 which projects into the cooling jacket 4 of the engine and is surrounded by the cooling water. The rotary valve is driven by a driving pin 13 which is mounted in the ball bearings 8 and is in turn driven from the engine shaft, for example, by a chain and a sprocket 14.

In order to obtain uniform heat distribution in the rotary valve 3 which is internally webbed by the walls 15, 16 of the gas passages 9, 10, the hollow space 18 between these walls and the outer wall 17 of the valve is filled with a salt adapted to melt at high temperatures, such as sodium salt or the like. The quantity of salt is such that it occupies about 4/5 of the space 18 and has a capacity for heat equal to or greater than the metallic parts of the valve body. The aperture for inserting the salt may be provided at any desired point in the valve body but it is to advantage, for reasons of simplicity of manufacture and of balancing of the masses, to provide the aperture in the hub portion 19 on the neck 12 of the valve body 3. A stopper 20 serves to close this aperture and is screwed into a thread in the neck 12.

Particular simplicity in the construction of the valve is achieved if the stopper 20, as shown in the drawing, is provided with a splined bore 21 in which engages a correspondingly splined extension 22 of the driving pin 13. After inserting the salt and screwing in the stopper 20, the joint 23 between the reduced hub portion 19 and the stopper 20 is closed to form a fluid-tight seal by soldering, welding or the like. The splined extension 22 of the driving pin 23, furthermore is provided with a collar 24 against the face of which the stopper 20 abuts and so prevents axial displacement of the valve body subject to a certain limited axial play.

When the engine is in operation the salt filling liquefies first of all at the highly heated walls 15, 16 of the gas passages until finally the whole salt filling in the valve body is molten. The great capacity for heat of the salt filling relative to that of the other parts of the valve body allow thermal peak loads occurring during operation of the engine to be compensated for, the salt thus acting as an accumulator of heat, as it were, which, on the temperature stress decreasing for short periods, passes on the heat to the cooling jacket.

Owing to the construction of the valve with the hollow neck 12 protruding into the cooling jacket 4, as provided for according to the invention, the hottest and, hence, lightest parts of the salt filling are urged into the interior of the reduced neck portion during rotation of the valve, where they are thoroughly cooled by the cooling water owing to the direct contact of the neck portion therewith. The molten salt therefore brings about uniform heat distribution over the whole of the valve body and above all it conducts the heat from the hot gas passage walls 15, 16, not only to the outer wall 17 of the valve body, but also to the particularly well cooled neck 12, so that unduly high heating of individual valve portions and distortions and consequent running difficulties are avoided.

It will be appreciated that a construction made in accordance with the present invention enables the difficulty inherent in known proposals to be overcome by the provision of the neck-like extension into which the hotter and lighter parts of the salt filling, which tend to accumulate near the axis of rotation of the valve, can be urged and subjected to the direct and efficient cooling action of the surrounding cooling jacket into which the neck-like extension projects. This is of particular advantage in constructions in which the gas passages, such as the exhaust passages, extend substantially centrally in the valve, because it is near the central axis that the greatest amount of heat is passed on to the valve body and the maximum cooling effect is desired.

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

1. An internally cooled rotary valve for internal combustion engines comprising a hollow valve body filled with a salt adapted to melt at a high temperature, the valve body being extended into a reduced neck-like portion which is surrounded by the engine cooling jacket and communicates with the hollow of the valve body for the purpose described.

2. A rotary valve according to claim 1 characterised in that the filling aperture for the salt is provided in the neck-like portion of the valve body and is closed by a stopper adapted to the operatively engaged by a member driven from the engine shaft.

3. A rotary valve according to claim 2 characterised in that the stopper is sealed in the necklike portion by a welded seam and is provided with an axial splined bore for engagement by a correspondingly splined extension of a driving pin driven from the engine shaft.

4. The constructional form of inter-

nally cooled rotary exhaust valve and valve mounting in an internal combustion engine shown in the accompanying drawing and described with reference thereto.

5. An internally cooled rotary valve for internal combustion engines substantially as hereinbefore described.

Dated this 29th day of June, 1938.

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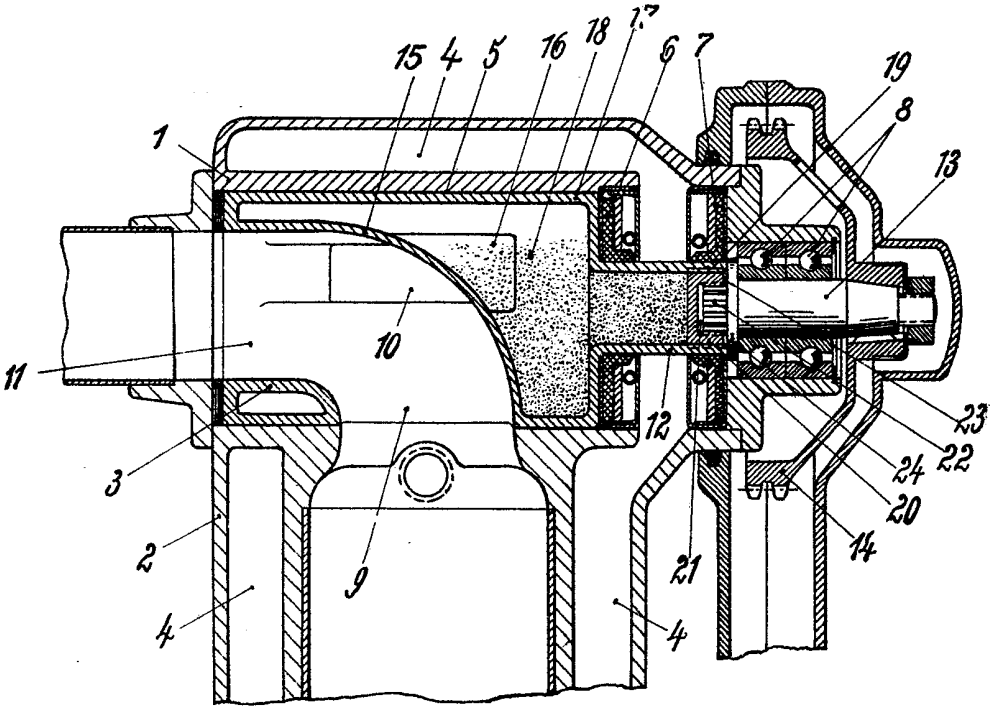
Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1939.



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