PATENT SPECIFICATION

Application Date: June 25, 1942. No. 8726/42. **559,710**

Complete Specification Left: June 24, 1943.

Complete Specification Accepted: March 2, 1944.

PROVISIONAL SPECIFICATION

Improvements in or relating to Internal Combustion Engines

I, FRANK METCALF ASPIN, a British subject, of 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention to be as follows:—

This invention relates to internal combustion engines and is particularly, though not exclusively, applicable to engines of the kind described in my prior Patent No. 463,412.

The thermal efficiency of an internal combustion engine varies very considerably with variation of working conditions and in particular it is affected by the throttle control. Generally speaking, all internal combustion engines are designed for an optimum compression ratio, so that, with a full charge under normal working conditions, the maximum power will be obtainable. The power obtainable from the explosion of each charge is however dependent on many factors of design in which compression ratio and detonation control are probably predominant, it being recognised that thermal efficiency increases with increase of compression ratio, provided that detonation control can be maintained. The practical determining factor of compression ratio with any given fuel is therefore mainly detonation control.

Internal combustion engines operate most of their time at less than full throttle and therefore seldom at maximum efficiency, because control of the engine power by the usual convenient method of throttling the supply of combustible gases immediately reduces the actual compression which obtains when the charge is ignited and this immediately reduces very substantially the thermal efficiency. For example, in the case of a small car, it is computed that it requires 30 h.p. to propel it at 60 m.p.h., but only 5 h.p. to propel it at 20 m.p.h. It should follow therefore, that for a journey of 60 miles at the slower speed the engine should require to provide only 15 h.p. hours or half that required at the higher speed and therefore that the fuel consumption should be halved. In actual fact, the fuel consumption at the different speeds will show very little difference, which indicates that the thermal efficiency at the slower speeds has been nearly halved, due to the lowering of the compression at which the charge is ignited, compared with the compression at the higher speeds.

The object of the invention is to improve the thermal efficiency of the engine when running under varying "throttled" conditions.

The invention is particularly applicable to the construction forming the subject of my co-pending Applications for Patent Nos. 7163/42 (Serial No. 557,564) and 7164/42 (Serial No. 557,565).

According to the invention, an internal combustion engine is characterised by means for varying the volume of the combustion space with variation of the volume of the charge.

According to a preferred embodiment of the invention, the engine is further characterised in that the means for varying the volume of the combustion space is automatically controlled by a factor controlling the volume of the charge.

In one example of the invention, the engine has an extension of the cylinder and a plug-like unit therein embodying the cylinder head and valve as described in the Specifications of my co-pending Applications for Patent aforesaid. The plug-like unit is axially movable in the end of the cylinder and the axial movement and/or mean location of the plug-like unit is controlled by a piston in a vacuum cylinder, the pressure in which varies with the pressure in the induction system.

Thus, as the pressure in the induction system varies as a function of both the engine speed and throttle opening, so the plug-like unit will be moved to decrease or increase the volume of the compression space as some function of the volume of the charge, so that the optimum, or an approximation to the optimum compression ratio, will be obtained for the lower or throttled engine power output.

Instead of controlling the movement of the plug-like cylinder head unit by variation of pressure in the induction system, it may be controlled mechanically as a function of both the engine speed and throttle position or by the pressure in the cylinder itself.

Obviously, there will be various mech-

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anical means by which the desired variation of volume of the combustion space may be effected, either automatically or otherwise, and the invention is not limited to the details of the example above given.

Dated this 18th day of May, 1942.
For the Applicant,
WILSON, GUNN & ELLIS,
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54/56, Market Street, Manchester, 1.

COMPLETE SPECIFICATION

Improvements in or relating to 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 rotary valve internal combustion engines and rotary valve assemblies therefor and is particularly, though not exclusively applicable to engines having the rotary valve construction described in my prior Patents Nos. 463,412, 511,208, 535,856 and 537,863.

It is known in the design and construction of internal combustion engines of the kind having poppet valves, to locate a relatively movable plug-like, or piston-like, member in the end of the cylinder, or in an extension thereof, movement of which is adapted to vary the volume of the combustion space; and to provide means for determining the positioning of such movable member proportional with one or more other variable factors affecting the working of the engines, such as engine speed, load and throttle control.

The object of the present invention is to apply such principle and method of variable combustion space volume to rotary valve internal combustion engines so as to enable the advantages of such principle and method to be obtained in combination with the advantages of the rotary valve.

According to the invention, a rotary valve assembly for an internal combustion engine comprises a plug-like member adapted to be mounted so as to be axially movable at the end of the engine cylinder for varying the combustion space and a rotary valve member mounted in the plug-like member, said plug-like member embodying a seating for the rotary valve member.

In the accompanying drawings:—

Fig. 1 is a longitudinal section illustrating one example of the invention.

Figs. 2 and 3 are diagrams showing modifications of the invention.

As shown in the drawings, the engine has an extension 10*a* of the cylinder 10 and a plug-like unit 11 therein embodying the cylinder head and rotary valve as described in the Specifications of my co-pending Applications for Patent aforesaid. The plug-like unit which embodies a conical seating for the rotary valve member 12, is axially movable in the end of the cylinder and has gas sealing rings 13 above and below its port 14 whilst, as can be seen, the complementary ports, such as 15 in the cylinder extension, are flared so as to provide free passage in whichever position the plug may be located. On the end of the cylinder extension is a thrust plate 16 secured by screws 16^1 and below which is rotatably mounted one part 17 of a face cam. The lower part 18 of the face cam is secured to a flange on the plug 11. The plug 11 carries anti-friction bearings 19 for the driving pinion 20. The plug 11 is restrained from rotation by a locating pin 21.

Any suitable means may be provided for rotating the cam 17. For example, as shown in Fig. 2 the axial movement and/or mean location of the plug-like unit 11 is controlled by a piston 22 in a vacuum cylinder 23, together providing a pneumatic actuating mechanism, the pressure in which cylinder varies with the pressure in the induction system of the engine, to which system one end of the cylinder will be connected, return movement being provided for example by a spring and the action controlled by any suitable damping means.

Thus, as the pressure in the induction system varies as a function of both the engine speed and throttle opening, so the plug-like unit 11 will be moved to decrease or increase the volume of the compression space as some function of the volume of the charge, so that the optimum, or an approximation to the optimum compression ratio, will be obtained at all times and for all conditions of use especially for the lower, or throttled, engine power output.

Instead of controlling the movement of the plug-like cylinder head unit by variation of pressure in the induction system, it may be controlled by variation of pressure in the cylinder itself or mechanically as a function of the throttle position only or of both the engine speed and

throttle position in such latter case using, for example, as shown in Fig. 3, linkage coupling of an engine-driven governor 24 and a connection 25 to the throttle control whilst the cam 17 is operated by a connection 26 so arranged that increase of speed and closing of throttle will both operate to move and plug 11 towards the piston and decrease the volume of the compression space.

Obviously, there will be various mechanical means by which the desired variation of volume of the combustion space may be effected, either automatically or otherwise, and the invention is not limited to the details of the example above given. For example, instead of the cam of the example above described, quick-thread screw or other mechanism could be used as a means for effecting movement of the plug, whilst as regards control means for non-automatic adjustment as applied to the cam construction, this could include means for securing the cam 17 in any desired set position as, for instance, by arranging that the cam 17 is secured to the plate 16 and such plate has arcuate slots to permit rotational adjustment relative to the securing screws 16^1. In a multi-cylinder engine, where automatic adjustment is provided, the cams 17 for each cylinder may be connected together for synchronised movement.

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. A rotary valve assembly for an internal combustion engine comprising a plug-like member adapted to be mounted so as to be axially movable at the end of the engine cylinder for varying the combustion space, and a rotary valve member mounted in the plug-like member, said plug-like member embodying a seating for the rotary valve member.

2. A rotary valve assembly for an internal combustion engine according to Claim 1 characterised in that the plug-like member is constructed to be restrained from rotation or turning movement.

3. A rotary valve assembly for an internal combustion engine according to Claim 1 or 2 characterised in that the plug-like member is adapted to be mounted in the end of the cylinder, or in an extension thereof and has at least one lateral port opening adapted to register with a complementary port opening in the said cylinder or extension.

4. A rotary valve assembly for an internal combustion engine according to Claim 3 characterised in that the plug-like member is fitted with gas-sealing rings above and below the said lateral port opening.

5. A rotary valve assembly for an internal combustion engine according to Claim 2, 3 or 4 characterised in that the end of the plug-like member is shaped as a face cam and by a complementary relatively rotatable face cam for effecting axial adjustment of the plug-like member.

6. A rotary valve assembly for an internal combustion engine constructed and arranged substantially as herein described with reference to and as illustrated in Fig. 1 of the accompanying drawings.

7. A rotary valve assembly for an internal combustion engine according to any of the preceding claims and adapted for operation substantially as herein described with reference to Figs. 2 and 3 of the accompanying drawings.

8. A rotary valve internal combustion engine having a rotary valve assembly according to any of the preceding Claims.

Dated this 3rd day of June, 1943.

For the Applicant,
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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1944

Fig.1.

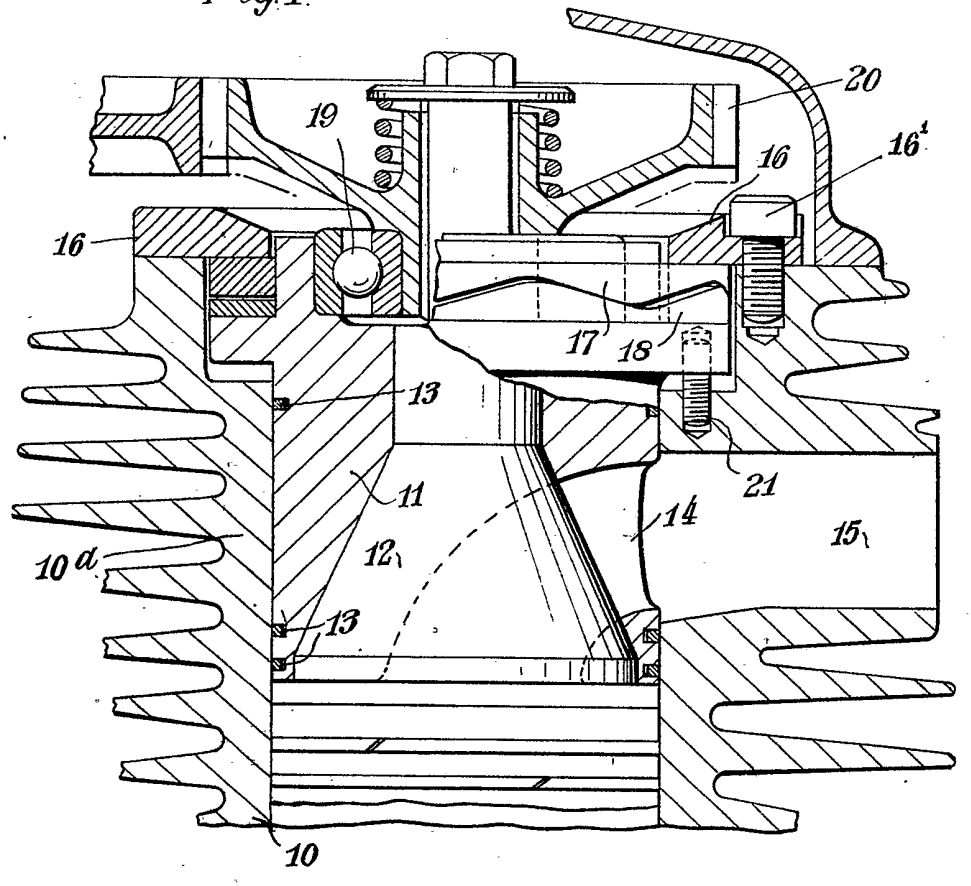


Fig.2.

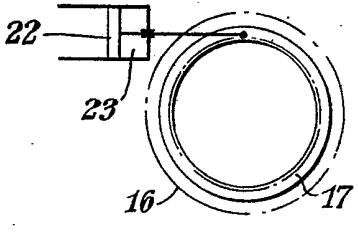
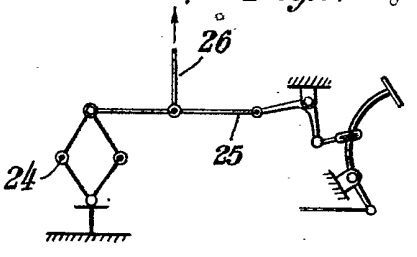


Fig.3.



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