Dec. 24, 1929. D. G. F. WHITE 1,740,758

VALVE FOR INTERNAL COMBUSTION ENGINES

Filed Nov. 28, 1928 3 Sheets-Sheet 1

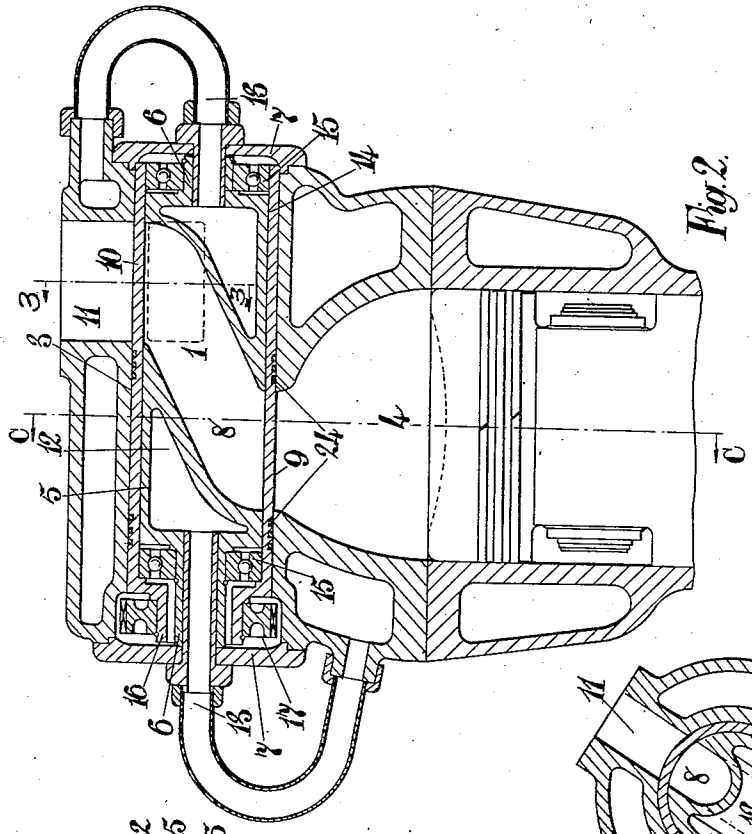

Fig. 2.

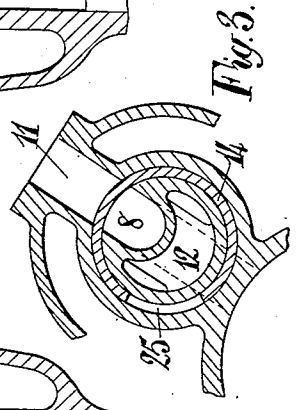

Fig. 3.

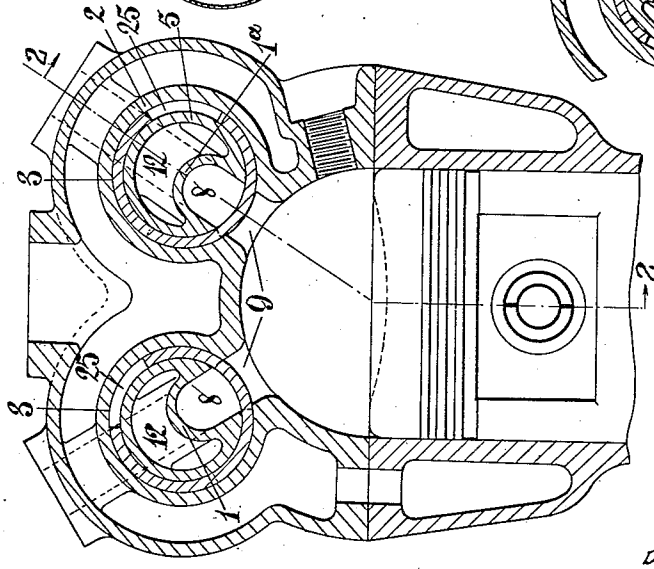

Fig. 1.

D. G. F. White
INVENTOR

By: Marks & Clark
Attys.

Dec. 24, 1929. D. G. F. WHITE 1,740,758

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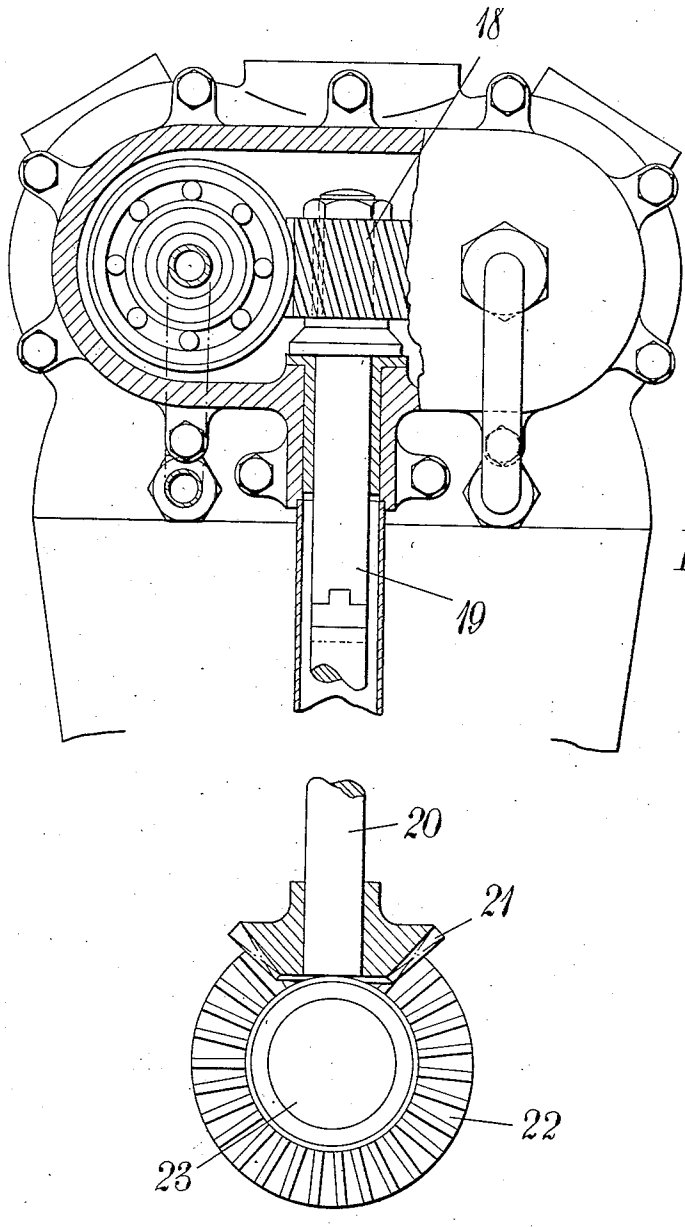

Fig. 4.

D. G. F. White
INVENTOR

By: Marks & Clerk
Attys.

Dec. 24, 1929. D. G. F. WHITE 1,740,758

VALVE FOR INTERNAL COMBUSTION ENGINES

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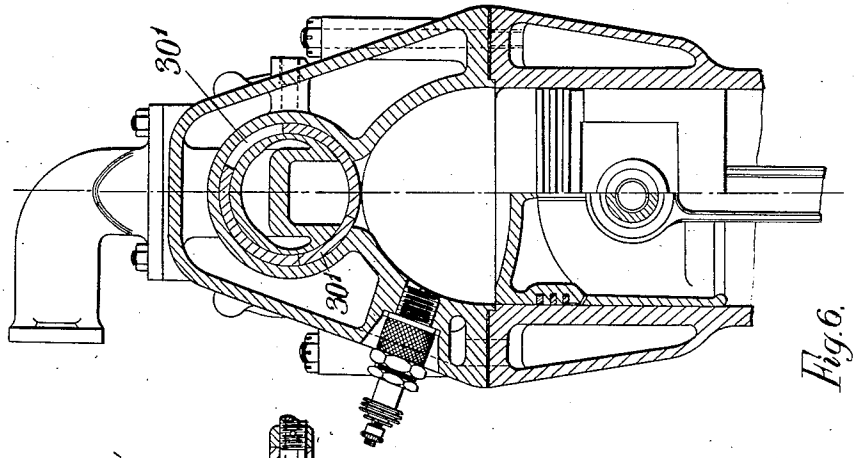

Fig. 6.

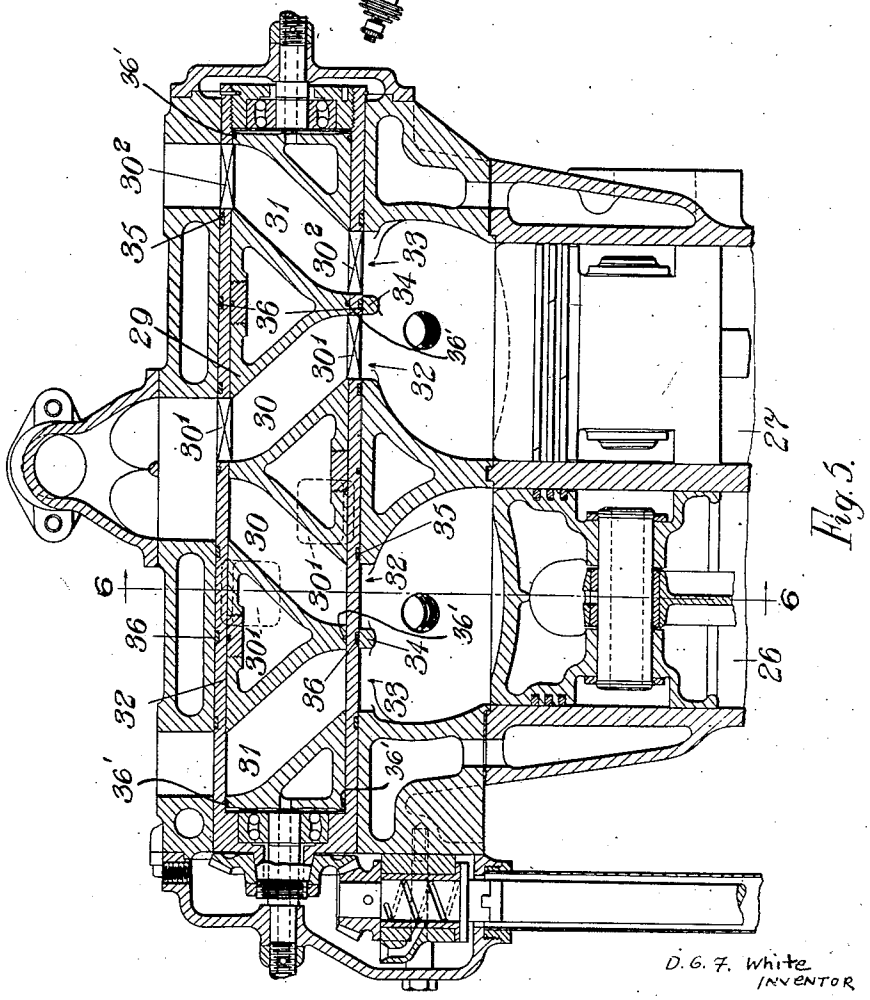

Fig. 5.

D. G. F. White
INVENTOR

By: Marks & Clerk Attys.

Patented Dec. 24, 1929 1,740,758

UNITED STATES PATENT OFFICE

DOUGLAS GEORGE FISHER WHITE, OF HAMMERSMITH, LONDON, ENGLAND

VALVE FOR INTERNAL-COMBUSTION ENGINES

Application filed November 28, 1928, Serial No. 322,485, and in Great Britain November 24, 1927.

This invention relates to valves of the rotary type suitable for internal combustion engines and the like.

The invention may be applied to internal combustion engines working on the two- or four-stroke cycles, of the so-called constant volume type or of the Diesel or semi-Diesel class.

An object of the present invention is to provide an improved valve device which is adapted to overcome many of the known defects attendant upon the various poppet, sleeve and other valves at present in use, and to obviate the troubles which arise in connection therewith while at the same time to produce a valve which may be manufactured cheaply and is calculated to afford increased efficiency, reliability and length of life.

The invention broadly comprises a ported sleeve member having a chambered core member with which it co-operates for control purposes by the aid of relative rotary motion.

A further feature of the invention consists in the provision of a fixed core around which the sleeve member is adapted to move in bearings, the arrangement being such that the sleeve relies for its support or bearing surface neither upon the core nor upon the outer casing for the sleeve.

A further feature of the invention resides in the cut-off and sealing functions of the valve with regard to the combustion chamber, which comprise in the first instance a double cut-off action and in the second interception by sealing rings of the piston type. In the preferred form the sleeve ports on opposite sides of the valve sleeve are staggered or displaced axially and separated or intercepted by a piston ring (or rings) and may also possess angular displacement from the diametric position.

Reference will now be made to the accompanying drawings in which:—

Figure 1 is a sectional view of an engine cylinder head showing my improved valve applied thereto.

Figure 2 is a section taken on line 2—2 of Figure 1.

Figure 3 is a section taken on 3—3 of Figure 2.

Figure 4 is an end view of a cylinder head partly broken away showing an overhead gear drive.

Figure 5 is a longitudinal sectional view of my invention applied to an engine having a pair of cylinders.

Figure 6 is an end view taken on line 6—6 of Figure 5.

Referring to Figures 1 to 3 wherein my invention is shown in its application to a four-stroke engine, the valve devices indicated generally at 1, 1^a are in unit form, the cylinder head 2 is cast with a pair of throughway cylindrical chambers 3 each adapted to receive one of the valve units. In the form shown the valve unit 1^a is designed for exhaust and the unit 1 for inlet and are disposed with their axes arranged at an angle to the axial plane common to a crankshaft for a plurality of cylinders.

For convenience and as the units are in the present example duplicates one of the other, only one (say that for inlet) of the pair will be described.

The cylindrical chamber 3 communicates on the one hand, with the combustion space 4 of the engine through a suitable port or opening and, on the other hand, communicates through a similar opening with the induction pipe of the engine. This cylindrical chamber is adapted to accommodate a cylindrical core 5 which is provided with trunnions 6 at each end adapted to be rigidly mounted in end caps 7 or other support means which may also conveniently form a closure for the cylindrical chamber.

The core member 5 is provided through its body with a transfer passageway 8 arranged obliquely and terminating on one side with what may be called a passage cylinder port 9 to the cylinder, and on the other with what may be termed the passage inlet port 10, the former being more or less in register with the opening in the combustion space 4 of the engine cylinder and the latter adapted to communicate with the inlet pipe or chamber 11. This oblique arrangement causes these two passages or ports to be staggered or displaced axially with respect to one another. The amount of axial displacement is prefer-

ably such as to afford a marginal piece or circumferential band spacing the planes of the edges of the passage ports from one another axially.

In addition to the gas or transfer passage above described the core 5 is cast with spaces 12 adjacent or around the passageway for the circulation of water or other cooling medium, the circulation preferably being effected by forming the trunnions hollow and providing suitable connections 13 with the circulating system of the engine. The core member 5 is arranged coaxially with the cylindrical chamber in the cylinder head and its dimensions are such as to leave an annular clearance between it and the wall of the cylindrical chamber. This space is adapted to receive a sleeve 14 which may be hereinafter referred to as the "valve sleeve."

In addition to the axial displacement of the passage cylinder port 9 and the passage inlet port 10, these ports may also be displaced angularly with respect to the diametric plane, that is to say, the transfer passage may be symmetrical about a diametric plane of the core but it is preferred that it should be bent so that the ports in question are displaced angularly with respect to the diametric plane with a view to affording a more tortuous path for any gases tending to escape through clearances.

Towards each end this valve sleeve is adapted to be supported on ball, roller or other bearings 15 which may be conveniently mounted upon the trunnions 6 of the core member 5. Towards one side the sleeve 14 may have an extension 16 of smaller diameter which may serve as a mounting for the bevel or other gear wheel 17 through which the sleeve may be revolved in the appropriate manner according to the cycle of the engine. Obviously any suitable toothed, worm gearing or other form of drive may alternatively be applied to operate the valve sleeve.

A convenient arrangement for effecting such drive is shown in Figure 4 in which a helical gear 18 is employed for revolving both valves, the gear being mounted on a spindle 19 driven by a vertical shaft 20 having at its lower end a bevel gear 21 meshing with a second gear 22 rotated by the crank shaft 23.

The dimensions of the sleeve 14, the core member 5 and cylindrical chamber 3 are so related that between the core member and the sleeve, and between the sleeve member and the cylindrical chamber in the cylinder head, a small clearance is provided of the order of a few thousandths of an inch, so that the sleeve member does not rotate in actual contact either with the core or with the cylindrical chamber but floats between them.

The valve device may be sealed by means of piston or other spring sealing rings, such as 24, the outer surface of the valve sleeve being preferably formed with a series of circumferential grooves each of which is adapted to receive one or more sealing rings and it is preferred that the arrangement should be such that these piston rings contact and make a secure joint with the wall of the cylindrical chamber and do not rotate, relative motion occurring between the piston ring and the valve sleeve. Alternatively or additionally, the cylindrical chamber and/or the core may be provided with piston rings. A piston ring or a group of piston rings is arranged in a pair of planes and as shown these are located upon each side of the port 8 or opening to the cylinder, one piston ring (or one group) being arranged in the marginal band referred to above.

The valve sleeve is provided with ports 25 disposed axially and circumferentially to register with the ports of the transfer passage 8 at the appropriate and predetermined times for the purpose of the cycle.

It will be appreciated that the position of the piston rings as indicated above, isolates the combustion space of the engine and prevents the escape of gas either axially or circumferentially and that even were a leakage to take place past the rings, gas would have to traverse an extended and tortuous path. Furthermore, it will be observed that the control to and from the cylinder is a double one in that cut-off occurs on both sides of the core passage, viz, between the sleeve ports 25 and the passage cylinder port 9 on the one hand and the passage inlet port 10 on the other.

The invention is illustrated in Figures 5 and 6 as applied to a four-stroke engine having a pair of cylinders 26, 27, the same general principles of construction applying as already described above. In this case, however, the valves shown generally at 28 for the two cylinders are according to one form combined in a single structure. The core member 29 is integral and is located and extends over both cylinders, being arranged with its axis in the axial plane common to the two cylinders. The core is provided with inlet passages 30 and exhaust passages 31 for both cylinders, that is to say with two pairs of inlet and exhaust passages.

Similarly, the valve sleeve 32 is integral and provided with corresponding inlet ports $30'$ and exhaust 30^2 for the two cylinders. Each cylinder is provided with inlet openings 32 and exhaust openings or apertures 33 at the upper extremity of the combustion chamber separated from one another by a bridge piece 34. The inlet and exhaust transfer passages 30, 31 in the core part for one engine cylinder are arranged obliquely in opposite sense so that from one aspect they may be said to diverge from one another towards the induction side. The inlet and exhaust ports $30'$, 30^2 respectively are adapt-

ed to register with openings of the inlet and exhaust transfer passages 30, 31 respectively of the core at the appropriate times. Piston rings 35 (or groups of rings) may be provided as hereinbefore described. For example, piston rings 36 may be arranged in the planes of the bridge piece 34 and of the marginal band. Additional piston rings 36' may be provided towards the extremities of the core member 29 or elsewhere.

The arrangement above described with reference to a pair of cylinders may be equally applied or extended for four or more cylinders.

In most applications of the invention it will be found, owing to the clearances referred to, that the valve sleeve may be run without special lubrication but in some circumstances it may be preferred to introduce a film of oil in these clearances which may serve as a lubricant and an additional seal. If this be required the oil may be introduced through a duct leading to the cylindrical chamber out of register with the control ports but in register, if desired, with oil ports in the valve sleeve.

Several examples of modes of carrying the invention into effect have been shown and described but it is to be understood that the invention is not limited in these respects. It will be appreciated that the invention may be carried into effect in a great variety of ways and many combinations may be effected. For example, one valve device or unit may have both inlet and exhaust passages adapted to serve one or a series or block of cylinders.

The invention may be applied to Diesel engines for controlling inlet and/or exhaust.

Further, it will be appreciated that the port arrangement or order longitudinally of the core member, that is to say, the sequence, viz, inlet, exhaust, inlet etc., may constitute any variation appropriate to the design of the engine or conditions desired.

The ports may be of any appropriate area or shape to afford the most efficient conditions and to accord with the motion imparted to the sleeve.

I claim:

1. Valve means for internal combustion engines comprising a valve chamber, a sleeve within said chamber but disposed with slight clearance therefrom, a stationary core member disposed with slight clearance within said sleeve, said sleeve and said core having staggered inlet and exhaust ports, packing rings arranged on said core member between adjacent inlet and exhaust ports, and trunnion means for supporting said sleeve independently of said core and said chamber.

2. Valve means for internal combustion engines comprising a valve chamber, a sleeve within said chamber but disposed with slight clearance therefrom, a stationary core member disposed with slight clearance within said sleeve, said sleeve and said core member having staggered inlet and exhaust ports, packing rings arranged on said sleeve between adjacent inlet and exhaust ports, packing rings arranged on said core member between adjacent inlet and exhaust ports and trunnion means for suppporting said sleeve and said core, said sleeve being driven by means mounted independently of said trunnion means.

In testimony whereof I have signed my name to this specification.

DOUGLAS GEORGE FISHER WHITE.