

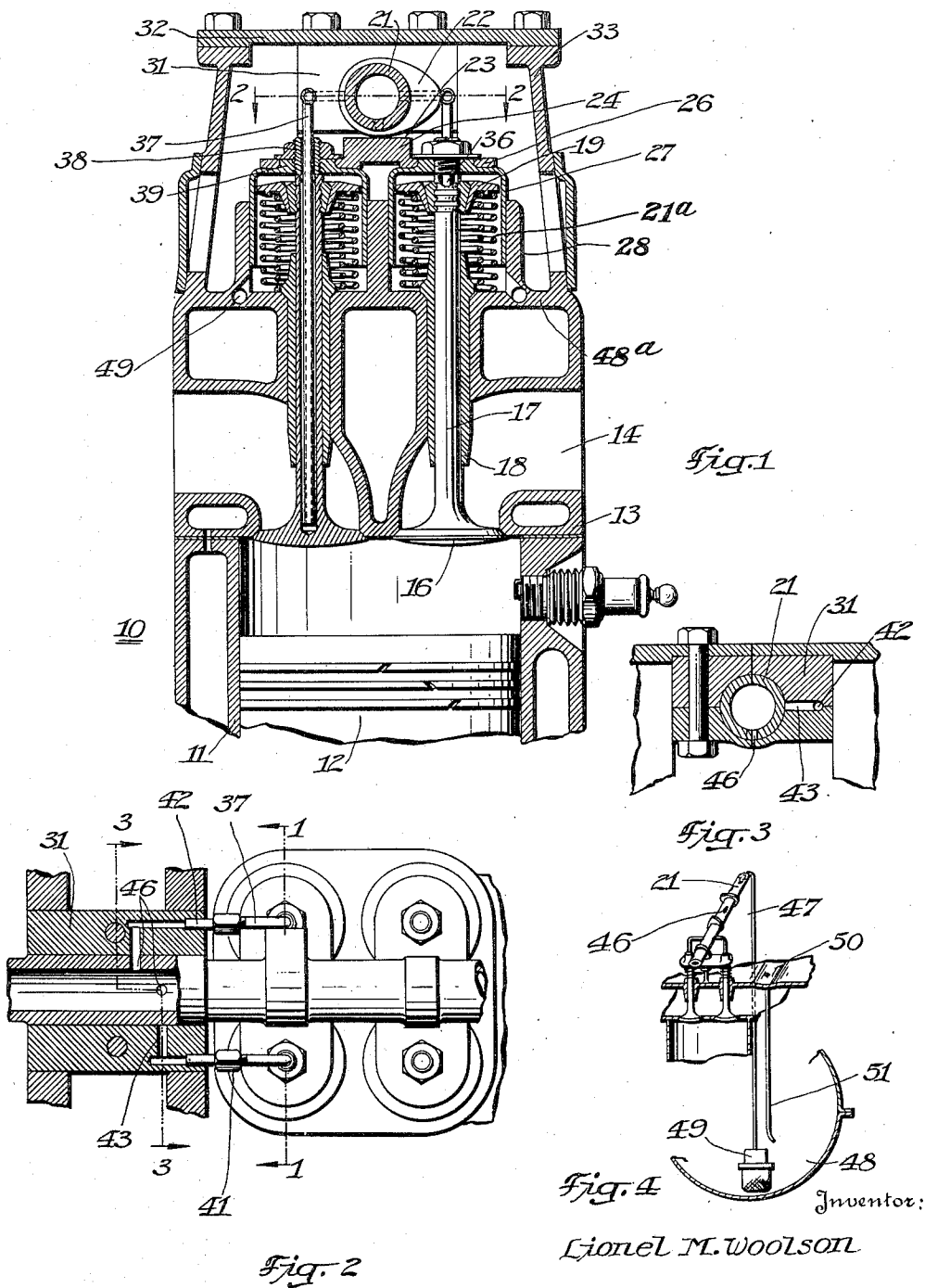
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INTERNAL COMBUSTION ENGINE

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INTERNAL-COMBUSTION ENGINE.

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This invention relates to internal combustion engines, and more particularly to means and methods of cooling and lubricating the valves and valve mechanisms thereof.

5 An object of the invention is to supply a stream of cooling liquid to the valve mechanisms of a motor vehicle.

Another object is to provide means for cooling the valves of internal combustion engines, in which the cooling fluid shall also serve to assist lubrication of the valve actuating mechanism.

Other objects of the invention will appear from the following description taken in connection with the drawing which forms a part of this specification, and in which:

15 Fig. 1 is a vertical section through the upper part of an internal combustion engine showing the application of the invention thereto, taken substantially on the line 1—1 of Fig. 2;

Fig. 2 is a plan view, partially in section on the line 2—2 of Fig. 1;

25 Fig. 3 is a detail section on the line 3—3 of Fig. 2, and

Fig. 4 is a schematic representation of a portion of an internal combustion engine, showing the circulation of the cooling oil.

It is well recognized in internal combustion engine practice that high valve temperature is one of the factors limiting power output. Especially is this true of the exhaust valves of high speed, heavy duty engines such as are used in the propulsion of air craft, in which it is not uncommon for these valves to run at a bright red heat, causing them to warp and stick, and to seat poorly. To remedy this evil it has been heretofore proposed to cool such valves by circulating through appropriate channels therein, a cooling fluid, usually water. Such cooling systems have necessitated a double connection to the valve stem, which is in rapid motion, and difficulties have arisen in maintaining such connections fluid-tight and in obtaining reasonable freedom from breakage thereof.

50 This invention provides valve cooling means in which the cooling fluid used is preferably the engine lubricating oil, which is conducted to the interior of the valve by a single stationary connection, and which overflows from the valves into the housing therefor, thus assisting in the lubrication of the valve actuating mechanism.

Referring to the drawing, at 10 is shown an internal combustion engine having a cylinder 11 in which is mounted a piston 12 in the usual manner. The cylinder 11 is provided with a head 13, in which are formed exhaust passages 14, and similar intake passages (not shown). The passages 14 communicate with the cylinder 11 through the usual valve ports, in which poppet valves 16 are adapted to seat. The valves 16, which may be formed with hollow heads, are provided with vertically disposed tubular stems 17, slidably mounted in guides 18, carried by the head 13. The stems 17 are provided near their upper ends with spring abutments 19, cooperating with springs 21^a, which serve to urge the valves 16 to their seats in a manner well understood in the art to which this invention relates. The upper ends of the tubular stems 17 are notched to provide lateral channels 36, formed normal to the axis of the stem and adapted to communicate with the interior thereof.

The engine 10 may be equipped with any preferred arrangement of valves 16, and any suitable actuating means may be employed to open the valves in timed relation to the engine cycle. In the embodiment illustrated, each of the engine cylinders is equipped with pairs of intake and exhaust valves, the valves of each pair being adapted for operation in unison. As the actuating mechanisms for each of these pairs of valves are in all respects similar, only one set will be described herein. This mechanism comprises a hollow cam shaft 21, provided with cams 29, each adapted to bear against a cam follower 23. The cam follower 23 is formed as a yoke member 24 having laterally extending portions 26, connected to suitable guide members 27, which are mounted for reciprocation in guides 28 in the head 13.

The hollow cam shaft 21 is journaled in suitable bearings 31, supported above the valve mechanism in any convenient manner, as by a cover plate 32 mounted upon the walls 33 of the valve housing, and is adapted to be driven in the usual way in timed relation to the engine.

Suitably supported from the cam shaft bearings 31 are stationary tubes 37, which extend downward through the tubular valve stems 17 nearly to the ends thereof, as clearly shown in Fig. 1. The tubes 37 pass loosely through bushings 38 which are threaded into

bosses 39 on the upper faces of the guide member 27, these bushings constituting adjustable tappets by means of which motion of the guide member 27 is communicated to the ends of the valve stems 17. The upper ends of the tubes 37 are connected in any suitable manner, as by compression couplings 41, with conduits 42 formed in the cam shaft bearings 31, and these conduits 42 are provided with lateral branches 43, which extend inwardly to the bearing surface, as best shown in Fig. 3. The hollow cam shaft 21 is provided, at suitable points along its length, with metering ports 46, affording communication from the interior of the cam shaft to the branch conduits 43, and it is connected at one end with a suitable pressure pipe 47, to which is supplied oil under pressure from the engine crank case 48 by any ordinary pump 49.

The interior of the valve housing has a horizontally disposed floor 48^a in which are formed longitudinally extending troughs 50, connected by suitable drain pipes 51 to the crank case 48.

It will be seen that during operation of the engine, oil is pumped from the engine crank case 48 through the pipe 47 to the interior of the hollow cam shaft 21^a. The metering ports 46 register once during each revolution of the cam shaft with the conduits 43, during which interval a measured charge of oil under pressure flows from the interior of the cam shaft 21 through the conduits 43 and 42 into the stationary tube 37, and thence downwardly to the bottom of the tubular valve stem 17. The oil then passes upwardly through the annular space between the tubular stem 17 and the exterior of the tube 37, overflowing through the channels 36 over the valve springs 21 and the guide members 27, and assisting in the lubrication thereof. The temperature of the oil is greatly increased during its circulation through the valve stem, and the heat absorbed is carried off with the overflowing oil, thus maintaining the valve cool in a manner that will be readily understood. The overflowing oil is collected in the troughs 50 and returned through the drain pipes 51 to the engine crank case.

It will be understood that various forms of the invention other than those described above may be used without departing from the spirit or scope of the invention.

I claim:—

1. In combination in an internal combustion engine, a hollow poppet valve having a tubular stem, a stationary tube extending through the hollow stem into said valve, and means for intermittently delivering successive charges of cooling fluid through the tube to the interior of the valve.

2. In combination in an internal combustion engine, a hollow poppet valve having

a tubular stem, a stationary tube extending through the hollow stem, and means independent of said valve for delivering measured charges of oil through the tube to cool said valve.

3. In combination in an internal combustion engine, a hollow poppet valve having a tubular stem, a stationary tube extending through the hollow stem into said valve, a cam shaft adapted to actuate said valve, and means associated with said cam shaft to measure charges of oil and deliver said charges into the tube to cool the valve.

4. In combination in an internal combustion engine, a hollow poppet valve having a tubular stem, a hollow cam shaft adapted to contain oil under pressure, metering means associated with said cam shaft and means adapted to deliver measured charges of oil from the metering means into the tube.

5. In combination in an internal combustion engine, a hollow poppet valve having a tubular stem, a stationary tube extending through the hollow stem into said valve, a hollow cam shaft adapted to contain oil under pressure, metering means associated with said cam shaft, and a conduit connecting the metering means with said tube.

6. In combination in an internal combustion engine, a reservoir adapted to contain oil, a hollow cam shaft, means adapted to supply oil under pressure from the reservoir to the interior of the cam shaft, a hollow poppet valve having a tubular stem, a stationary tube extending through the hollow stem into said valve, means repeatedly connecting the tube to the interior of the cam shaft, and means to conduct the overflow of oil from the valve stem to the reservoir.

7. In combination in an internal combustion engine, a hollow poppet valve having a tubular stem, a stationary tube extending through the hollow stem into said valve, a reservoir for oil, means adapted to deliver measured charges of oil from the reservoir to the tube, and means to return the overflow of oil from the valve stem to the reservoir.

8. In combination in an internal combustion engine, hollow poppet valves having tubular stems, a hollow cam shaft mounted in bearings adapted to actuate the valves and containing oil under pressure, a stationary tube extending through each of said valve stems, conduits in the cam shaft bearings connected to each of the tubes, and means associated with the cam shaft to meter charges of oil therefrom into each of the conduits in succession, whereby said valves are cooled.

9. In an internal combustion engine, a poppet valve having a tubular stem, a stationary tube extending through stem, means for actuating the valve, means for introducing successive charges of oil under pressure into the tube, whereby the valve is cooled

by the flow of oil through the tube and the stem, and the actuating means is lubricated by the overflow of oil from the stem.

10. In an internal combustion engine, a hollow poppet valve having a tubular stem, a hollow cam shaft adapted to actuate the valve and containing oil under pressure, and means for metering successive charges of oil through the valve, said means comprising a metering port in the cam shaft, and a conduit connected to the tube and adapted to register with the metering port once in each revolution of the cam shaft.

11. In an internal combustion engine having a head, and a crank case adapted to contain oil, a hollow poppet valve in the head, a tubular stem for the valve, a hollow cam shaft adapted to actuate the valve, means to supply oil under pressure from the crank case to the interior of the cam shaft, means including a stationary tube in the valve stem to supply oil from the cam shaft to the hollow valve, and means including a drain trough in the head to return the overflow of oil from the valve stem to the crank case.

12. In combination with the hollow poppet valve having a tubular stem, means independent of said valve including a stationary tube for delivering successive measured charges of cooling fluid through the stem into said valve.

13. In combination with a hollow poppet valve having a tubular stem, cooling means including a stationary tube disposed in the stem, and means for intermittently delivering cooling fluid in successive charges through said tube.

14. A metering device for oil cooled poppet valves comprising a hollow cam shaft adapted to actuate said valves and containing oil under pressure, bearings for the cam shaft, conduits in the bearings connected to the valves, and metering ports in the cam shaft adapted to connect the interior thereof to each conduit once during each revolution of the cam shaft.

15. The combination in an internal combustion engine, of a hollow camshaft adapted

ed to contain oil under pressure, valves having tubular stems actuated by said camshaft, bearings for said camshaft, and means including conduits in said bearings and tubes supported by said bearings to conduct oil from the camshaft into said tubular valve stems.

16. The combination in an internal combustion engine, of a hollow camshaft adapted to contain oil under pressure, valves having tubular stems actuated by said camshaft, bearings for said camshaft, and means supported by said bearings to conduct oil from said camshaft into said tubular valve stems.

17. The combination in an internal combustion engine, of a hollow camshaft adapted to contain oil under pressure, valves having tubular stems actuated by said camshaft and provided with ports, bearings for said camshaft having conduits adapted to periodically register with the ports, and stationary tubes supported by the bearings and entering the tubular valve stems to deliver successive charges of oil from the camshaft into said stems.

18. In an internal combustion engine including a valve to be cooled, the method of cooling said valve which comprises supplying a stream of liquid thereto and periodically interrupting said stream, whereby predetermined successive quantities of said liquid are supplied to said valve.

19. In an internal combustion engine including a recessed valve to be cooled, the method of cooling said valve which comprises supplying a stream of liquid to said recess and periodically interrupting said stream, whereby predetermined successive quantities of said liquid are supplied to said valve.

20. In an internal combustion engine including a recessed valve to be cooled and lubricated, the method of cooling and lubricating said valve which comprises supplying a stream of oil to said recess, periodically interrupting said stream and periodically ejecting oil from said recess.

In testimony whereof I affix my signature.

LIONEL M. WOOLSON.