May 31, 1932. F. B. STONER 1,860,725

DUAL ROTARY VALVE

Filed Jan. 25, 1930 2 Sheets-Sheet 1

Fig. 1

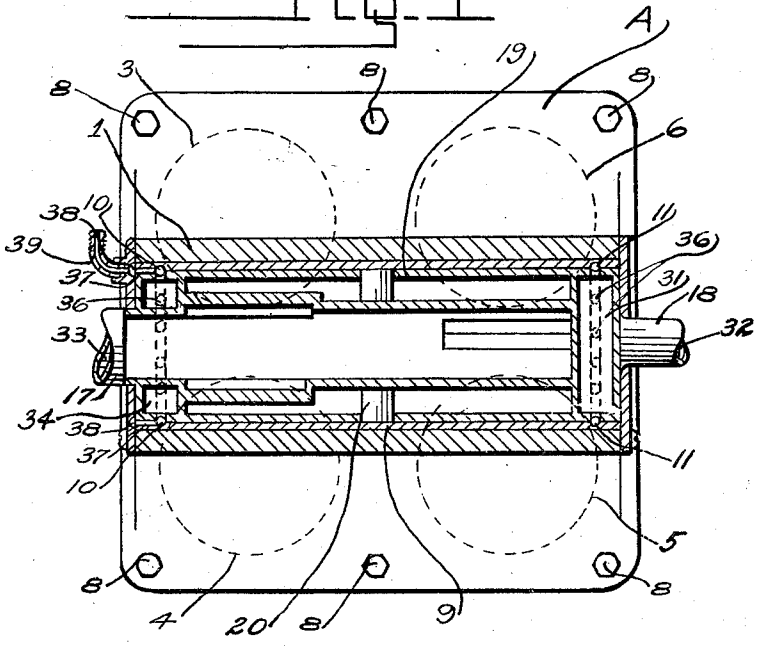
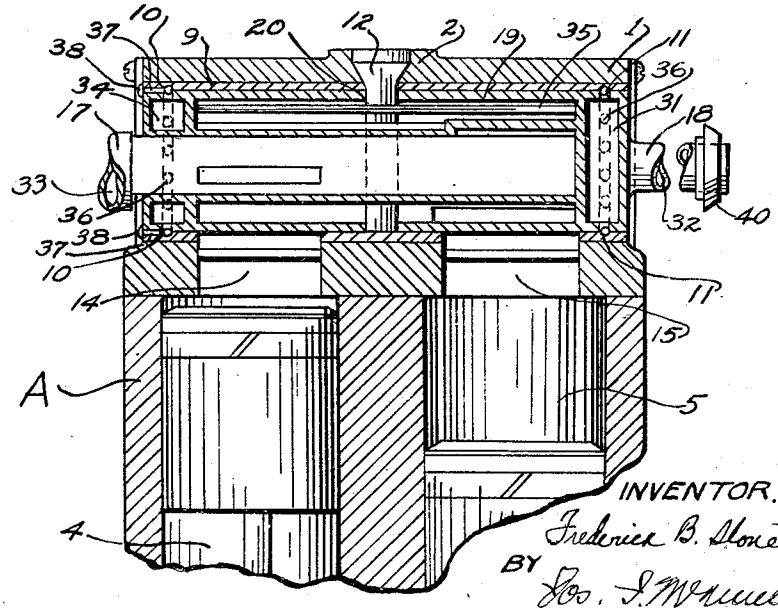


Fig. 2



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DUAL ROTARY VALVE

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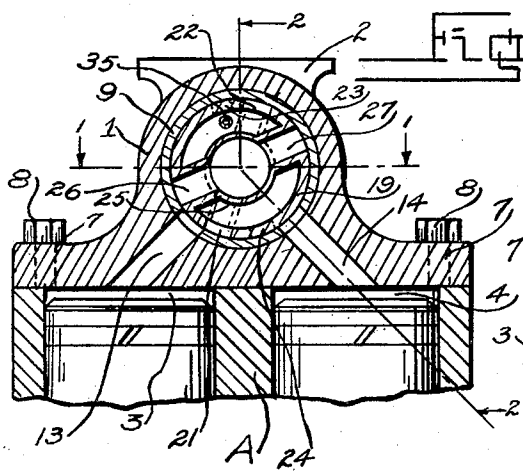


Fig. 3.

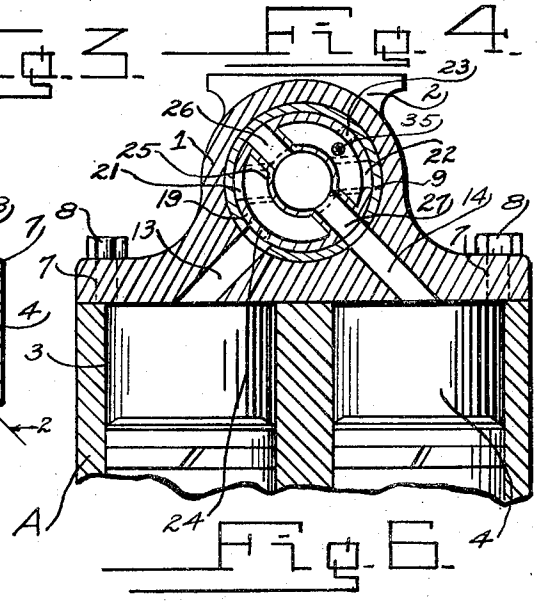


Fig. 4.

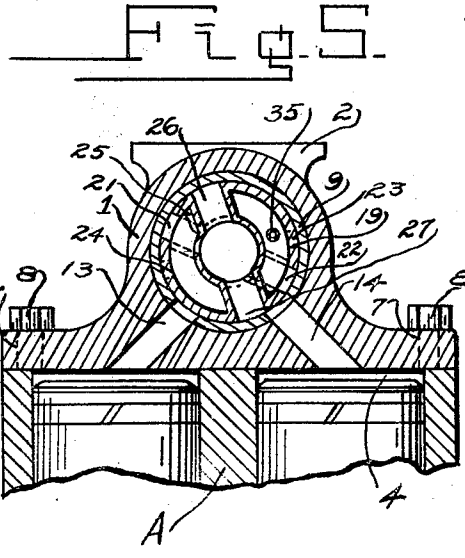


Fig. 5.

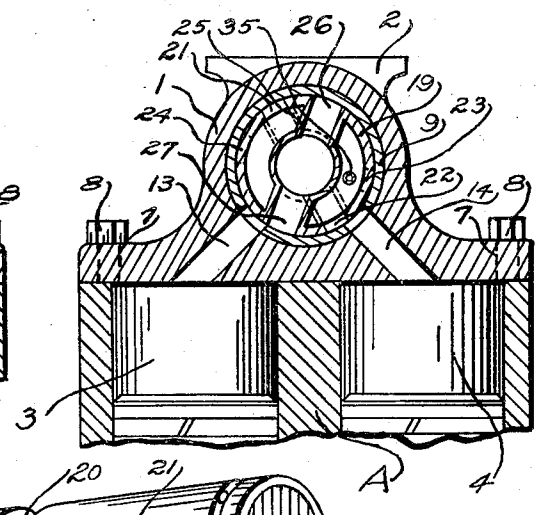


Fig. 6.

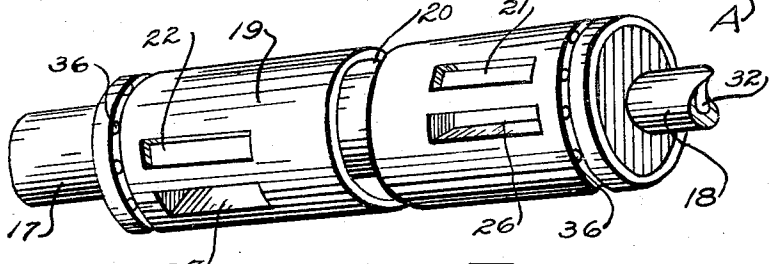


Fig. 7.

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Patented May 31, 1932 1,860,725

UNITED STATES PATENT OFFICE

FREDERICK B. STONER, OF RIVERSIDE, CALIFORNIA

DUAL ROTARY VALVE

Application filed January 25, 1930. Serial No. 423,475.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

This invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

My invention relates to a rotary valve for engines but more particularly to a dual rotary valve which is capable of controlling the cycle events of four cylinders.

One object of my invention is to produce a rotary valve that is adapted to be cooled by oil or a similar circulating fluid.

Another object of the invention is to provide a valve structure wherein the combustible is preheated with consequent cooling of the valve body.

Still another object is the provision of a unitary valve with a minimum number of parts to control all the cycle events necessary of a four cylinder engine.

A further object is to develop a rotary valve which may be easily and inexpensively reproduced.

Another object of my invention is the provision of a novel valve lubricating system.

Still another object is to effect a valve construction wherein differential temperatures, which tend to adversely effect the valve, are eliminated.

The valve is best adapted for and is illustrated with a four cylinder, four-cycle internal combustion engine of the type wherein the pistons are yoked together in pairs, each piston of a pair performing its inward and outward stroke in unison. It is contemplated to construct the valve to accommodate it to an engine of the type described wherein the firing of the cylinders is alternated, one cylinder of each pair being fired each quarter revolution of the crank.

Briefly, the valve organization comprises a casing provided with one passage to each of four engine cylinders and a single opening through which is introduced a gaseous fuel or motive fluid, the passages each designed to function both as an inlet and an exhaust for one cylinder. Journalled within the casing through the intermediary of hollow spindles is a hollow thin walled valve provided at its mid section with an annular orifice which continually communicates with the opening in the casing. The construction is such that there is provided a relatively large hollow portion through which gaseous fuel or motive fluid entering through the opening must pass prior to its introduction into the engine cylinders.

This hollow portion is provided with two diametrically opposed ports on each side of the annular orifice, these ports constituting the means of egress from the cage to the passages leading to the cylinders. Each pair of ports is staggered with respect to the pair on the other side of said annular opening for a purpose which is obvious from the firing order set forth supra. Extending longitudinally through the hollow valve is a hollow septum which is ported at four points in proximity to the before mentioned ports in the hollow valve and constitutes an exhaust passage. Although the septum passes completely through the hollow valve the half on either side of the annular orifice is deflected with respect to the other half in order that the exhaust ports through the valve into the septum may be uniformly positioned with respect to those ports designed to carry the gaseous fuel or motive fluid into the cylinders.

The hollow septum is connected at one of its extremities with a hollow spindle whereby exhaust gases may be withdrawn to the atmosphere while at the other extremity the septum is blocked-off by means of an oil chamber fashioned within that end of the valve. Encompassing the hollow spindle through which the exhaust gases are designed to pass is a second oil chamber connected by means of a pipe to the first oil chamber. Both of said chambers are provided with oil holes leading to an oil groove positioned between each oil chamber and the valve casing. The other spindle, as opposed to the one through which pass the exhaust gases, is designed with an opening therein for the purpose of introducing oil which is in turn transmitted through the before mentioned pipe to the other oil chamber. The latter chamber is furnished with means for withdrawing oil therefrom so that a continual circulation of oil through the chambers may be effected.

It is to be borne in mind that not only do these oil chambers furnish lubrication for the valve organization but they likewise, by means of the circulation through them, maintain the ends of the same cooled, while the central portion of the valve organization is retained at a moderate temperature by means of the gaseous fuel or motive fluid which is capable of filling the central portion of the valve around the septum. This construction has the advantage not only of cooling the central portion of the valve and valve casing but also of preheating incoming fuel to the engine cylinders. The construction of the valve is such, taking into consideration the annular orifice, that suction within the engine cylinders is transmitted to the annular oil grooves and tends to assist, by drawing oil therefrom, in the lubrication of the rotary valve within the valve casing.

The rotary valve is turned through the intermediary of a pinion positioned upon that spindle through which oil is introduced. It is contemplated that the valve will be rotated at a speed one-quarter that of the engine crank shaft but the details of such rotation are so obvious that it is not deemed necessary to further consider them. In order that the invention may be readily understood reference is had to the accompanying drawings forming a part of this specification in which—

Fig. 1 is a section at 2—2 on Fig. 3;

Fig. 2 is a section at 2—2 on Fig. 3;

Figs. 3, 4, 5 and 6 represent the positions of the valve at the beginning of each of the four cycles and

Fig. 7 is a perspective showing of the valve.

A valve casing (1) provided at one side with a boss (2) and designed to constitute a cylinder head for cylinders (3), (4), (5) and (6) is bolted through the intermediary of bolts (7) and nuts (8) to an engine bloc broadly designated as A. Within the casing is fastened a bushing (9) furnished near its ends with oil grooves (10) and (11) for a purpose which will hereinafter appear. This bushing actually constitutes a portion of the valve casing and is employed merely to facilitate the construction of the same. Centrally of the boss there is fashioned an opening (12) for the purpose of introducing a gaseous or motive fluid to the valve and, provided through the base of the casing so as to connect the interior thereof with each of the four cylinders, are four passages (13), (14), (15) and (16). It is to be noted that there is but a single passage from each cylinder to the interior of the valve casing, this passage constituting both the intake and the exhaust for its respective cylinder.

Journaled within the casing (1) by means of spindles (17) and (18) is a valve, generally designated as (19), provided with an annular orifice (20) and ports (21), (22), (23) and (24). The orifice 20 continually communicates with opening (12) while the ports are for the purpose of transmitting a gaseous medium from the opening (12) and annular orifice (20) to the passages (13), (14), (15) and (16) and into the cylinders of the engine. Extending diametrically through the valve (19) is a hollow septum (25) designed to constitute a passageway through which exhaust gases from the cylinders may be directed to the atmosphere. Septum (25) is staggered at its central portion immediately adjacent the annular orifice (20) so as to make possible the positioning of a pair of ports (26) and (27) through the cage into the hollow septum at points differing radially from the two similar ports (29) and (30) at the other end of the valve cage. The reason for the staggered relation of all ports on one side of the annular orifice with respect to all parts on the other side is obvious when the firing order set forth supra is taken into consideration.

The septum (25) is closed at one end by an oil chamber (31) fashioned within the valve and communicating through the duct (32) in hollow spindle (18) with a source of oil. Spindle (17) is supplied with a large opening (33) which communicates with the septum (25) for the purpose of withdrawing exhaust gases therefrom. At this end of the valve and surrounding opening (33) is a second oil chamber (34) connected through the intermediary of pipe (35) to the oil chamber (31) and provided, as is also chamber (31), with holes (36) through which oil may enter grooves (10) and (11). An annular depression (37) fashioned in casing (1) is so positioned that it is concentric with the surface of contact of bushing (9) and valve (19). The bushing (9) is cut away as at (38) between groove (10) and depression (37) so that oil passing out through holes (36) may enter the depression (37) and be withdrawn therefrom through outlet (39). It can be readily seen that with this construction oil introduced at (32) may be circulated through both chambers (31) and (34) and ultimately withdrawn and it goes without saying that any pressure desired may be impressed upon the oil in the circuit.

Provided on the extremity of spindle (18) is a pinion (40) through which rotation of the valve may be brought about in any desired manner. It is contemplated, as before stated, that the valve be rotated at a speed one-quarter that of the engine crank shaft, and it is further contemplated that the pistons of engine A operate in pairs as illustrated on Figs. 3 and 6. In other words, as previously suggested, the ascent and descent of each pair of pistons is in unison, and the cycles are alternated so that the compression stroke of one piston of each pair con-

stitutes the exhaust stroke of the other piston of that pair.

It is particularly to be noted that when the ports (21), (22), (23) and (24) engage their respective passages that suction in the cylinders operates through these passages in the valve casing (1) and the annular orifice (20) to effect a withdrawal of oil from grooves (10) and (11) and to advance the oil along the valve (19) and sleeve (9) to lubricate these parts of the valve organization. This advance of the lubricant is further facilitated and promoted by the pressure under which the lubricant is circulated.

From the foregoing description the operation of the valve is clearly as follows: A gaseous medium introduced at (12) enters the valve (19) and prior to passing out of the port (21), for instance, traverses the valve in contact with its walls and in so doing cools the same which have previously been heated by exhaust gases coursing through the septum. Simultaneously, oil circulating through the valve, operates to preclude high temperatures of the valve ends and also lubricates the valve.

It can be seen that I have provided a valve wherein operative difficulties set up by differential temperatures due to uneven cooling are minimized, one in which a unitary rotary element of the simplest configuration is capable of controlling the intake and exhaust of the maximum number of cylinders and a valve which is novelly and effectively lubricated.

It is to be understood that the above described constructions are only exemplary and may be replaced by mechanical equivalents without departing from the scope of the invention.

Having described my invention, what I claim as new and wish to protect by Letters Patent is:

1. In a valve organization adapted for use in engines, a valve casing provided with fuel inlet opening, a hollow valve journalled within the casing, lubricant chambers in the valve, an annular orifice in constant engagement with said opening, a hollow septum constituting and exhaust passage within the valve, passages in the casing and means in said valve for communicating the hollow valve and septum selectively with said passages in the casing.

2. In a valve organization adapted for use with engines, a valve casing, a hollow valve within the casing, lubricant chambers in the valve, an opening in the casing for introducing motive fluid to the valve, a hollow septem in the hollow valve constituting an exhaust passage, ports through the valve to the septum, ports into the hollow valve and passages in the casing designed to be selectively engaged with the beforementioned ports.

3. In a valve organization adapted for use with engines, a valve casing, a hollow valve, lubricant chambers in the valve, spindles on the valve designed to be journalled in the casing, a hollow septum extending longitudinally through the valve and constituting an exhaust passage, an opening in the casing for the introduction of motive fluid, passages in the casing to the engine cylinders, an annular orifice in the valve in constant contact with the opening, and ports through the valve to the hollow septum and valve designed to selectively engage the said casing passages.

4. In a valve organization, a valve casing, a valve journaled within the casing, combined lubricant and cooling chambers at each end of the valve, a connection between the chambers, an oil groove between each chamber and casing and communicating with the chambers whereby lubricant may have access to the valve to lubricate it and means for circulating oil through the chambers to cool the valve.

5. In a valve organization designed to be utilized with internal combustion engines, a valve casing provided with an opening for the introduction of gaseous fuel and passages adapted to engage the engine cylinders, a hollow valve within the casing, an annular orifice in the cage valve in constant communication with said opening, a hollow septum in the valve constituting an exhaust passage, combined lubricant and cooling chambers in the valve, means for circulating oil through the chambers, means for leading oil out of the chambers to lubricate the valve and ports through the valve into said septum and valve designed to selectively engage said passages.

6. In a valve organization adapted to control the cycle events of engine cylinders, a valve casing having a motive fluid inlet and passages to the cylinders, a hollow valve within the casing having an annular orifice engaging the inlet and provided with oil chambers for cooling the valve ends, such chambers so positioned as to provide a space between them to receive motive fluid entering through said opening, means for introducing motive fluid to the cylinders and means for circulating oil through the chambers.

7. In a valve organization, a valve casing having a motive fluid inlet, a valve within the casing and provided with a motive fluid cooling chamber, an orifice communicating said inlet and chamber, liquid cooling chambers in the valve and means for circulating liquid through said liquid cooling chambers to assist the motive fluid in cooling the valve.

8. In a valve organization, a valve casing, a valve in the casing, combined lubricating and cooling chambers provided in the valve and a fluid cooling chamber interposed between the first mentioned chambers, whereby the valve ends are cooled by liquid and the central portion by fluid.

9. In a unitary valve organization de-

signed to control the events of a multiplicity of engine cylinders, a valve casing, a valve in the casing, liquid cooling chambers in the valve to cool the valve ends and a fluid cooling chamber in the valve to cool the central portion thereof.

10. In a unitary valve organization to be utilized with an engine, a valve casing provided with a motive fluid inlet passage and a multiplicity of common cylinder intake and exhaust passages, a hollow valve within the casing, an exhaust septum within the valve, combined lubricant and cooling chambers within the valve and means for selectively communicating the hollow valve and septum with the common cylinder intake and exhaust passages.

11. In a valve organization, a valve casing, a valve within the casing supported on hollow spindles, an exhaust septum in the valve communicating with one hollow spindle and lubricant chambers within the valve communicating with the other hollow spindle.

12. In a valve organization, a valve casing, a hollow valve within the casing, hollow spindles on the valve constituting exhaust and lubricant conduits, an exhaust septum in the valve, lubricant chambers in the valve and means for selectively communicating the hollow valve and septum with the common cylinder intake and exhaust passages.

13. In a valve organization, a valve casing, a valve journalled on spindles within the casing, combined lubricant and cooling chambers at each end of the valve, a conduit connecting the chambers and means including a passage through one spindle for circulating lubricant through the valve.

14. In a valve organization, a valve casing, a valve within the casing, combined lubricant and cooling chambers in the valve ends, a conduit connecting the chambers, a motive fluid cooling chamber between the before mentioned chambers and means for circulating a lubricant through the lubricant chambers and a motive fluid through the fluid chamber.

15. In a valve organization, a valve casing, a valve within the casing, an exhaust passage in the valve, a combined lubricant and cooling chamber encircling the passage and means for circulating a lubricant through the chamber.

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