B. D. GAMBLE.

EXPLOSION ENGINE.

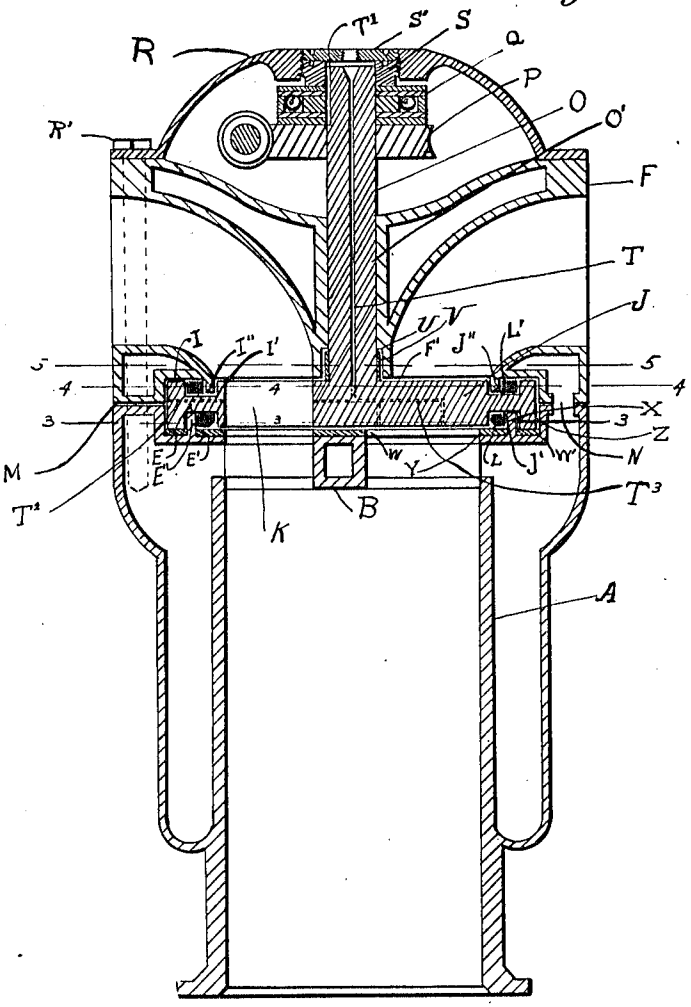
APPLICATION FILED OCT. 27, 1914.

1,314,137.

Patented Aug. 26, 1919.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

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INVENTOR.

BY

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2 SHEETS—SHEET 2.

Fig. 2.

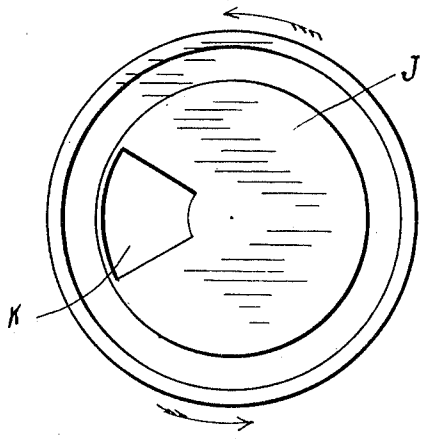


Fig. 3.

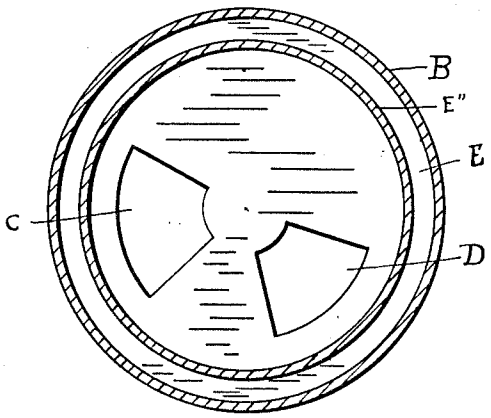


Fig. 4.

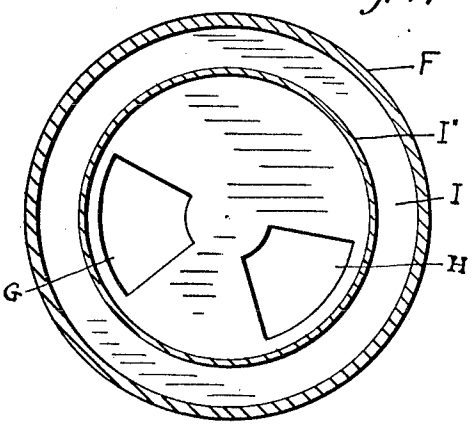


Fig. 5.

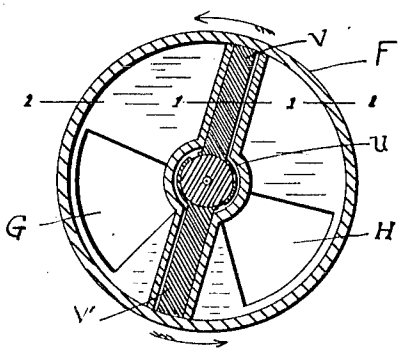




Fig. 6.

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EXPLOSION-ENGINE.

1,314,137. Specification of Letters Patent. Patented Aug. 26, 1919.

Application filed October 27, 1914. Serial No. 868,838.

To all whom it may concern:

Be it known that I, BERTUS D. GAMBLE, a citizen of the United States of America, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Explosion-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to explosion engines of the type in which rotary valves are employed, and particularly in the construction of the valves and valve gearing of explosive engines of the four cycle type.

The objects of my invention are to provide a new and improved form of rotary disk valve and gearing arranged to control the admission of the explosive mixture and the exhaust for the products of combustion in a simple and effective manner, to operate with uniform efficiency at all speeds, to eliminate the vibration and the noise incident to the operation of valves of the reciprocating type, to increase the power and efficiency of the engine and durability of the valves, and to require the minimum of power to actuate said valves.

A further object of the invention is to provide a valve of the form mentioned, such valve being unaffected in its operation when the same expands during the operation of the engine.

A further object of the invention is to provide means of reducing expansion of the valve during the operation of the engine to the minimum.

A special object of the invention is to provide means of reducing friction of the valve and valve gearing to the minimum during the operation of the engine.

A further object of the invention is to provide means of supplying oil to the valve and its seat without the employment of force feed means.

A further object of the invention is to provide means of effectively retaining gases under compression within the limits of the combustion chamber of the engine, and particularly to prevent the escape of said gases over the periphery of the valve disk.

A further object of the invention is to provide means permitting the use of a common gasket or packing for the joint between the integral and detachable heads, and further, to protect said gasket or packing from destruction by gases under pressure.

A further object of the invention is to provide means of preventing intermingling of the products of combustion and the explosive mixture on the upper face of the valve disk.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the drawings, Figure 1 is a vertical central section through the cylinder and head of the engine, Fig. 2 is a plan view of the valve disk, Fig. 3 is a section on the line 3—3 of Fig. 1, Fig. 4 is a section on the line 4—4 of Fig. 1, Fig. 5 is a section on the line 5—5 of Fig. 1, and Fig. 6 is a section on the line 1—1 of Fig. 5.

A is the cylinder of the engine provided at its upper end with an integral water jacketed head B having inlet and exhaust ports C and D extending therethrough. E and E′ are recesses formed in the upper face of the integral water jacketed head, and E″ is a circumferential projection of said head dividing said recesses. F is a detachable water jacketed head which has inlet and exhaust passages G and H arranged to substantially register with the ports C and D. I and I′ are recesses formed in the under face of the detachable water jacketed head, and I″ is a circumferential projection of said head dividing said recesses I and I′. J is a rotary valve seated on the integral water jacketed head, having a port K which alternately registers with the ports C and D, and said valve at a diameter slightly greater than the bore of the cylinder having circumferential channels J′ and J″, into which channels extend the projections E″ and I″. Packing rings L and L′ occupy the remaining portions of said channels. F′ is used in referring to the space between the valve disk J and detachable head F. M is a gasket joint between the integral and detachable water jacketed heads, and N is a passage for water from the lower to the upper of said heads. O is the stem of the valve disk J extending through a centrally located journal bearing O′ in the detachable water jacketed head. P is a worm gear wheel attached to said stem, and Q is a ball thrust bearing surrounding the stem and bearing on the upper face of the said worm gear wheel. R is a detachable head or cap resting on the upper face of the detachable water jacketed head and being secured together with

said detachable water jacketed head to the integral water jacketed head B by means of bolts as indicated by R'. S is an adjusting nut screwed through the cap R and adapted to be brought into contact with the ball thrust bearing Q. S' is a lock nut for said adjusting nut. T is an oil passage through the stem O, and T', T^2, and T^3, are used in referring to means of supplying oil to bearings. U is a counter bore in the journal bearing O' which is extended in channel form across the detachable water jacketed head as clearly shown in Fig. 5. V and V' are sealing bars partially enveloped by said channel U and resting on the upper face of the valve disk J. W is the large central bearing face for the valve, and W' the smaller bearing at the periphery of the valve disk. Y is the peripheral portion of the bearing W in contact with the valve disk J. X and Z indicate oil wells or pockets formed on either side of the lower peripheral projection of the valve disk J. The arrows in Figs. 2 and 5 indicate the direction in which the valve disk rotates.

With the construction as described it will be observed that the rotary valve disk J is arranged between the detachable water jacketed head F and the integral water jacketed head B, but seated upon and having actual contact with said integral head only. The integral head B being water jacketed, protects the valve and its seat from the heat of the combustion chamber, while the detachable water jacketed head F being in direct communication with the integral head by means of the water passages N, not only assists in cooling the valve and gearing, but makes uniform any expansion of the large inner bearing face of the valve disk. Owing to seating of the valve on said inner or integral head, the total upward thrust or pressure upon the valve disk through the compression and firing cycles is limited to and measured by the total area of the ports C and D. Furthermore, said pressures are not applied to the valve on its seat, but tend to lift or raise it above said seat. This is prevented by means of the cap R through which is screwed the adjusting nut S, said nut having been brought into contact with the ball thrust bearing Q resting upon the gear wheel P attached to the valve stem O, the result being that said aforementioned pressures are applied to the ball thrust bearing Q. It is essential that the curved cap R be of sufficient strength or stiffness not to yield to the pressure at explosion, but it is, however, desirable that the curved sides of said cap be not so stiff as to prevent the slight rise of the valve stem under excess expansion of the valve and its seat. This for the purpose of protecting the valve mechanism should the engine become too hot, as it is clear that expansion of the valve and gearing is reduced to the minimum during the proper operation of the engine. It is, however, a well known fact that a large percentage of operators of engines, particularly automobile engines, either through neglectfulness or inexperience, at one time or another fail to give proper attention to the oiling and water cooling systems. Such inattention is fatal to most forms of rotary valves, but, with the construction as herein specified, the trouble, when it comes, may be observed before actual damage to said valve mechanism occurs.

The inner portion of the valve disk which engages the bearing face W and the circumferential wall of the integral head E'' is preferably ground about two thousandths of an inch deeper than the bearing portion of said disk at its periphery which engages the bearing W'. It will now be observed that in assembling the valve and gearing, the valve disk is laid upon and engages the integral head at the peripheral bearing W' only, leaving the said approximately two thousandths of an inch space between said inner portion of the valve disk and its bearings. The adjusting nut S is then brought into contact with the ball thrust bearing Q with sufficient pressure to take up any slack between the various pieces, and locked in position by its lock nut S'. Assuming now, that the engine has been running for some little time, it will be further observed that all expansion of the valve disk and its seat likely to occur has now occurred, with the result that said broad inner face of the valve disk and seat having been subjected to a greater heat and afforded less protection than the peripheral bearing, has consequently expanded more, and the aforesaid inner bearings and the peripheral bearing are now approximately uniform in their contact with the valve disk. All of which has taken place without creating an appreciable pressure either upon the ball thrust bearing Q or the aforesaid integral head bearings. Thus, while expansion has been reduced to the minimum, the small amount existing is prevented from causing undue friction, and better means afforded of effecting and maintaining a liquid seal between said large inner portion of the valve disk and its bearings.

Considerable difficulty has been encountered with valves of the rotary disk type in providing means to effectively retain the explosive mixture within proper confines during the cycles of compression and firing, owing to leakage over the periphery of the disk, especially in close proximity to the ports. Another difficulty arising from the same source is to provide a cheap but effective gas and water tight joint between heads

that will withstand the forces of leaking gases as above mentioned. These difficulties are absolutely overcome by means shown in Fig. 1 as follows: Escaping gas having passed between the small rim of the disk at Y and the bearing face W, is at once shut off by the packing ring L, said ring being preferably chamfered in such manner that the gas pressure upon same will effectively seal the only outlet for the escaping gas, viz: between the small bearing face of the projection E'' in contact with the valve disk, by spreading and holding said packing ring in positive contact with said bearing. Assuming, however, that some gas gets by the packing ring L, it is further prevented from escaping by virtue of the aforementioned bearing at E''. Again assuming that gas escapes through said bearing E'' it is then shut off by a well of oil as at X, a bearing as at W', another well of oil as at Z, and finally by the upper packing ring L'. On suction stroke or back pressures, practically the same resistance is met in reverse order. This construction affords ample protection to the joint between heads, effectively prevents escape of gases over the periphery of the valve and accomplishes these desirable features with minimum friction on the periphery of the valve.

Having shown that the valve and valve gearing operate with minimum friction, it necessarily follows that minimum power is required to actuate said valve.

The space F' between the upper face of valve disk and under face of detachable water jacketed head F, is made very small but great enough to obviate seizure in case of excess expansion. The intermingling in said space of the products of combustion and explosive mixture is prevented by the channel section extending across the under face of the detachable water jacketed head between the exhaust and intake passages (as shown in Figs. 5 and 6), said channel section having inserted therein two steel or other suitable bars exactly alike, having one end in the form of a hook which extends or hooks around a portion of the valve stem O. These bars, and the sides of the aforementioned channel are preferably machined so as to effect a seal when said bars are held against said channel sides by the rotative action of the valve disk upon which the bars rest.

It will be observed that inasmuch as there is no requirement of nor defined seating of the detachable water jacketed head F, that a common gasket or packing may be employed for the joint M between the water jacketed heads.

Oil is supplied through the lock nut S' and a portion of same is carried by the conduit T' to the ball thrust bearing Q and gear wheel P. The same oil then finding the central journal bearing O' of the valve stem O, passes down through same, through the small spaces between hook ends of the sealing bars V and V' and on to the upper face of the valve disk, whence it is distributed by centrifugal action and serves to obviate friction of the sealing bars on the disk and to afford a liquid seal between said bars and the sides and ends of the aforementioned channel in which said sealing bars are arranged. The greater portion of the oil, however, will flow through the axial oil passage T in the valve stem O to a horizontal intersecting passage drilled from the periphery of the valve through and some distance beyond the center of said disk, substantially as indicated in Fig. 1 at T^2 and T^3. Through smaller conduits tapping the oil passage T^2 oil is conducted to the outer bearings of the valve disk, while in like manner from the oil passage T^3 an equal portion of the oil is conveyed to the inner bearings of the valve disk. It will be observed that this construction insures absolute distribution of oil to the desired locations by means of centrifugal action, and that same is not retarded by pressures of gases from the combustion chamber, and does not require force feed means.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same and that changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the following claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In an explosion engine, the combination with a cylinder having an integral ported head, a detachable ported head, recesses in said heads, a rotary disk valve provided with a port for registering with the ports in said heads arranged in the recesses therein, the disk portion of said valve contacting with and seating upon said integral head only, a rotary stem for said valve passing outwardly through said detachable head, means for rotating said rotary stem and valve, and means attached to said detachable head for engaging said rotary stem to retain said valve upon its seat.

2. In an explosion engine, the combination with a cylinder having an integral head and a detachable head, of a rotary valve disk arranged in recesses in said heads but seated upon and having a bearing contact with the upper face of the lower or integral head only, of a rotary stem for said valve disk passing outward through said detachable head, and a functional cap attached to said detachable head provided with adjustable means of engaging a thrust bearing mounted upon a gear wheel secured to said rotary stem, whereby said rotary valve

disk is held to its seat upon said integral head.

3. In an internal combustion engine, the combination with a cylinder having an integral head, a detachable head, a rotary disk valve arranged in recesses in said heads, the disk portion of said valve being seated upon and having contact with the integral head only, a rotary stem for said valve disk passing outward through said detachable head, a functional cap secured to said detachable head provided with adjustable means of engaging said rotary stem to retain said valve disk upon its seat, and means to prevent the intermingling of the products of combustion and explosive mixture in the space between the upper face of said rotary disk valve and lower face of said detachable head.

4. In an explosive engine, the combination with a cylinder having an integral ported head, a detachable ported head, recesses in said heads, a ported rotary disk valve arranged in the recesses in said heads, the disk portion of said valve contacting with and seating upon said integral head only, a rotary stem for said valve passing outward through said detachable head, external means attached to said detachable head for retaining said valve upon its seat, and packing bars arranged in a diametrical recess in the lower face of said detachable head passing between the ports in said head.

5. In an explosion engine, the combination with a cylinder having an integral ported head and a detachable ported head with recesses in said heads, a rotary valve disk provided with a port for registering with the ports in said heads, said valve disk arranged in said recesses but having contact with said integral head only, a rotary stem for said valve disk extending outward through a journal bearing in said detachable head, of a counter bore in said journal bearing forming a recess in said detachable head contiguous with a channel shaped recess extending across said head and between the ports thereof, and with sealing bars arranged in said recesses.

6. In an explosion engine, the combination comprising a cylinder having an integral head, said head having inner and outer recesses therein, a rotary disk valve located in said recesses, and said 'disk valve being slightly thicker at its peripheral bearing portion than at any other part thereof.

7. In an internal combustion engine, the combination with a cylinder having an integral head and a detachable head, said heads being provided with inner and outer recesses therein, a rotary valve disk located in said recesses, but having contact with said integral head only, and said valve disk being slightly thicker at its peripheral bearing portion than at any other part thereof, the differences of thickness of said valve disk providing capillary spaces between said integral head and the major portion of said valve disk.

8. In an internal combustion engine, the combination with a cylinder having an integral head and a detachable head, a rotary valve disk arranged in recesses in said heads but having a bearing contact with said integral head only, and a rotary stem for said valve disk provided with an axial conduit for oil, said conduit communicating with a second oil conduit substantially at right angles to said stem, and said second conduit passing through the body of the valve disk from its periphery through the axis of said valve disk and intersecting point of the conduits to a point less than the diameter of the valve disk, said second conduit being tapped by smaller conduits at the proper points for distribution of oil to the inner and outer bearing portions of the lower face of the valve disk.

9. In an explosion engine, the combination with a cylinder having an integral head and a detachable head, a rotary valve disk arranged in recesses in said heads, but having a bearing contact with said integral head only, a rotary stem for said valve disk passing outward through said detachable head, a functional cap secured to said detachable head provided with adjustable means of engaging said rotary stem, said rotary stem having an axial conduit for receiving oil through said means of adjustment, and said conduit intersecting with a second oil conduit substantially at right angles to said stem, said second conduit passing through the body of the valve disk from its periphery through the axis of said disk and intersecting point of the conduits to a point less than the diameter of the valve disk, said second conduit being tapped by smaller conduits at the proper points for distribution of oil to the inner and outer bearing portions of the lower face of said valve disk.

10. In an explosion engine, the combination with a cylinder having an integral head with recesses therein, said recesses being divided by a circumferential projecting wall of said head, with bearings arranged in said inner and outer recesses, of a rotary valve disk seated upon said bearings, and a rotary stem for said valve disk having an axial conduit for oil intersecting with a second oil conduit substantially at right angels to said stem, said second conduit passing through the body of the valve disk from its periphery through the axis of the valve disk and intersecting point of the conduits to a point less than the diameter of the valve disk, said second conduit being tapped by smaller conduits at the proper points for distribution of oil to said inner and outer bearings.

11. In an explosion engine, the combination with a cylinder having an integral head and a detachable head, a rotary valve disk laterally disposed to the axis of the cylinder arranged in recesses in said heads but seated upon and having contact with bearings located in recesses of the upper face of the lower or integral head only, projecting circumferential walls of said heads intermeshing with circumferential annular channels in both faces of said valve disk, and packing rings arranged in said channels, a rotary stem for the valve disk passing outward through said detachable head, an axial duct through said stem intersecting with a diametrical duct extending into the body of the valve disk from a point in its periphery to a point beyond the axis of the valve disk, providing means whereby equal portions of oil are conveyed to the inner and outer bearings of said valve disk; of a functional cap attached to said detachable head provided with adjustable means of engaging said rotary stem, and means to prevent the intermingling of the products of combustion and explosive mixture in the space between the upper face of the valve disk and said detachable head.

12. In an internal combustion engine, the combination with a cylinder having an integral ported head and a detachable ported head, said heads being provided with inner and outer annular recesses, a ported rotary valve disk provided with annular recesses located in the recesses of said heads but contacting with said integral head only, packing rings arranged in said recesses, said valve disk being slightly thicker at its peripheral bearing portion than at any other part thereof, a rotary stem for said valve disk passing outward through said detachable head, a detachable cap secured to said detachable head, said detachable cap provided with adjustable means for engaging said rotary stem to retain said valve disk upon its seat, means for rotating said rotary stem and valve disk, an axial conduit extending through said rotary stem for conveying oil to a diametrical conduit in said valve disk, said diametrical conduit being tapped by smaller conduits at the proper points for distribution of oil, and packing bars arranged in a diametrical channel in the lower face of said detachable head, said channel passing between the ports of said head.

In testimony whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

BERTUS DOWTHETT GAMBLE.

In the presence of—
ALBERT J. COOK,
JAMES G. MARKS.