A. E. WINCKLER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 31, 1913.

1,130,872.

Patented Mar. 9, 1915.

4 SHEETS—SHEET 1.

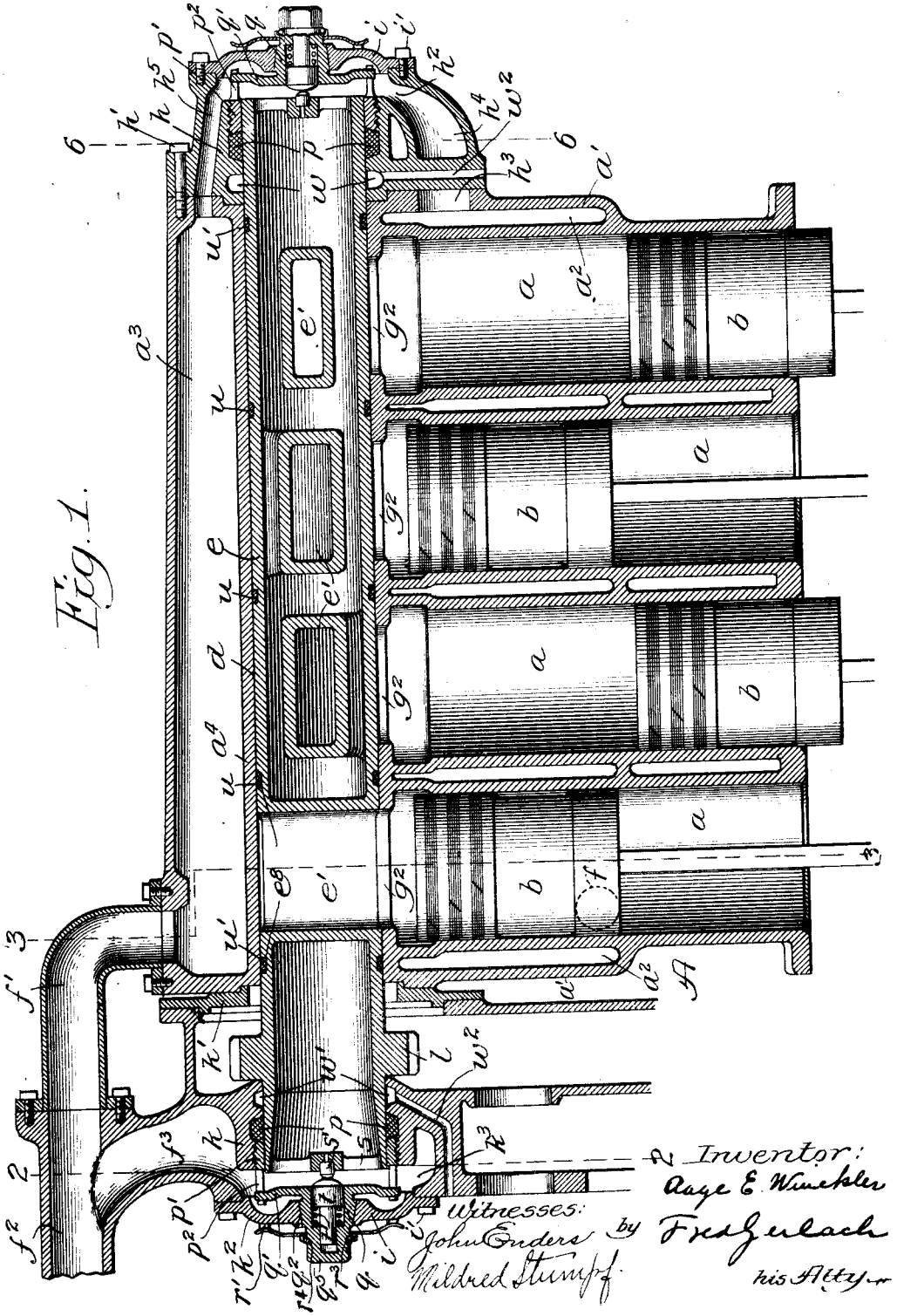


Fig. 1.

Witnesses:
John Enders
Mildred Stumpf

Inventor:
Augo E. Winckler
by Fred Zulach
his Atty.

A. E. WINCKLER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 31, 1913.

1,130,872.

Patented Mar. 9, 1915.

4 SHEETS—SHEET 2.

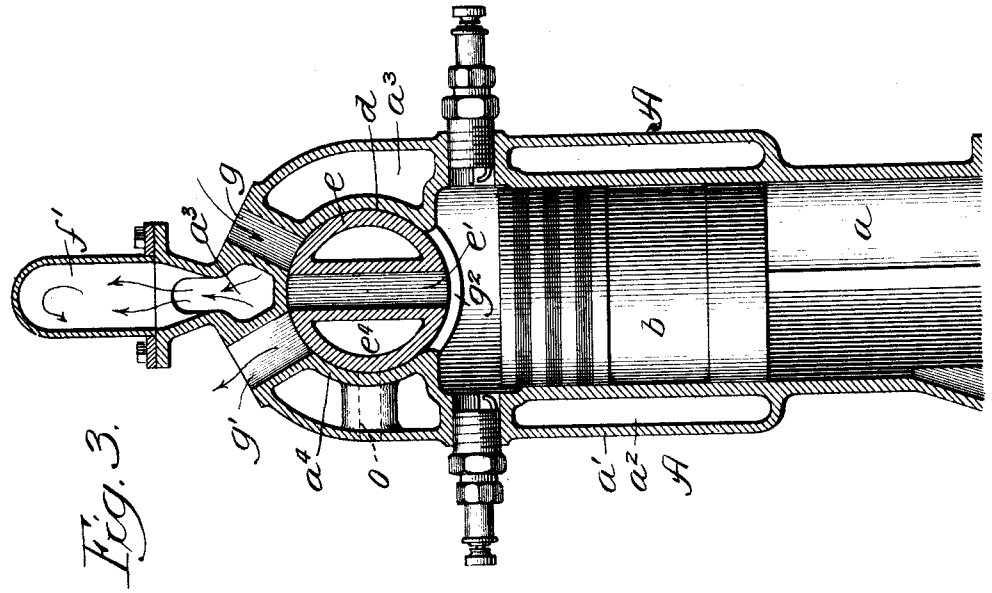


Fig. 3.

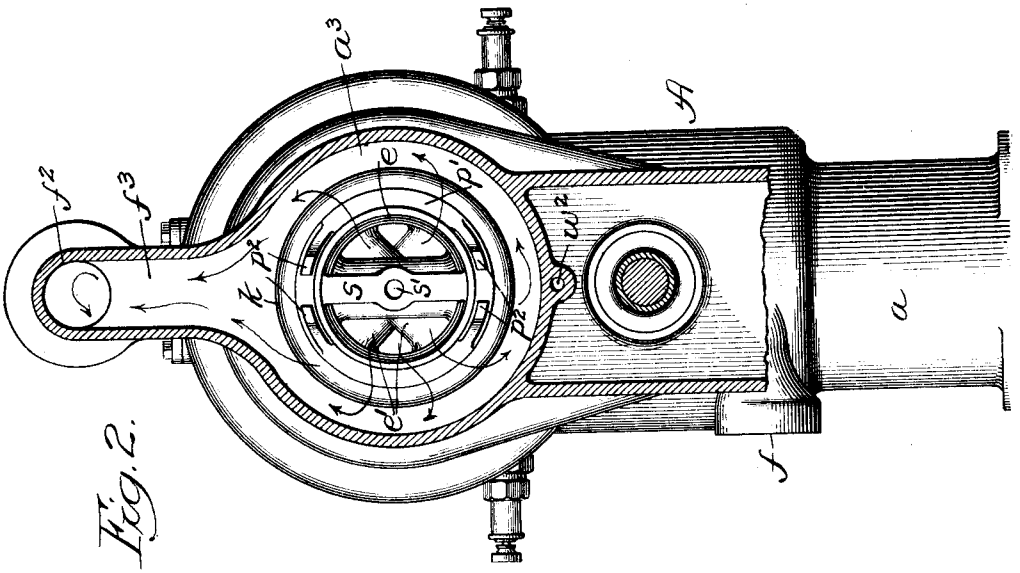


Fig. 2.

Witnesses:
John Enders
Mildred Stumpf.

Inventor:
Augie E. Winckler
by Fred Gerlach
his Atty.

A. E. WINCKLER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 31, 1913.

1,130,872.

Patented Mar. 9, 1915.

4 SHEETS—SHEET 3

Fig. 4.

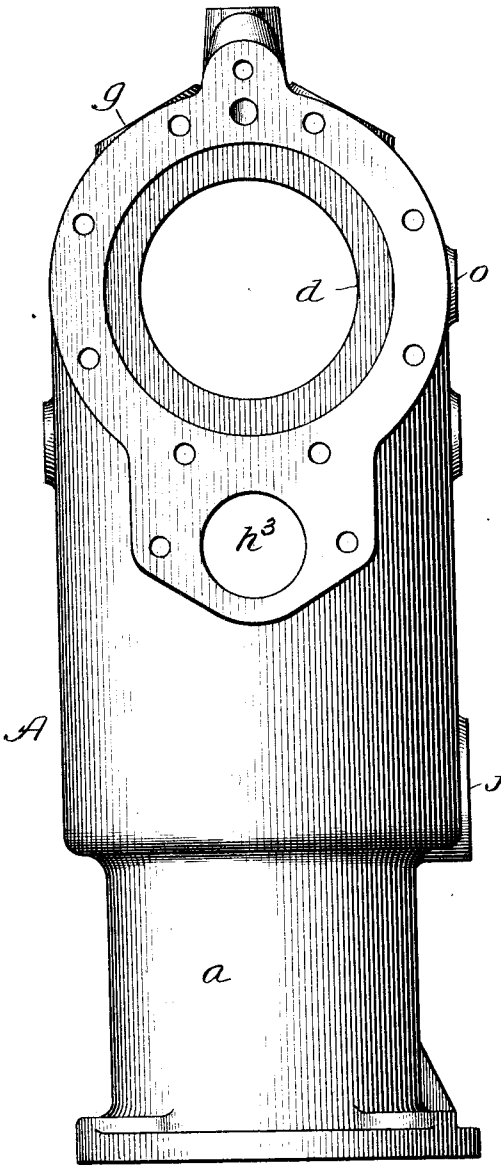


Fig. 5.

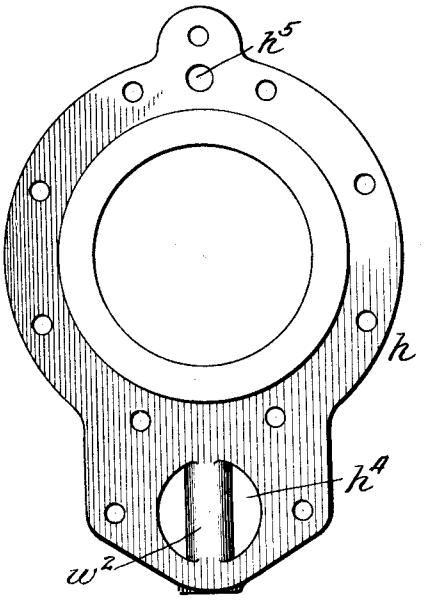
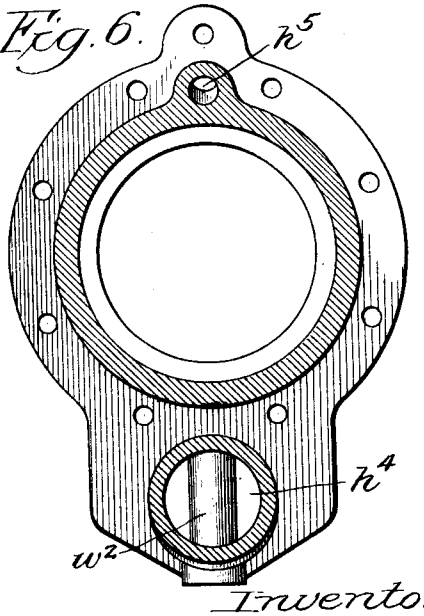


Fig. 6.



Witnesses:
John Enders
Mildred Stumpf.

Inventor:
Aage E. Winckler
by Fredgerlach
his Atty.

A. E. WINCKLER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 31, 1913.

1,130,872.

Patented Mar. 9, 1915.

4 SHEETS—SHEET 4.

Fig. 7.

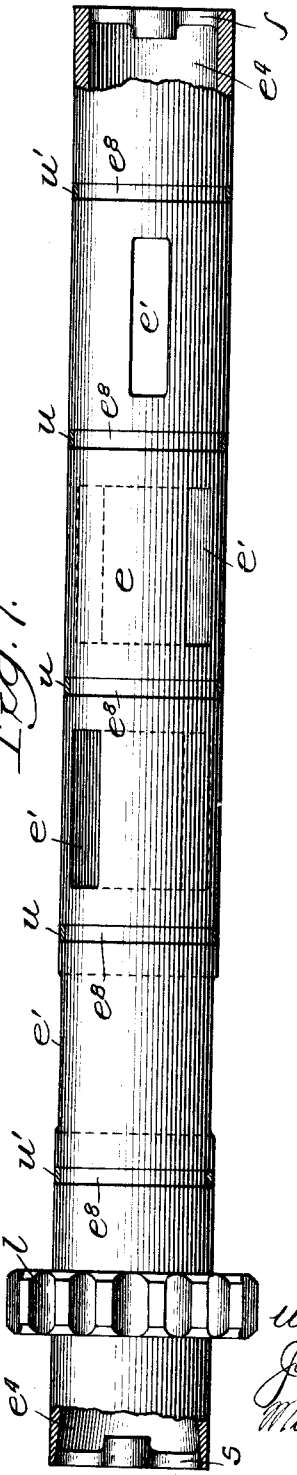


Fig. 11.

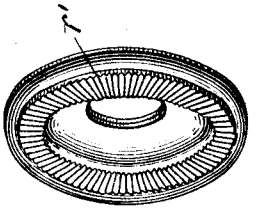


Fig. 10.

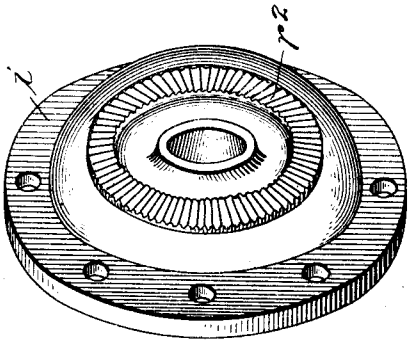


Fig. 9.

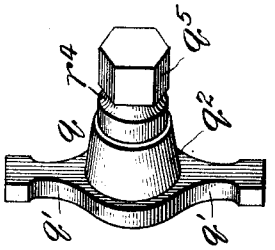
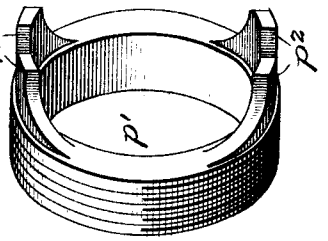


Fig. 8.



Witnesses:
John Enders
Mildred Stumpf

Inventor:
Augt E. Winckler
by Fred J. Leach
his Atty.

UNITED STATES PATENT OFFICE.

AAGE E. WINCKLER, OF RACINE, WISCONSIN, ASSIGNOR TO ROBINSON & ROBINSON, A COPARTNERSHIP CONSISTING OF RICHARD T. ROBINSON & RICHARD T. ROBINSON, JR., OF COLORADO SPRINGS, COLORADO, AND RACINE, WISCONSIN.

INTERNAL-COMBUSTION ENGINE.

1,130,872. Specification of Letters Patent. Patented Mar. 9, 1915.

Application filed May 31, 1913. Serial No. 770,958.

To all whom it may concern:

Be it known that I, AAGE E. WINCKLER, a resident of Racine, in the county of Racine and State of Wisconsin, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a full, clear, and exact description.

The invention relates to internal combustion engines.

One object of the invention is to provide an internal combustion engine comprising a rotary valve which has a chamber therein for the circulation of cooling water, with means for preventing the leakage of water from the valve at the inlet and outlet connections therefor.

A further object of the invention is to provide water-tight connections which are disposed in the engine casing.

A still further object of the invention is to provide improved adjusting devices for the packing of the water-tight joints which are operable from the outside of the engine-casing, so that adjustment may be made without disturbing the connections.

A further object of the invention is to provide means for preventing the escape of fluid from the engine cylinder between the working faces of the rotary valve and its seat.

Lastly, the invention designs to improve the construction and operation of rotary-valve mechanism for internal combustion engines.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings: Figure 1 is a vertical longitudinal section of a multi-cylinder engine embodying the invention. Fig. 2 is a section taken on line 2—2 of Fig. 1. Fig. 3 is a section taken on line 3—3 of Fig. 1. Fig. 4 is a rear-end view of the engine-casing, the head being removed. Fig. 5 is an inner face view of the engine-casing. Fig. 6 is a section taken on line 6—6 of Fig. 1. Fig. 7 is a detail of the rotary valve. Fig. 8 is a detail perspective of one of the followers for adjusting one of the packings at the end of the rotary valve. Fig. 9 is a perspective of the adjusting stud. Fig. 10 is a perspective of one of the removable caps on the heads of the engine-casing. Fig. 11 is a detail of the retaining ring for the stud.

The engine comprises a suitable casting A in which the cylinders a, in any desired number, usually four, are formed. Pistons b are slidably fitted in the cylinders in the usual manner, to drive a crank-shaft (not shown), as well understood in the art. A cylindrical valve-seat d is formed in a wall a^4 of case A and extends longitudinally across the top of all the cylinders. A cylindrical rotary-valve e is fitted in the seat d. The casting A serves as an engine-casing and comprises an outer wall or shell a' which provides a water-jacket around the cylinders, a chamber a^2 being formed between the cylinder-walls and the outer wall, for the circulation of cooling-water. An inlet connection f is formed in one side of wall a' for a pipe which conducts cold water to the water-chamber in the casing, this pipe being usually connected to a circulating pump which receives water from the cooler or radiator, (not shown), as usual in the art. The top of one end of the engine-casing A is provided with an outlet f' to which a discharge-pipe f^2 is connected, for conducting the cooling water, after it has cooled the cylinders and the valve, to the radiator.

The outer walls of casing A are formed to leave a water-chamber a^3 around wall a^4 in which the valve-seat d is formed, and this chamber communicates with the chambers a^2 around the cylinders. Resultantly, water forced into these chambers will cool these surrounding walls of all the cylinders and the valve-seat.

The rotary valve is formed with relatively offset through-ports e' (one for each cylinder) to successively serve as exhaust and intake ports. At one side of the top of casing A, an inlet port g is formed for each cylinder and at its opposite side an exhaust-port g' is formed for each cylinder. An opening g^2 is formed between the valve-seat and each of the cylinders, respectively.

A suitable manifold (not shown) supplies combustible fluid to all of the inlet ports and an exhaust manifold (not shown) carries off the products of combustion escaping through all of the ports g', as well understood in the art. The operation of each of

the valve-ports for the several cylinders will be the same, except that they will operate in properly timed succession to cause the pistons to be operated successively, as well understood in the art.

In operation, valve *e* will be continuously rotated in the proper ratio, (usually 1 to 4) to the engine-shaft, so that during the initial down-stroke or first cycle, a charge of combustible mixture will be drawn through inlet *g*, valve-port *e'* and opening g^2, and into the cylinder. During the compression-stroke and the power-stroke, the valve-port will remain closed and during the fourth cycle, said port will be disposed to permit the products of combustion to escape through the exhaust port *g'*. Water entering the bottom of the water-jacket at inlet *f* will circulate around the cylinder-walls and also around the valve-casing or wall a^4 in transit to the outer pipe *f'*. Valve *e* extends from end to end of the body-section of valve-casing a^4 and projects beyond the ends thereof. The rotary-valve is hollow or tubular to provide a passage or chamber e^4 extending from end to end thereof, so water will flow longitudinally through the valve. The rear end of valve *e* terminates in a head *h* which is fitted and secured to the casing A, by bolts *h'*. This head is provided with a chamber or duct h^2 which receives water from the water-chamber a^2 around the cylinders, through a port h^3 in the end of casing A and an inlet port h^4 in the head. A cap *i* is removably secured to the head by bolts *i'* to afford access to the outer end of the valve *e*. The chamber h^2 serves to conduct water into one end of valve *e* adjacent said chamber, the end of the valve being open to direct water from chamber h^2 into the water-chamber e^4 in the rotary-valve. A small by-pass duct h^5 is formed in the head *h* and conducts water from the top of chamber h^2 to one end of the water-chamber a^3 to prevent the formation of air or steam pockets in the valve, the head h^2, or in one end of chamber a^3. The front end of valve *e* is also open and is disposed in a valve-head *k* which is secured with a ring *k'*, to the front end of casing A. The outer end of head *k* is provided with a removable cap k^2 to afford access to the valve when desired. A water-chamber k^3 is formed in head *k* to conduct water flowing out of the rotary-valve to a duct f^3 in the head *k*, which conducts the water to outlet-pipe f^2. As a result of this construction, cold water passing to the water-jacket through inlet *f* will initially circulate around the engine-cylinders *b* where its temperature will be raised. A portion of this water will flow around the wall a^4 in which the valve-seat for the rotary-valve *e* is formed, to cool said wall, and after that the water will flow to the outlet *f'*. Another portion of the water will pass through opening h^5 at the rear of the casing to the water-chamber in head *h*, thence into one end of the rotary-valve *e* and thence through the chamber in said valve to cool the cylindrical wall of the valve and the walls around the ports *e'* which control the passage of fluid to and from the engine-cylinders. This water, after passing through the rotary-valve, passes through chamber k^3 and duct f^3 in head *k* to the water-outlet f^2. Resultantly, the cooling water, after passing around the engine-cylinders is divided into two streams, one of which flows through and cools the rotary-valve and the other of which flows around and cools the wall of the valve-seat. This manner of circulating the cooling liquid causes effective equalization of the temperature of all portions of the rotary-valve and the valve-casing, so that there will be, at substantially all times, corresponding variation in the temperature of the rotary-valve and its seat, which will cause substantially equal expansion or contraction of the valve and the walls forming its seat, so that the fit and operation of the rotary-valve will not be materially effected by variations in the temperature, because the variations will not be relative. The by-pass h^5 effectively prevents the formation of any air or steam pockets in the outer end of the valve or the adjacent end of the chamber around the valve-seat, because there is escape for the liquid from the highest portion of the water-chamber in the head to the adjacent end of chamber a^3. A sprocket-wheel *l* is provided on an exposed portion of the rotary-valve, and this sprocket wheel may be driven by any suitable mechanism from the crank-shaft.

Lubricant is supplied to the periphery of the rotary-valve *e* and to the valve-seat *d* through one or more ducts *o* at one side of the casing, from any suitable source of supply. In practice, it is desirable to prevent the escape of lubricant to the water-chamber and also to exclude water from the working surfaces of the valve and its seat. For this purpose, a packing *p* is provided around each end of the rotary-valve in the heads in which its ends terminate. It is desirable to adjust this packing without opening the the water-chamber which would make it necessary to drain the engine before the packing could be adjusted and to this end devices are provided for adjusting the packings from the outside of the casing. A follower-ring *p'* is provided for each packing *p*. Each follower is screw-threaded to its head, is provided with oppositely disposed pairs of lugs p^2. An adjusting-stud or spindle *q* for each follower, is provided with a pair of oppositely disposed arms *q'* which extend between said pairs of lugs to cause the follower to rotate with the stud, the slidable fit between the arms and the lugs per-

mitting the follower to move into and out of the head. Each stud q passes through one of the caps i, on the heads, respectively, and has a tapered portion q^2 fitting in a corresponding tapered opening in the cap to form a water-tight joint between the stud and the cap. The outer end of each stud q is of suitable shape, as at q^5, for the application of a turning-tool or wrench. A spring-ring is provided to hold each stud seated in its head, and is formed with teeth r^2 adapted to engage an annular series of teeth r^5 on the outside of caps respectively. The inner end of each ring bears against a ring r^3 held in a groove r^4 on the stud. Said rings are formed of spring-metal, and serve to hold the studs against rotation and firmly seated in the tapered sockets in the caps. A cross-rib s is formed in each end of the rotary-valve e and a bearing-pin s' is secured therein. A plunger t is slidably held in each cap and is acted upon by a spring t'. These engage the pins s' and serve to hold the rotary-valve against longitudinal movement in its seat. A packing-ring u is provided in the rotary-valve between each pair of adjacent valve-ports c' and each pair of cylinders. Said rings are held in annular grooves e^8 in the valve. A similar ring u' is provided in the valve at each end of the casing A. These packings serve to effectively prevent escape of fluid from one cylinder to another, and the escape of fluid at the valve-ends, between the working-faces of the valve and its seat.

An annular channel w is formed in head k and a similar channel is formed in the head k. These channels are open to the periphery of the valve e. A duct w^2 leads from the lower portion of each of the channels w and w'. Channel w prevents the passage of oil on the periphery of the valve into the water chamber at the adjacent end thereof. Channel w' prevents oil on the valve from passing to the water-chamber at the other end of the valve. These channels w and w' also catch any water which may leak in through packings p, so it will escape through one of the ducts w^2. Furthermore, when water is seen discharging from the outlet-ducts w^2, it will indicate that adjustment of the packing should be made. In other words, it serves to indicate any leakage of water at packings p.

The invention thus provides an improved explosive engine in which efficient cooling means is provided and in which the valve is inclosed with packing for preventing leakage at the valve ends. The invention also exemplifies an adjusting device for the packing which is adjustable from the outside of the casing, so that adjustment can be effected without discharging the water from the water-chambers. The invention also exemplifies a rotary-valve which is provided with means between the cylinders for preventing escape of fluid from one cylinder into the next; also means for preventing water from passing into the valve seat and for preventing oil used in lubricating the valve from passing into the cooling water. In practice the presence of oil in the cooling water has been found to be objectionable.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

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

1. In an internal combustion engine, the combination of a cylinder, a hollow rotary valve having openings in its ends and which has a passage for cooling liquid to flow longitudinally therethrough, a casing, a valve seat in said casing, a water-jacket extending around the seat and said cylinders, means for conducting cooling liquid from the water-jacket to one end of said valve, an outlet from the water-jacket through which water will flow which has not passed through the valve, and means for conducting water which has passed through the valve to the water from said outlet.

2. In an internal combustion engine, the combination of a cylinder, a hollow rotary valve having openings in its ends, a casing extended to inclose one end of the valve, a valve seat in said casing, a water-jacket in the casing and extending around the cylinder and the seat, a water-duct in the casing between the water-jacket and one end of the valve, and a water-outlet from the jacket through which water will flow which has not passed through the valve, a water-outlet connected to the other end of the valve, and a common discharge to which both of said outlets are connected.

3. In an internal combustion engine, the combination of a casing, a cylinder, a water-jacket in the casing around the cylinder, a hollow rotary valve having a passage for water, means for supplying cooling water to said water, means for conducting a portion of the water which has passed through said jacket into the rotary valve, an outlet for the water in the valve, and an outlet for the water in the water-jacket which causes the remainder of the water to circulate through the jacket without passing through the valve.

4. In an internal combustion engine, the combination of a casing, a cylinder, a valve-seat in the casing, a hollow rotary valve having both of its ends open and formed with a chamber for the passage of water therethrough, a water jacket around the cylinder and the seat and extended and inclosing around one end of said valve, and having a

duct therein communicating with the open end of the valve inclosed thereby, a head inclosing the other end of said valve and having a chamber therein communicating with the end held in the head, and a gear on the valve and disposed between said head and said jacket.

5. In an internal combustion engine, the combination of a casing, a cylinder, a valve-seat in the casing, a water-jacket in the casing and extending around said seat and said cylinder, a hollow rotary valve having openings in its ends and a passage for water therethrough, a conduit in the casing and between the water-jacket and one end of the valve for conducting a portion of the water which has passed through the jacket to the said valve, a water-outlet at the other end of the valve, and an outlet for the escape of the remainder of the water from the jacket which has not passed through the valve.

6. In an internal combustion engine, the combination of a casing, a cylinder, a valve-seat in the casing, a water-jacket extending around the cylinder and the seat, a hollow rotary valve having openings in its ends and a passage for water therethrough, means for conducting a portion of the water in the jacket to the hollow valve, a water outlet leading from substantially the highest point of the water-jacket, for causing the remainder of the cooling water to circulate around the valve seat without passing through the valve.

7. In an internal combustion engine, the combination of a casing, a valve-seat in the casing, a cylinder, a water-jacket around the cylinder and the seat, a hollow rotary valve having open ends and a passage for water therethrough, a removable head at one end of the casing, a conduit in said head and leading from the water-jacket around the cylinders to one end of the valve, an outlet leading from the jacket for causing a portion of the water to circulate around the seat and escape without passing through the valve, and a restricted duct in said head and leading from the inlet to the valve back to the water-jacket to prevent formation of air and steam pockets at the end of the valve.

8. In an internal combustion engine, the combination of a cylinder, a rotary valve having an opening in one of its ends, a casing having a duct therein leading to said open end of the valve and extending outside of said end to inclose it, a valve-seat in the casing, a packing between the casing and the valve, and means for adjusting the packing, extending through the portion of the casing inclosing said end and operable from the outside of the casing.

9. In an internal combustion engine, the combination of a cylinder, a rotary valve having an opening extending through one of its ends, a casing having a duct therein leading to said open end of the valve and extending outside of and inclosing said end to prevent escape of fluid from said duct, a valve seat in the casing, a follower for the packing disposed around the valve and within the casing, and means extending through the end of the casing and operable from the outside thereof for shifting the follower to adjust the packing.

10. In an internal combustion engine, the combination of a cylinder, a rotary valve having an opening in one of its ends, a casing having a duct therein leading to said open end of the valve, and a cap outside of said end, a valve-seat in the casing, a packing between the casing and the valve, and means extending through the cap and operable from the outside of the casing for adjusting the packing.

11. In an internal combustion engine, the combination of a cylinder, a rotary valve having an opening extending through one of its ends, a casing having a duct therein leading to said open end of the valve, and a cap on the outside of said valve-end, a valve seat in the casing, a follower for the packing disposed around the valve and within the casing, and means extending through the cap and operable from the outside thereof for shifting the follower to adjust the packing.

12. In an internal combustion engine, the combination of a cylinder, a rotary valve, a casing comprising a removable cap outside of one end of said valve, a valve seat in the casing, a packing between the casing and the valve, and means for adjusting the packing, extending through the cap and operable from the outside of the casing to adjust the packing.

13. In an internal combustion engine, the combination of a cylinder, a rotary valve, a casing, extending outside of and inclosing one end of said valve, a valve-seat in the casing, a packing between the casing and the valve, a follower within the casing for adjusting the packing, follower-adjusting means mounted in the casing, and operable from the outside thereof, and a separable operable connection in the casing and between the adjusting-means and the follower.

14. In an internal combustion engine, the combination of a cylinder, a rotary valve, a casing comprising a removable cap outside of and inclosing one end of said valve, a valve seat in the casing, a packing between the casing and the valve, and means for adjusting the packing, extending through and removable with the cap and operable from the outside of the casing to adjust the packing.

15. In an internal combustion engine, the combination of a cylinder, a rotary valve, a casing comprising a removable cap outside of and inclosing one end of said valve, a

valve-seat in the casing, a packing between the casing and the valve, a follower within the casing for adjusting the packing, and follower-adjusting means extending through, mounted on, and removable with the cap, and operable from the outside thereof, and a separable connection between the adjusting-means and the follower.

16. In an internal combustion engine, the combination of a cylinder, a rotary-valve, a casing, inclosing one end of the valve, a seat for the valve, in the casing, a packing between the casing and the valve, a ring for adjusting the packing the ring having its outer end disposed within the casing, a device extending through the casing and having means on the inside for shifting said ring, and a water-tight connection between said device and the casing.

17. In an internal combustion engine, the combination of a cylinder, a rotary-valve, a casing inclosing one end of said valve, a seat for the valve, in the casing, a packing between the casing and the valve, a ring for adjusting the packing, the ring having its outer end disposed within the casing, a device extending through the casing and having means on the inside for shifting said ring, a water-tight connection between said device and the casing, and means for causing water to flow through said casing and said valve.

18. In an internal combustion engine, the combination of a cylinder, a rotary-valve, a casing inclosing one end of said valve, a seat for the valve, in the casing, a packing between the casing and the valve, a device extending through that portion of the casing which incloses one end of said valve operable from the outside of the casing for adjusting the packing, means forming a water-tight connection between said device and the casing, and holding-means for said device.

19. In an internal combustion engine, the combination of a cylinder, a rotary-valve, a casing inclosing one end of said valve, a seat for the valve in the casing, a packing between the casing and the valve, a ring for adjusting the packing, a device operable from the outside and extending through that portion of the casing which incloses one end of the valve, for shifting said ring, a water-tight connection between said device and the casing, means for causing water to flow through said valve and said casing, and holding-means for said device.

20. In an internal combustion engine, the combination of a cylinder, a casing, a water-jacket in the casing, a hollow rotary-valve inclosed in the casing, a valve-seat in the casing, the valve having a fluid-controlling port therein, and one of its ends inclosed in said casing, a channel independent of the liquid supply and formed between the casing and the valve for receiving liquid on the working face of the valve, the channel being disposed between the inclosed valve-end and the fluid-port in the valve and escape means leading from said channel.

21. In an internal combustion engine, the combination of a cylinder, a casing, a water-jacket in the casing, a rotary-valve, a valve-seat in the casing, said valve having a fluid-controlling port therein, said casing inclosing one end of said valve, a channel between the valve and its face and independent of the lubricant supply for preventing lubricant from the working-face on the valve from passing into the jacket escape means for the lubricant reaching the channel, and means for causing water to flow through said valve and said jacket.

22. In an internal combustion engine, the combination of a cylinder, a casing, a rotary-valve, a valve-seat in the casing, a water-jacket in the casing and extending around one end of the valve, a channel between the valve and the casing and between the port and one end of the valve and independent of the lubricant supply, for trapping water to prevent it from reaching the port and for preventing lubricant from passing into the casing from the working faces of the valve and its seat and escape means leading from said channel.

AAGE E. WINCKLER.

Witnesses:
MILDRED STUMPF,
ETHEL GERLACH.