F. J. & F. C. ARNOULD.

ROTARY VALVE.

APPLICATION FILED SEPT. 26, 1917.

1,283,028.

Patented Oct. 29, 1918.

2 SHEETS—SHEET 1.

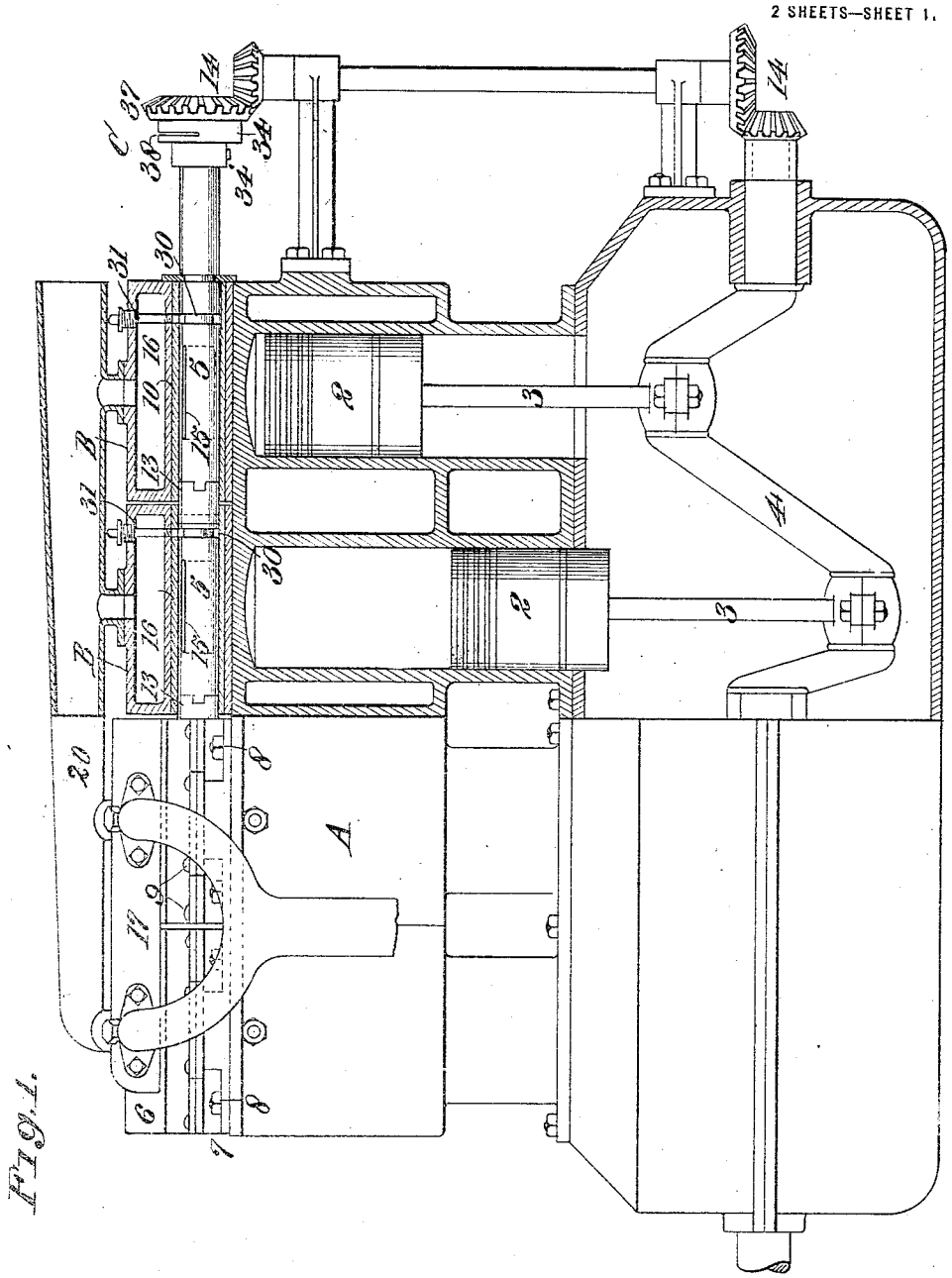


Fig. 1.

WITNESS:

Charles Pickles

Julius C. Benesch.

INVENTORS

Firmin J. Arnould,

Felicien C. Arnould.

By Strong & Townsend

ATTORNEYS.

F. J. & F. C. ARNOULD.

ROTARY VALVE.

APPLICATION FILED SEPT. 26, 1917.

1,283,028.

Patented Oct. 29, 1918.

2 SHEETS—SHEET 2.

Fig. 2.

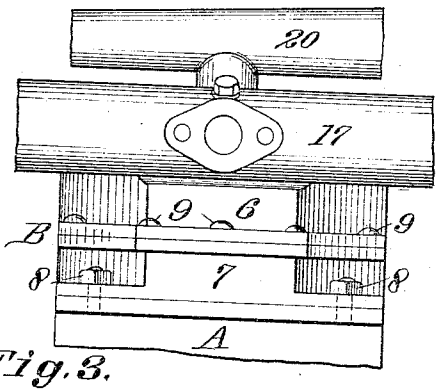


Fig. 4.

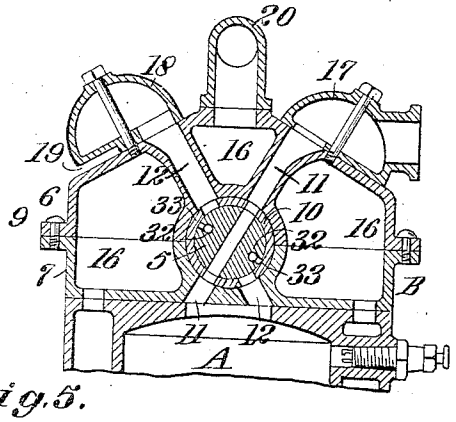


Fig. 3.

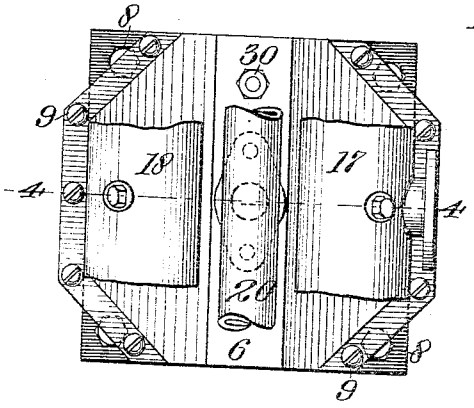


Fig. 5.

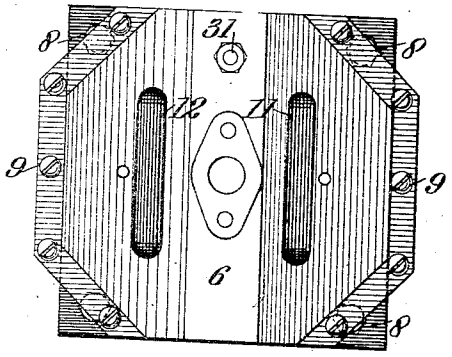


Fig. 6.

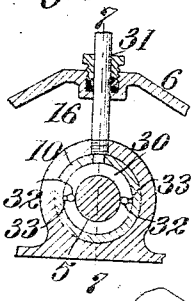


Fig. 7.

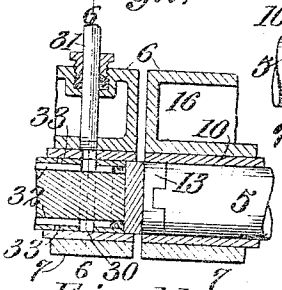


Fig. 8.

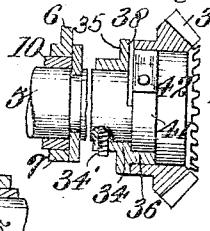


Fig. 9.

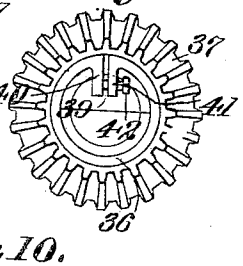


Fig. 11.

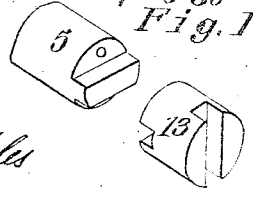
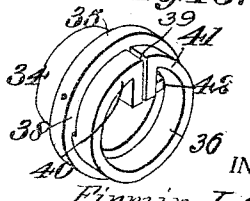


Fig. 10.



WITNESS:

Charles Pickles

Julius C. Bensch

INVENTORS

Firmin J. Arnould.

Felicien C. Arnould

By Strong & Townsend

ATTORNEYS.

UNITED STATES PATENT OFFICE.

FIRMIN J. ARNOULD AND FELICIEN C. ARNOULD, OF SAN FRANCISCO, CALIFORNIA.

ROTARY VALVE.

1,283,028. Specification of Letters Patent. Patented Oct. 29, 1918.

Application filed September 26, 1917. Serial No. 193,350.

To all whom it may concern:

Be it known that we, FIRMIN J. ARNOULD and FELICIEN C. ARNOULD, both citizens of the United States, residing at the city and county of San Francisco and State of California, have invented new and useful Improvements in Rotary Valves, of which the following is a specification.

This invention relates to a rotary valve.

One of the objects of the present invention is to provide a simple form of rotary valve for internal combustion engines adapted to be driven at a ratio of 1 to 4 of the engine shaft, and provided with a single port which will alternately perform the required functions of admitting the charge, retaining the same during the compression and firing stroke, and also permit exhaust of the expanded gases. Another object of the invention is to provide a novel form of water cooled valve head having alined exhaust and inlet passages formed therein, and an adjustable ported bearing sleeve for the reception of the rotary valve. Another object of the invention is to provide a friction drive through which the valve may be driven. Further objects will hereinafter appear.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a side elevation partly in section, of an internal combustion engine showing the application of the invention.

Fig. 2 is a side elevation of the valve head.

Fig. 3 is a plan view showing the connected manifolds in position.

Fig. 4 is a cross section on line 4—4 of Fig. 3.

Fig. 5 is a plan view showing the manifolds removed.

Fig. 6 is a cross section on line 6—6 of Fig. 7.

Fig. 7 is a detail longitudinal section showing the manner in which the lubricating oil is admitted to the valve and also the connection between the two valves.

Fig. 8 is a detail longitudinal section of the friction connection between the driving gear and the valve.

Fig. 9 is a front view of the driving gear and the friction sleeve.

Fig. 10 is a perspective view of the friction sleeve.

Fig. 11 is a perspective view of the coupler forming the connection between two valves.

Referring to the drawings in detail, A indicates in general the cylinders in an internal combustion engine, 2 the piston, 3 the connecting rods, 4 the crank shaft and 5 the rotary valve forming the subject-matter of the present invention. The engine here shown consists of four cylinders, each provided with a separate head B for the reception of the rotary valve. These heads are each constructed in two sections 6 and 7; the lower section of each head being secured to its cylinder by stud bolts 8, while the upper head section is secured to the lower section by flanging the heads and providing screws 9. Each head is provided with a central passage for the reception of a bearing sleeve 10, and each head section is provided with alined inlet and exhaust passages, as shown at 11 and 12, respectively. The inlet and exhaust passages are cored out when the castings are made, while the alined ports formed in the sleeve are machine cut, and positively spaced, to permit the correct timing of the engine.

Each head is provided with a separate rotary valve 5, and each valve is connected with the other through a coupler such as shown at 13, Fig. 11. The valve formed of the several sections and interposed couplers is driven at the ratio of one to four of the engine shaft through the bevel gear train shown at 14, and each valve is provided with a single oblong port 15, which is adapted to alternately serve the several functions of admitting the charge, retaining the same during the compression and firing stroke, and also permitting exhaust of the expanded gases.

Each valve is surrounded by a water jacket 16 formed in the head and only a slight amount of heat is communicated to the valve and ports as compared with the heat communicated in a construction utilizing a puppet valve, in which the exhaust gas is required to change its direction in being carried away.

The present arrangement of the port 15 and the alined exhaust and inlet passages 11 and 12, permits both incoming and exhaust gases to sweep on a straight line through the valve and ports. This construction disposes of the exhaust gases in the most efficient manner with the least resistance possible, and permits a complete scavenging of

the engine cylinders, and also the admission of a larger incoming charge than is otherwise possible.

The splitting of the head into the sections 6 and 7 as shown, and the provision of the bearing sleeve is another important feature. The inlet and exhaust passages cored out when the casting is made, are often slightly displaced. Such displacement would cause a great loss in engine efficiency unless it could be corrected. This is accomplished in the present instance by machining the registering ports in the bearing bushing 10, and adjusting the same with relation to the engine pistons and the ports formed in the heads; the sleeve being secured in adjusted position by merely clamping down the upper section of the head. This clamping action locks the sleeve against circumferential movement, and the adjustment in a circumferential direction of course permits an absolute timing and positioning of the ports to produce the highest efficiency possible.

The individual heads with which each cylinder is provided, are in the present instance connected by a single intake manifold 17 and a single exhaust manifold 18. The manifold 18 is spaced with relation to the head as shown at 19 to permit circulation of air and to prevent transmission or conduction of heat to the head. A water manifold 20 for the discharge of circulating water both from the cylinders and the heads is also provided.

Another important feature is the provision of an ideal lubricating system. This is accomplished by grooving one end of each valve, as shown at 30, and inserting an oil pipe 31, which may be connected with a force pump or the like. The groove 30 communicates with two horizontally positioned ducts 32 formed in each valve, and these ducts in turn are provided with radially disposed ports 33, which permits the oil to be delivered through pipe 31 to the groove 30 to be evenly distributed between the valve and the sleeve at different points throughout the length of each valve section. This manner of lubrication has not only proven efficient and positive, but also serves as a means for assisting in cooling each valve member. That is, the oil circulating through the ducts 32 tends to carry off what little heat is contained. The valves however have comparatively little tendency to heat as they are not only surrounded by a water jacket and cooled by oil circulation, but the single port provided serves alternately as an inlet and exhaust passage, and therefore has comparatively small tendency to heat.

A friction drive generally indicated at C, is however provided to permit the valve to stick if it should happen to become overheated through lack of lubrication, or otherwise. The sticking of the valve under such conditions would of course throw the engine out of time and immediately bring it to a stop, thereby preventing damage to the valve mechanism, or any of the other connecting parts.

The friction drive consists of a sleeve 34 which is adapted to be secured to the outer end of the valve 5 by means of a key or set-screw 34'. The sleeve is provided with a collar 35 and an extension 36, which is adapted to receive the driving gear 37. The extension 36 is first cut crosswise as at 38, and lengthwise as at 39. This cutting of the extension forms two expanding jaws 40 and 41, which are adapted to be expanded by a set-screw 42 to secure the driving gear 37. The friction between the driving gear and the extension 36 is sufficient to drive the valve under normal conditions, but sticking of the valve, accidental or otherwise, will permit sufficient slippage to take place to immediately throw the valve mechanism out of time to bring the engine to a stop.

The importance of a driving connection such as herein described should readily be appreciated, as it positively prevents cutting of the valves, or the bearing sleeves in which they are mounted, and of course immediately stops the engine from running and any damage from taking place.

The usual cam shafts, idle gears, valve springs and push rods are entirely eliminated. The engine is practically noiseless in operation and a more perfect charging of the cylinders and the exhausting of the expanded gases is permitted.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:—

1. In an internal combustion engine, a rotating valve for admitting and exhausting the gases, an extension member on the valve, a driving member having a bore receivable over the extension, one of said members being split to provide a pair of jaws, means to drive the driving member, and means to adjust the jaws whereby to regulate the degree of frictional contact between the said two members so as to thereby control slippage between the driving member and the valve.

2. The combination with the crank snaft of an internal combustion engine and a rotating valve for admitting and exhausting the gases, of means for transmitting rotary movement from the crank shaft to drive the valve, and a friction driving member interposed in said driving connection to permit a slippage and a continued rotation on said drive connection if the valve should stick, said friction driving member comprising a sleeve adapted to be secured to the valve, a collar on said sleeve, an annular extension on said collar adapted to receive a driving gear, said collar being split longitudinally

and crosswise to form a pair of expanding jaws, and a set screw carried by one of said jaws adapted to engage the opposite jaw to expand the same and secure the driving gear.

3. In an internal combustion engine, a cylinder head having an upper and a lower section, the lower section having its upper end exteriorly flanged and the upper section having its lower end exteriorly flanged and seated on the flanges of the lower section, said sections having complementary passage-forming parts to provide a passage extending centrally and longitudinally through the head, and said parts being spaced from each of the respective sides of the sections so as to be free of connection therewith, a machined bearing sleeve in the passage, inlet and outlet ports communicating with said passage, a valve in the sleeve formed to register with the inlet and outlet ports and means to secure said flanges together to clamp the bearing sleeve against movement.

4. In an internal combustion engine, a rotating valve for admitting and exhausting the gases, a sleeve on the valve having an extension, a driving member having a bore receivable over the periphery of said extension, said extension being split to form a pair of jaws, means to expand the jaws against the wall defining the bore of the driving member, and means to drive the driving member.

5. In an internal combustion engine, a rotating valve for admitting and exhausting the gases, an extension on the valve, a driving member having a bore receivable over the extension, said extension being split to provide a pair of jaws, means to drive the driving member, and means to adjust the jaws whereby to regulate the degree of frictional contact between the member and extension so as to thereby control slippage between the member and valve.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

FIRMIN J. ARNOULD.
FELICIEN C. ARNOULD.

Witnesses:
JOHN H. HERRING,
B. C. CELIO.