J. F. STUDHOLME.

ROTARY ENGINE.

APPLICATION FILED MAR. 8, 1909.

929,512.

Patented July 27, 1909.

4 SHEETS—SHEET 1.

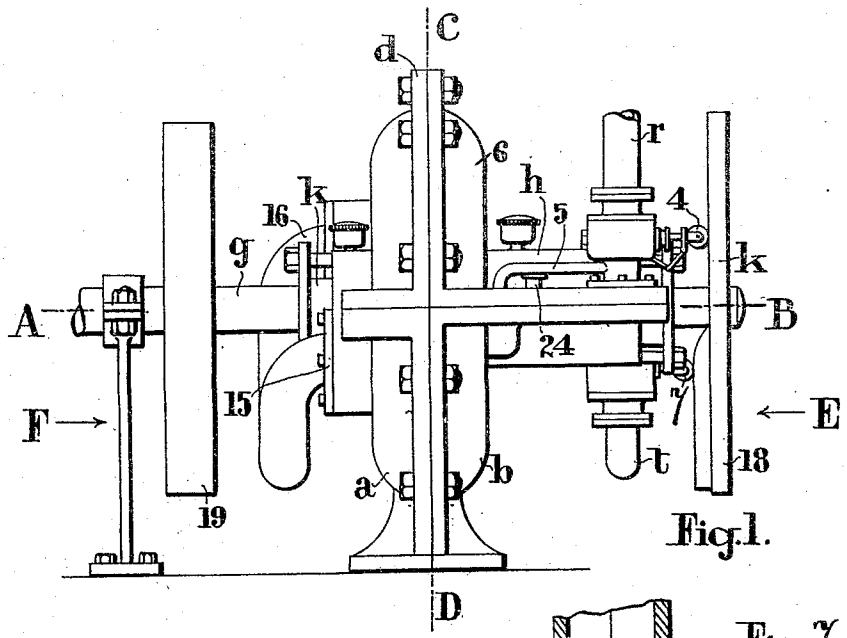


Fig. 1.

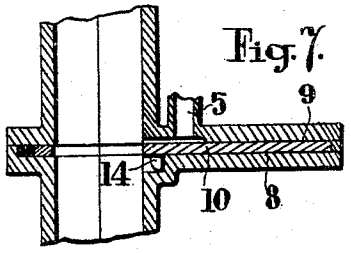


Fig. 7.

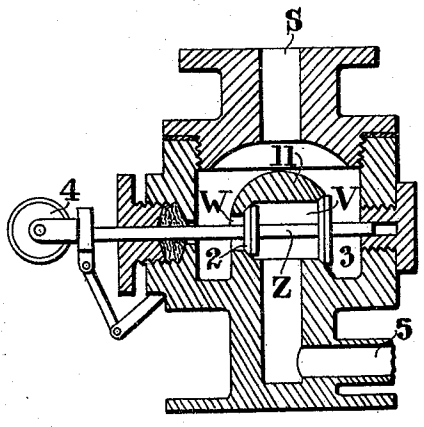


Fig. 6.

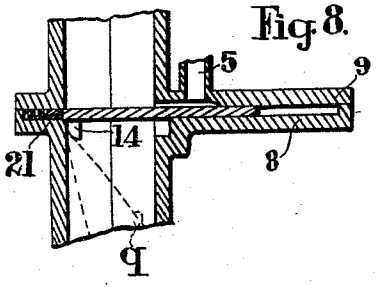


Fig. 8.

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ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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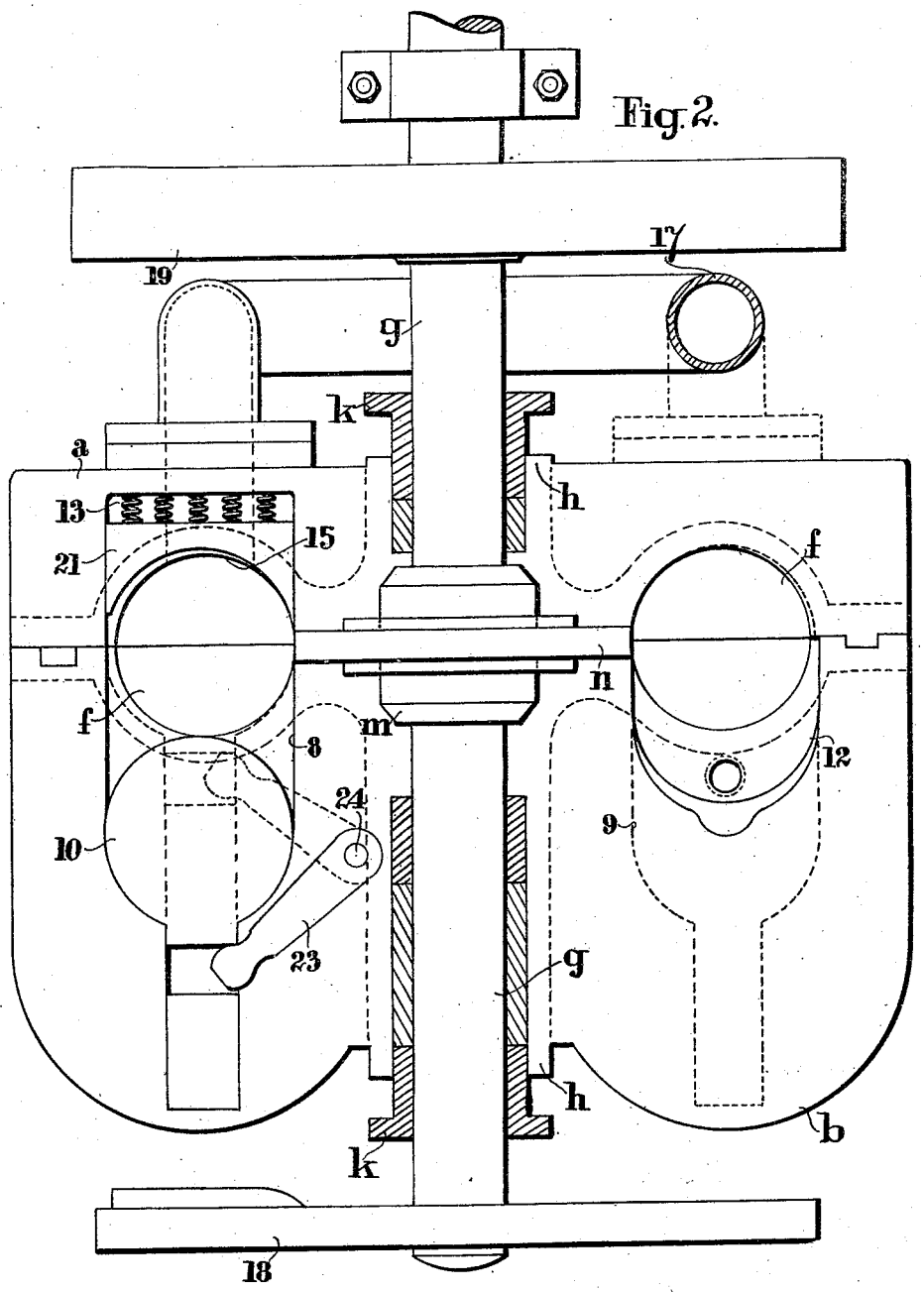
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4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

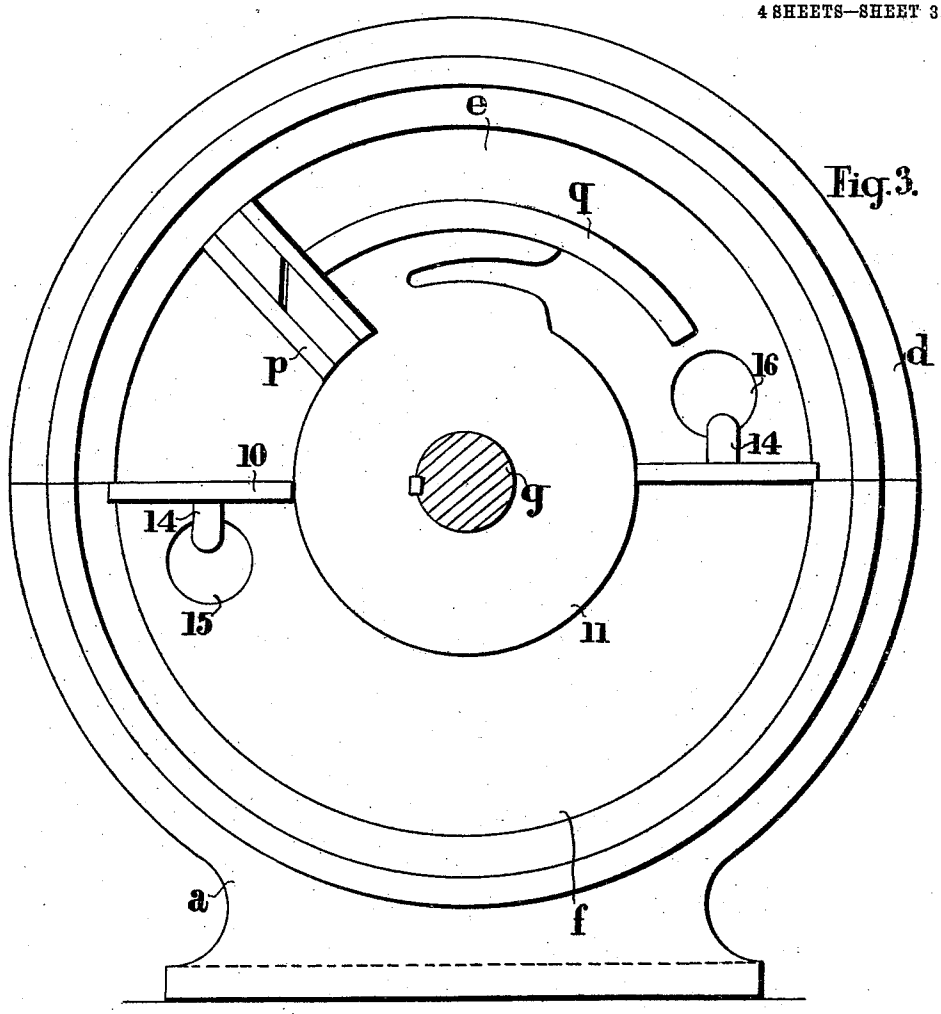


Fig. 3.

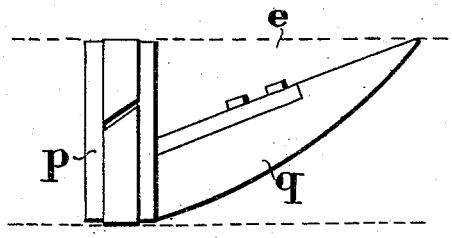


Fig. 9.

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4 SHEETS—SHEET 4.

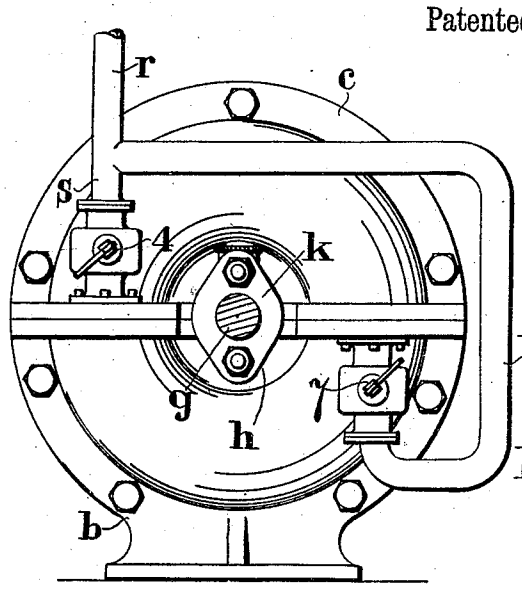


Fig. 4.

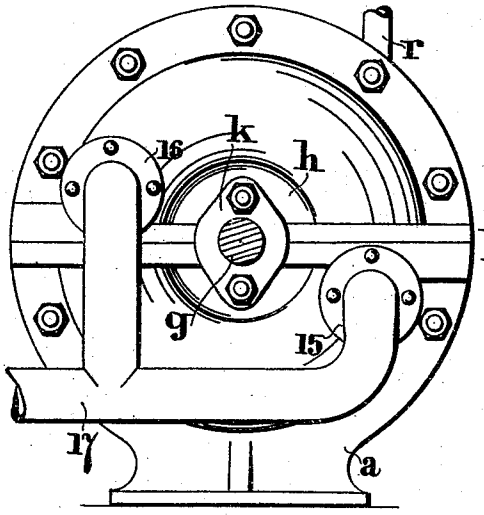


Fig. 5.

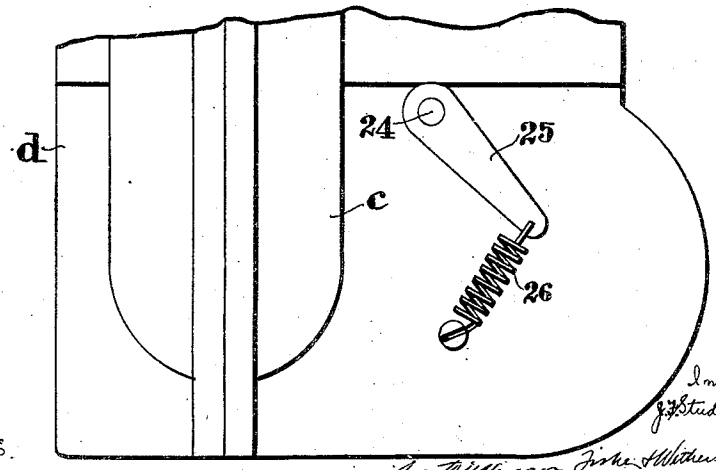


Fig. 10.

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UNITED STATES PATENT OFFICE.

JOSEPH FRANCIS STUDHOLME, OF RUANUI, NEW ZEALAND.

ROTARY ENGINE.

No. 929,512. Specification of Letters Patent. Patented July 27, 1909.

Application filed March 8, 1909. Serial No. 482,137.

To all whom it may concern:

Be it known that I, JOSEPH FRANCIS STUDHOLME, a subject of the King of England, residing at Ruanui, in the Dominion of New Zealand, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved rotary engine, suitable for driving machinery, propelling road vehicles and for other purposes for which a prime mover of this description is suitable.

The engine is of a type wherein a ring shaped chamber is provided in which works a rotary piston and refers to a special form of construction of such engine whereby great efficiency is attained.

According to the typical method of carrying out my invention I provide the engine with a ring shaped chamber in which works a rotary piston. This chamber is divided into two equal parts by means of slides which slide backward and forward being closed by a spring or other suitable means and opened by means of a piston during its travel. Suitable inlet and exhaust ports are provided and means furnished for enabling the coöperation of the parts to be very accurately synchronized. And in order that my said invention may be better understood, I will proceed to describe the same with reference to the drawings accompanying this specification, in which:—

Figure 1 is an elevation of the complete engine; Fig. 2 is a section along the line A, B, Fig. 1; Fig. 3 is a vertical section at the line C, D, Fig. 1, showing some of the principal parts of the engine; Fig. 4 is an end view in the direction of the arrow E, Fig. 1, with the cam wheel removed to show details more clearly; Fig. 5 is an end view in the direction of the arrow F, with the fly wheel removed; Figs. 6 to 10 are details hereinafter referred to.

The same letters and numerals of reference are employed to denote the same parts in all the views.

The casing of the engine is made up of four castings *a*, *b*, *c*, *d*, which are shaped so as will be seen clearly from comparing Figs. 1, 2, 4, 5, that a ring shaped chamber composed of two halves *e*, *f* is formed.

g is the shaft of the engine.

h, *h* are bearings.

k, *k* show stuffing boxes.

m is a boss mounted on the shaft *g*.

n is a disk made in one with or fixed to the boss *m*. This disk *n* works within the parts *a*, *b*, *c*, *d* of the main casting of the engine and reaches to the annular chamber *e*, *f* of the engine. The disk *n* has fixed thereto a circular piston *p* and there is also mounted on the disk *n* on the side of the piston *p* toward which the piston works, a cam or beak *q* (see Figs. 3 and 9).

The means for supplying steam to the engine will now be explained.

r is the main steam pipe, see Fig. 4. This branches into two pipes *s* and *t*. The pipe *s* communicates with the valve chamber, seen at Fig. 6. This chamber has within it a projection *u*, which has a hole *v* diametrically across it, terminating at the side *w* in a smaller hole.

z is the valve spindle provided with two valves 2 and 3, the valve 3 being larger than the valve 2. The valve 2 rests on a seating over the hole *w* and the valve 3 on a seating at the end of the hole *v*. At the end of the spindle *z* is a roller 4. 5 is a pipe communicating with the valve chamber through the holes *w* and *v*. It may be convenient to here explain the action of this valve:—When the spindle is pushed in by means of a cam hereinafter mentioned pushing against the roller 4, the valves 2 and 3 are opened and steam can pass through the pipe *s* to the pipe 5. When, however, the roller 4 is no longer in contact with the cam, the effective pressure on the valve 3, which is of greater area being greater than the effective pressure on the valve 2 which is of less area, the valves close automatically and the passage between the pipes *s* and 5 is closed. It will be understood that the valve arrangement is duplicated above and below as will be seen from Fig. 4, where the branch steam pipe *t* enters a valve chamber of like construction to that already described, which valve chamber terminates in a pipe 6, the valve in this chamber being operated by a roller 7.

Referring now to the slides shown in detail at Figs. 7 and 8, where at Fig. 7 the slide is shown withdrawn from the annular chamber and at Fig. 8 projected within the same; the castings *b* and *c* are formed at 8 and 9 with depressions which when the castings are placed together form a guide way

in which the slide 10 works. The casting is channeled at 12 to enable the steam to pass from the pipe 5 into the annular chamber of the engine when the slide 10 is in the position shown at Fig. 8. A small chamber 13 at the opposite side of the annular chamber is provided with a spring buffer against which the slide 10 strikes when it is driven into the annular chamber of the engine, the buffer 21 being cushioned by the springs behind it. 14 is a beveled pin attached to the slide 10 in such a position that as the cam *q* comes around it takes against the beveled surface, and forces back the slide 10 between the guides 8 and 9. The slide 10 has formed in an extension thereof a slot 11 into which takes the free end of a lever 23. This lever is keyed to a spindle 24 which passes out through the casing *c* and has keyed on the outside thereof another lever 25, see Fig. 10, which has at the end a tension spring 26, the other end of which is attached to any suitable part of the casing. The effect of this arrangement is that the spring 26 constantly tends to keep the slide 10 pushed into the annular chamber of the engine but when the beak comes against the beveled pin 14 the slide is pushed out against the action of the spring 26 enabling the piston to pass. 15 and 16 are the exhaust ports communicating with a common exhaust pipe 17. 18 is a cam on the shaft *g* which cam in its travel operates alternately the rollers 4 and 7, thus actuating the corresponding valves as previously described. It should be noted that the cam 18 is so set that the valves are only opened when the slides are in the closed position in the annular chamber. 19 is the fly wheel of the engine.

The action of the engine is as follows: Assuming the parts to be in the position shown at Fig. 3, steam is passing in over the slide 10 into the chamber *e* behind the piston *p*. As the piston *p* travels onward around the chamber *e* the cam or beak *q* strikes against the bevel pin 14 above the slide 10 at the right hand side of the drawing, and forces the slide back into a position corresponding to that shown at Fig. 7. As long as the roller 7 is resting on the cam 18 steam is passing in through the steam valve and entering the chamber *e* and consequently the piston *p* is under direct steam pressure but when the roller 7 leaves the cam and the steam valve closes, the steam only acts expansively and the piston continues its revolution under this expansive force. As the piston *p* continues to travel the exhaust port 16 is uncovered and the steam in the chamber is open to exhaust. The cam 18 is so placed in relation to the roller 4 that as soon as the piston *p* has completely passed the slide 10 at the right-hand side of the engine, the valve is opened and steam admitted through the pipe 5. The slide 10 having been already driven inward by the spring 26, shuts off the upper chamber *e* from the lower chamber *f* behind the piston *p*. The steam continues to enter through the pipe 6 and passing over the plate 10 enters the chamber *f* behind the piston and the cycle of operations is repeated.

I may modify my invention in various ways while still adhering to the principle of the same. For instance, I may in some cases find it desirable to divide the annular chamber of the engine into more than two sections and to provide a corresponding number of slides, valves, exhaust ports and the like.

I claim:—

1. In a rotary engine, the combination of a suitable support, a casing mounted thereon, composed of two parts fitted together so as to leave an annular chamber, a shaft passing through the center of said casing and provided with a disk mounted thereon, a piston and a cam mounted on said disk, said casing being provided with extensions located parallel to the axis of said shaft, valves adapted to slide in said extensions, spring-operated means for holding said valves normally closed, and cushioned abutments against which said valves are adapted to strike as they close, substantially as described.

2. In a rotary engine, the combination of a suitable support, a casing mounted thereon, composed of parts fitted together so as to leave an annular chamber, said casing being provided with inlet and exhaust ports, a shaft passing through the center of said casing, a disk on said shaft, a piston and cam mounted on said disk, valves governing the inlet ports to said casing, means carried by said shaft for opening said valves at intervals, said casing being provided with extensions in a plane parallel to said shaft, valves governing the outlets, mounted in said extensions, spring-operated means for holding said last named valves normally closed, and a cushioned abutment for each of said last named valves against which it strikes as it closes, substantially as described.

3. In a rotary engine, the combination of a casing composed of parts fitted together so as to leave an annular chamber, a shaft passing through said casing, a disk mounted on said shaft, a piston carried by said disk and adapted to revolve in said chamber, said casing being provided with inlet and outlet ports, a valve governing each inlet port, consisting of a stem on which two valve disks of different sizes are mounted, said stem being provided with a roller on one end, and means carried by said shaft adapted to strike said rollers and open said valves in succession, said valves closing automatically when said means passes out of contact with said rollers, substantially as described.

4. In a rotary engine, the combination of a

suitable support, a casing formed of two parts fitted together so as to leave an annular chamber, said casing being provided with inlet and outlet ports, a shaft passing centrally through said casing, steam pipes leading to said inlet ports, a valve in each steam pipe, composed of two disks of different diameters, mounted on a valve rod, said valve rod being provided with a roller on its exposed end, and a wheel provided with a cam mounted on said shaft, said valves being opened in succession by the cam and automatically closing, substantially as described.

5. In a rotary engine, the combination of a casing composed of suitable parts fitted together so as to leave an annular chamber, said casing being provided with inlet and exhaust ports, a shaft passing centrally through said casing, a disk mounted on said shaft and provided with a piston and a cam, said casing being provided with extensions in line with said shaft, valves governing the outlet ports slidably mounted in said extensions, spring-operated means for holding said valves normally closed, a cushioned abutment against which each of said valves is adapted to strike as it closes, steam pipes leading to said inlet ports, a valve governing the admission of steam into each of said ports, and means carried by said shaft for operating said last named valves in succession, substantially as described.

6. In a rotary engine, the combination of a suitable support, a casing carried thereby, composed of two parts fitted together so as to leave an annular chamber, said casing being provided with inlet and outlet ports, a shaft passing centrally through said casing, a disk provided with a piston and cam, mounted on said shaft, said casing being provided with extensions in line with said shaft, circular valves adapted to reciprocate in said extensions, spring-controlled levers for normally holding said valves closed, and cushioned abutments each having a semicircular face against which said valves are adapted to strike as they close, substantially as described.

7. In a rotary engine, the combination of a suitable support, a casing carried thereby, composed of two parts fitted together so as to leave an annular chamber therein, a shaft passing centrally through said casing, a disk mounted on said shaft and provided with a piston and a cam, said casing being provided with inlet and outlet ports and with extensions parallel to said shaft, circular valves adapted to slide in said extensions, each of said valves being provided on one of its faces with a beveled pin against which said cam is adapted to strike, spring-controlled means for normally holding said valves closed, and cushioned abutments, one for each valve, each having a semicircular face, substantially as described.

In testimony whereof, I affix my signature, in presence of two witnesses.

JOSEPH FRANCIS STUDHOLME.

Witnesses:
JOHN GAVIN DUNCAN,
WILLIAM EDWIN FULLER.