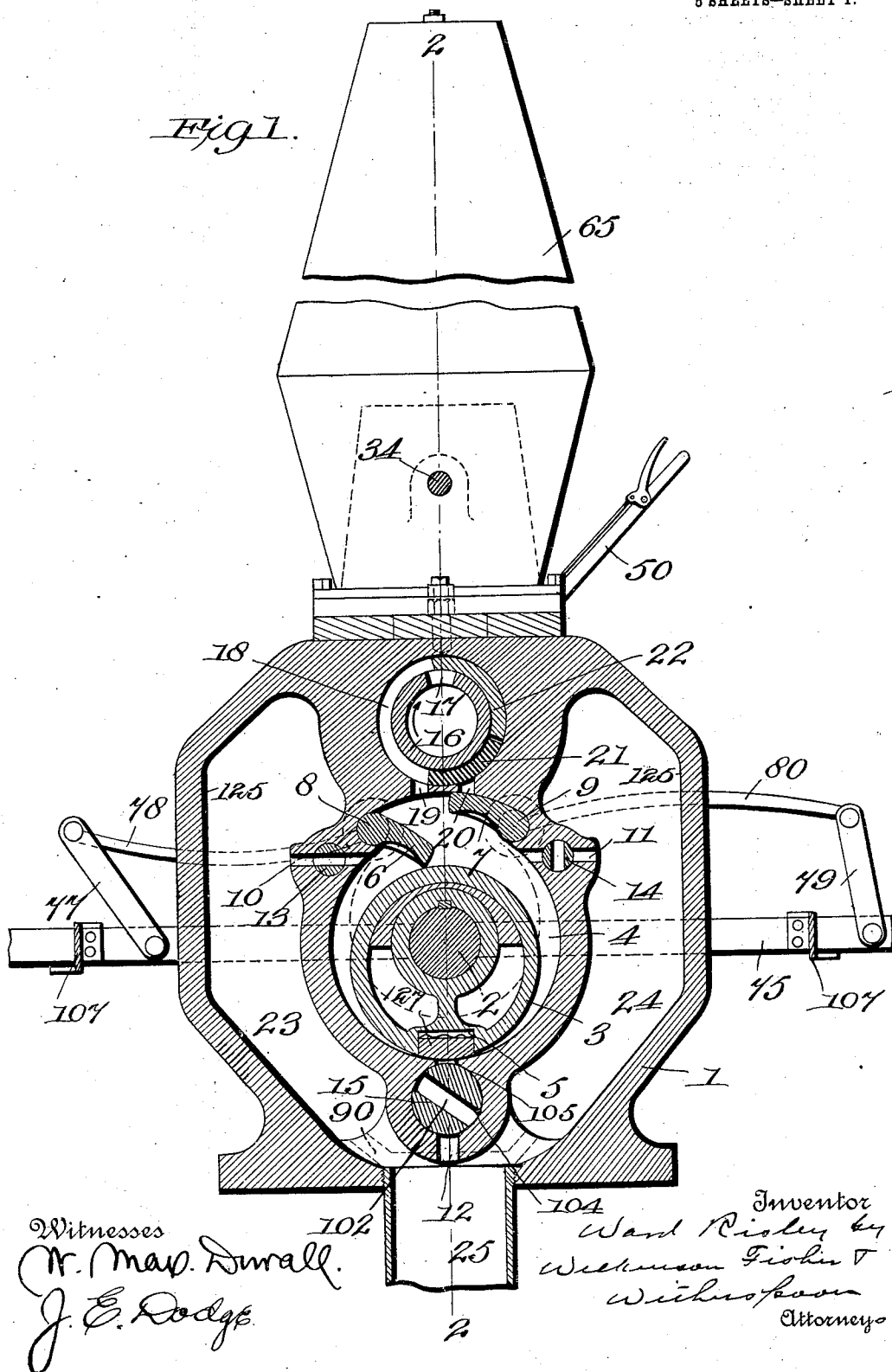


W. RISLEY.
 ROTARY REVERSIBLE ENGINE.
 APPLICATION FILED NOV. 3, 1908.

937,718.

Patented Oct. 19, 1909.
 6 SHEETS—SHEET 1.



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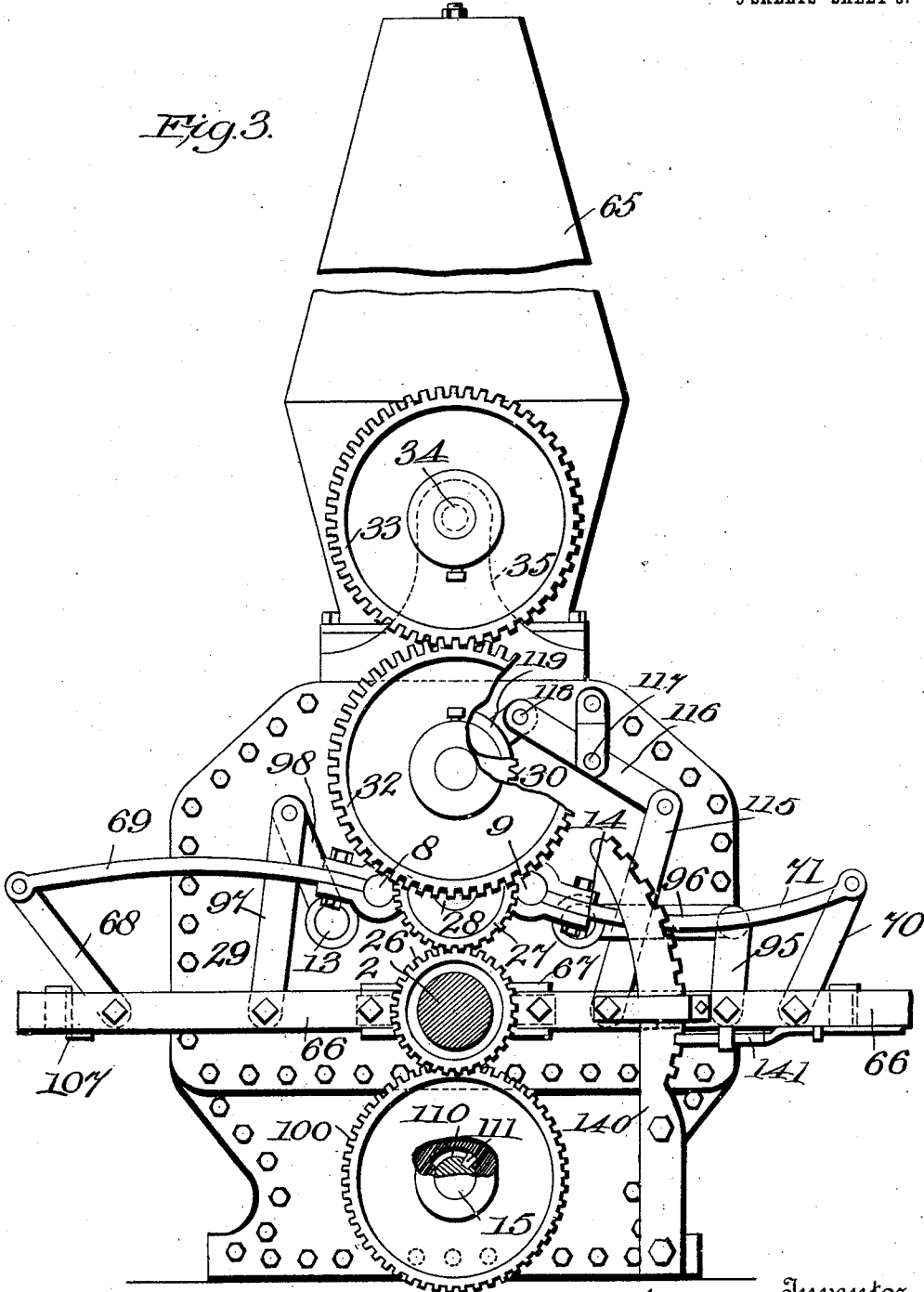
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Fig. 3.

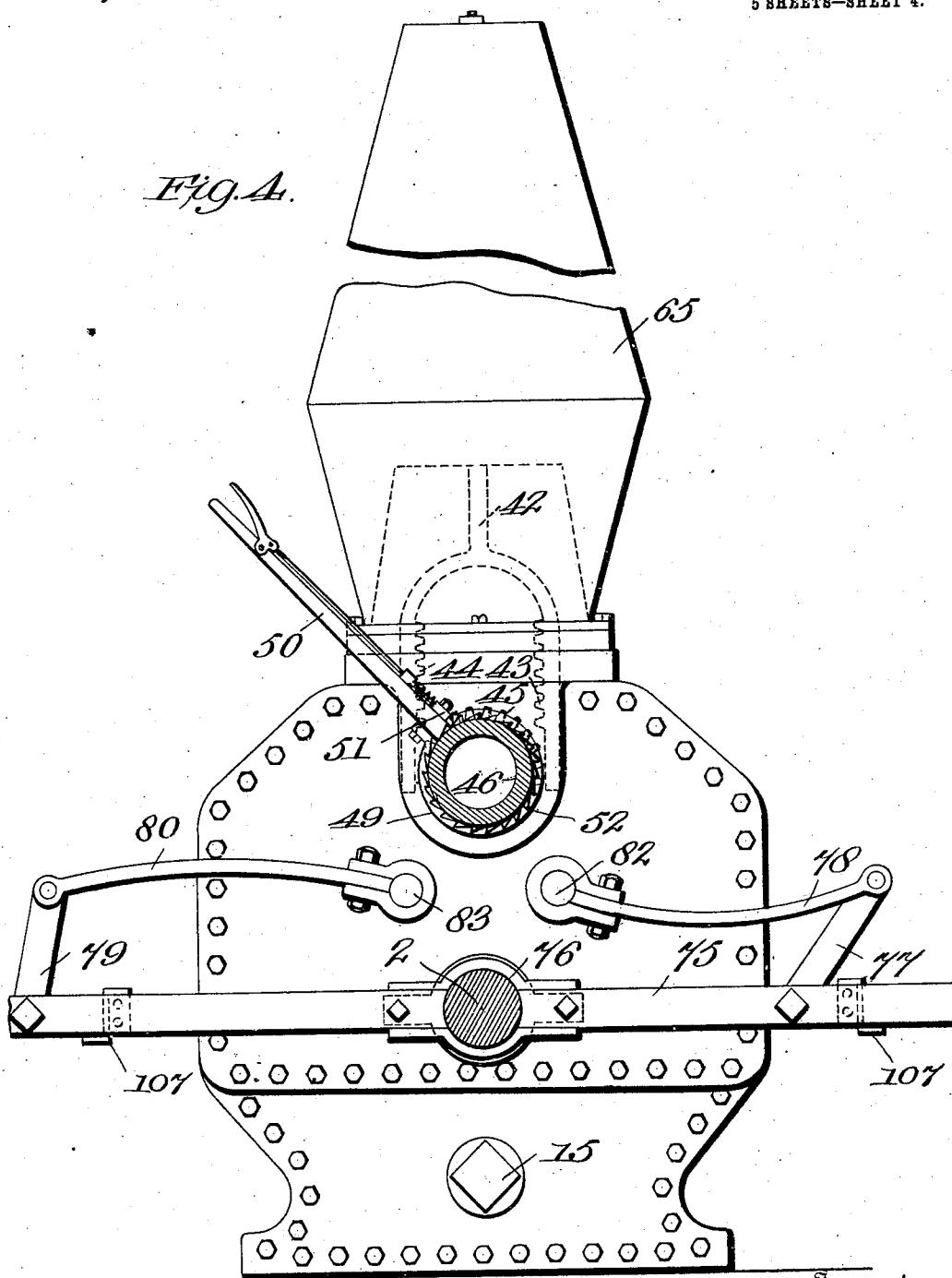


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Fig. 4.



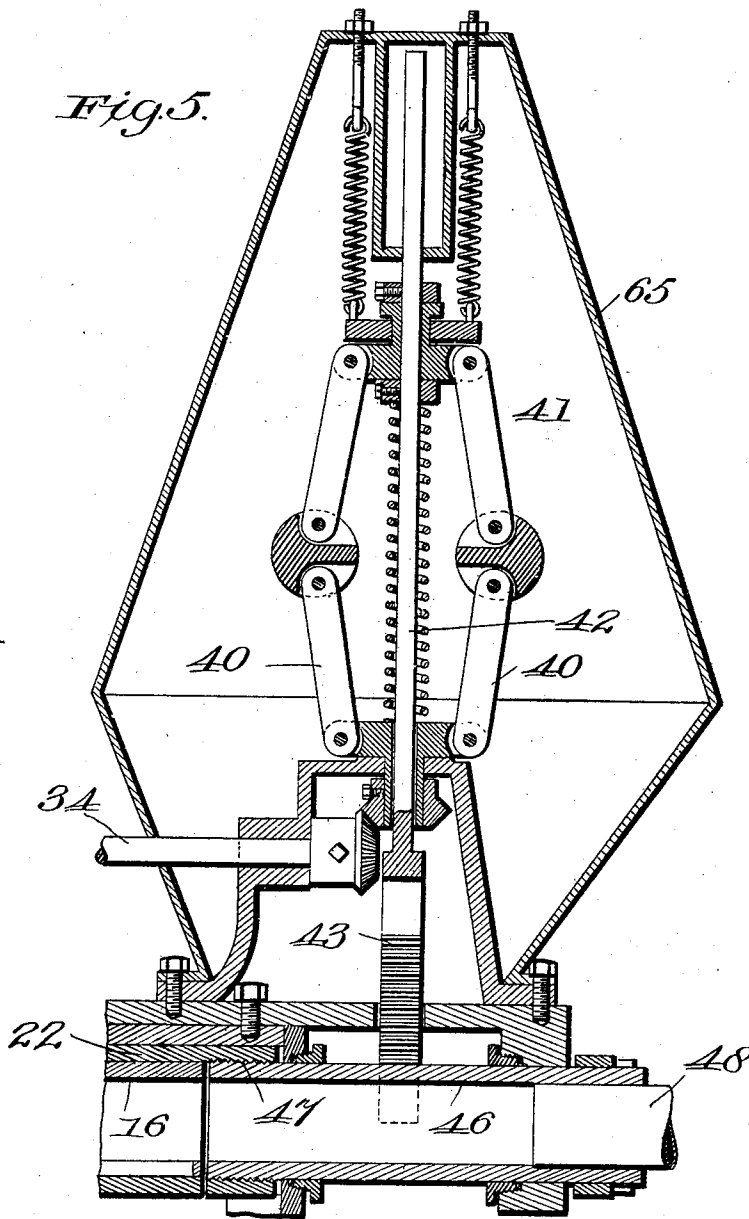
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UNITED STATES PATENT OFFICE.

WARD RISLEY, OF JACKSBORO, TEXAS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO ZEPH L. RISLEY, OF JACKSBORO, TEXAS.

ROTARY REVERSIBLE ENGINE.

937,718.

Specification of Letters Patent.

Patented Oct. 19, 1909.

Application filed November 3, 1908. Serial No. 460,825.

To all whom it may concern:

Be it known that I, WARD RISLEY, a citizen of the United States, residing at Jacksboro, in the county of Jack and State of Texas, have invented certain new and useful Improvements in Rotary Reversible 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 rotary engines, and has for its object the production of an engine which can be reversed at will, which will be certain and economical in action, which will be comparatively inexpensive to build, and which is incapable when used in pairs of stopping on a dead center.

With these and other objects in view the invention consists in the details of construction and combinations of parts more fully hereinafter disclosed, and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification in which like numerals refer to like parts in all the views:—Figure 1, is a cross-sectional view taken on the line 1—1 of Fig. 2, looking in the direction of the arrow. Fig. 2, is a longitudinal sectional view on the line 2—2 of Fig. 1. Fig. 3, is an end elevational view of the engine looking in the direction of the arrow in Fig. 2, with certain parts in section. Fig. 4, is a view similar to Fig. 3, but looking in the opposite direction and showing certain parts in section, and, Fig. 5, is a sectional detail view of the governor and its connecting parts.

1, represents the casting constituting the outer frame; 2, the main shaft; 3, the eccentrically mounted piston rigid therewith; 4, the cylinder in which the said piston revolves; 5, a packing box for said piston; 6 and 7, abutments; 8 and 9, pivots for said abutments; 10, 11 and 12, exhaust ports controlled respectively by the valves 13, 14 and 15; 16, an intake valve for fluid under pressure; 17, a port passing therethrough; 18, a passage for said fluid around said intake 16, and 19 and 20, ports admitting said fluid to the cylinder 4 of the engine. 21, is a reversing valve, and 22, a throttling valve. 23 and 24, represent steam jackets, and 25 an exhaust pipe.

On the shaft 2, see Fig. 2, is a pinion 26, which engages an idler 27, on the short shaft 28, passing steam tight through the end plate 29 of the engine, to get a firm support, as shown. The idler 27 meshes with the pinion 30, on the shaft 31, which also carries the gear 32, meshing with the gear 33 on the rod 34, mounted on the bracket 35 supported on the top of the engine, as shown. At the other end of the engine, the rod 34 carries a bevel pinion 36, meshing with the pinion 37 on the hollow stud 38, carrying the disk 39, to which are pivoted the arms 40 of the centrifugal governor 41. Since the details of this governor are not new, and since they are plainly shown and well understood, a further description thereof will be omitted. The reciprocating shaft 42 of this governor is provided with the two racks 43 and 44, as best shown in Fig. 4, which are adapted to engage the mutilated gear 45 on the rotating pipe 46, joined at 47 to the oscillating throttle valve 22, Fig. 2. The main steam pipe 48 enters the pipe 46 and registers with the intake 16, as shown.

Secured to the pipe 46 is a strap 49, to which is attached a lever 50, provided with a pawl 51 engaging the ratchet teeth 52 carried by the said pipe.

On the shaft 2 (see Fig. 2) it is preferred to place a piston 60, set at any desired angle to the piston 3, and also to place on said shaft a cylinder 61, and to provide abutments, exhaust ports and valves, each of which are substantial duplicates of corresponding parts above described. In fact it is found in many cases desirable to place two or more complete engines on the same shaft, with their pistons set at suitable angles to each other; and in Fig. 2, I have shown two such duplicate engines so placed, both of which are controlled by the same governor 41, which is preferably provided with a cover 65.

66 represents a reversing lever for the engine seen to the left in Fig. 2, which is provided with a strap 67 encircling the shaft 2, with an arm 68 joined to the preferably spring arm 69 rigidly connected with the pivot stud 8 of the abutment 6, and with the arm 70 connected with the preferably spring arm 71 rigidly connected with the pivot stud 9 of the abutment 7.

75 represents a reversing lever for the en-

gine seen to the right in Fig. 2, which is likewise provided with a strap 76 encircling the shaft 2, arms 77 and 78 connecting with the pivot of the left hand abutment 82, as it would appear if shown in Fig. 1, and with arms 79 and 80 connecting with the pivot of the other abutment 83 of said engine, all as previously set forth in connection with the right hand engine.

In operation, steam, compressed air or other fluid is admitted through the pipe 48, whereupon it passes to the port 17 of the intake valve 16, thence through the passage 18, port 19 and to the cylinder 4, causing the piston 3 to revolve until it uncovers the exhaust port 10, when the steam or other fluid passes through the jacket 23, port 90, to the exhaust pipe 25.

As the shaft 2 revolves with the piston it turns the pinion 26, which through the idler 27 turns the pinion 30, gears 32 and 33, and the governor rod 34. The pinion 30 turns the intake valve 16, through its shaft connection 31, as shown, and thereby causes its port 17 to revolve with the piston. With the relation of parts shown in Fig. 1, and the valve 16 revolving in the direction of the arrow, the throttle valve 22 is about to cut off the steam, and the steam is being used expansively through an angle of a little over 180° .

As the engine speeds up the rod 34 will speed up the governor 41, causing its weights to fly out and the rod 42 to descend. The rack 43 on said rod will thereupon descend and come into engagement with the mutilated gear 45 on the pipe 46, which in turn through its engagement 47 with the throttle valve 22 will cause the same to revolve in a direction against the hands of a watch, as seen in Fig. 1, and to thereupon cut off the steam earlier in the revolution of the piston 3. This action will cause the engine to slow down, and the governor rod 42 will thereupon rise, when the rack 43 will reverse the movement of the valve 22, and cause the period of expansion to be decreased, which of course will again speed up the engine. In other words, while the inlet port 17 is continuously revolving with the piston, the throttle valve 22 will oscillate back and forth to govern the period of expansion, and thereby keep the engine at a constant speed, notwithstanding the load may vary.

What has just been said of the left hand engine, shown in Fig. 2, of course is true of the right hand engine, and a description of its operation is therefore unnecessary.

When it is desired to reverse the engine, the right hand end of lever 66, as seen in Fig. 3, is raised, which through the connections 70 and 71 will lower the abutment 7, and through the connections 68 and 69 will raise the abutment 6. At the same time the connections 95 and 96 between said lever 66

and the exhaust valve 14, will cause the latter to open, and the connections 97 and 98 between said lever and the exhaust valve 13 will cause the said valve 13 to close. In the same way the operation of lever 75 will through the connections 77 and 78, 79 and 80, reverse the positions of their respective abutments in the right hand engine.

The exhaust valves corresponding to valves 13 and 14 in this engine and not shown, are operated in a manner which will presently appear.

Meshing with the pinion 106 on the shaft 2, is a gear 100 controlling the valve 15, and which gear has a diameter twice as great as that of said pinion 106. This valve 15, extends from the left hand engine through the right hand engine, as shown in Fig. 2, and is provided with the two openings 102 and 103 at a suitable angle to each other, as shown. When the piston 3 has moved through a little over 180° , the parts are so timed that the edge 104 of the opening 102 will begin to register with the port 105, and therefore steam will begin to exhaust through said ports 105 and 102, into the pipe 25. The object of providing this exhaust is to reduce the back pressure, and to exhaust to atmospheric pressure at the earliest possible moment.

The ports 102 and 105, extend over an angle of very nearly 90° , and therefore upon reversing the engine it is necessary to allow for this by providing a lost motion of about 90° . To do this I have provided the cut away place or slot 110 in the gear 100 in which loosely plays the key 111 which secures the said gear to the valve 15, and thereby causes the said valve to be not moved while the said gear is moving through the corresponding arc. But upon the engine being reversed, the opposite end of the said slot 110 will so act upon the said key, as to properly time the valve and piston. Since the said valve 15 extends through both engines, as above stated, it is evident that the single gear 100 is sufficient to operate both passages 102 and 103 for the respective engines; and in the same way the exhaust valves 13 and 14 are extended through both engines, and are each provided with duplicate openings and are operated for both engines by the single connections 95, 96, and 97 and 98, shown in Fig. 3. It is preferred to rigidly connect the reversing levers 66 and 75 in order to compel them to move together, and for this purpose I have provided suitable bars 107 which rigidly join the same.

When the abutments and exhaust valves 13 and 14 are operated for reversing the engines in the manner above described, the engine slows down owing to the back pressure in the cylinder; the racks 43 and 44 rise out of engagement with the teeth 45 on

the pipe 46, and the lever 50 is thrown over by hand to the right, as seen in Fig. 4, or to the left, as seen in Fig. 1, which causes the throttling valve 22 to move through an arc of about 90° in a direction against the hands of a clock, as seen in Fig. 1. In the meantime the operation of the lever 66 has through the arm 115, joined to the link 116 pivoted at 117 to the head 29 of the engine, and through the pivotal connection 118, moved the lug and collar 119 joined to the reversing valve 21, by means of the connections 120, as shown in Fig. 2. This movement, owing to the pivot 117, will be in the reverse direction to that of the valve 22, or with the hands of a watch, as seen in Fig. 1; and it will be just enough to uncover the port 20, and of course it closes the port 19.

When the steam is exhausted through the ports 10 or 11, into the jacket 23 or 24, its heat serves to aid in keeping up the temperature of the steam in the cylinder 4 in the manner well known; but, owing to the comparatively thin outer walls 125, and the extent of their outer surfaces, a considerable condensing action is going on at the outer portions of said steam and thereby lessening its back pressure, while its inner walls tend to remain at a somewhat higher temperature.

The pistons are provided with a suitable spring pressed packing bar 127, located in the box 5, and at its ends with suitably spring pressed packing rings 128, as best shown in Fig. 2. These rings 128 are provided with the holes shown in Fig. 2 to accommodate the outwardly pressing springs, and are preferably provided with notches, not shown, to fit corresponding projections on the piston and thereby prevent their being displaced.

On the head 29 of the engine there is provided a suitable rack 140, into which a catch 141 engages and holds the reversing lever 66 in its raised position.

It is not desired to limit this invention to the exact details of construction and combination of parts above set forth, except as is pointed out in the claims, for it is evident that changes may be readily made by those skilled in the art without departing from the spirit of the invention.

Having now ascertained the nature of this invention and the manner of constructing and using the same, what is claimed is:—

1. In a rotary engine, the combination of a cylinder; a rotating piston eccentrically mounted therein; an intake valve rotating with said piston; a throttle valve concentric with said intake valve and adapted to govern said intake valve; a governor; connections between said intake valve; and connections between said governor and said governor and said throttle valve, substantially as described.

2. In a rotary engine, the combination of a cylinder provided with an exhaust port; a rotating piston eccentrically mounted therein; an abutment in said cylinder adapted to contact with said piston; an intake valve rotating with said piston; a throttle valve concentric with said intake valve and adapted to govern said intake valve; a governor; and independent connections between said intake and governor and said throttle valves, substantially as described.

3. In a rotary engine, the combination of a cylinder provided with an exhaust port and an exhaust valve controlling the same; a rotary piston in said cylinder; a rotating intake valve driven by said piston; a throttle valve; a governor; different connections between the intake and throttle valves and the governor; and connections between said piston and said exhaust valve; whereby said exhaust and intake valves are compelled to revolve in a fixed relation with said piston, substantially as described.

4. In a rotary engine, the combination of a governor; a rotating piston eccentrically mounted; an oscillating reversing valve; a continuously rotating intake valve concentric with said reversing valve; an oscillating throttle valve governing the intake valve; and independent connections between said governor and said intake and throttle valves, substantially as described.

5. In a rotary engine, the combination of a cylinder; a rotating piston eccentrically mounted therein; an intake valve rotating with said piston; an oscillating reversing valve concentric with said intake valve; a throttle valve concentric with said intake valve and adapted to govern said intake valve; a governor; connections between said governor and said throttle valve and other connections between said governor and said intake valve, substantially as described.

6. In a rotary engine, the combination of a cylinder provided with a plurality of exhaust ports and valves controlling the same; a rotating piston in said cylinder; connections between said piston and one of said valves; a rotating intake valve; a governor connected to the same; connections between said piston and said intake valve, whereby the latter is compelled to revolve in a fixed relation with said piston; an oscillating reversing valve concentric with said intake valve, a throttle valve; and connections between the same and said governor, substantially as described.

7. In a rotary engine, the combination of a cylinder provided with an exhaust port and a valve controlling the same; a piston in said cylinder; a shaft on which said piston is eccentrically mounted; a rotating intake valve; gear connections between said shaft and each of said valves; a centrifugal governor; gear connections between said in-

take valve and said governor; a throttle valve concentric with said intake valve; and connections between the same and said governor, substantially as described.

- 5 8. In a rotary engine, the combination of a cylinder; steam jackets partially surrounding the same; an exhaust passage between said cylinder and one of said jackets provided with a valve; a piston eccentrically
10 mounted in said cylinder; a pivoted abutment in said cylinder adapted to contact with said piston; a rotating intake valve; an oscillating throttling valve concentric with said intake valve; a governor; connections
15 between said governor and said throttling valve, and connections between said governor and said intake valve, substantially as described.
9. In a rotary engine, the combination of
20 a cylinder; steam jackets partially surrounding the same; an exhaust passage between said cylinder and each of said jackets provided with a valve; a piston eccentrically mounted in said cylinder; a pair of pivoted
25 abutments in said cylinder adapted to contact with said piston; a rotating intake valve; an oscillating throttling valve concentric with said intake valve; a reversing valve; means for operating the same; means
30 for operating said abutments; a governor; connections between said governor and said throttling valve, and connections between said governor and said intake valve, substantially as described.
- 35 10. In a reversible rotary engine, the combination of a frame provided with a plurality of steam jackets and a cylinder; a plurality of exhaust ports between said cylinder and jackets; valves in said ports; a plu-
40 rality of pivoted abutments in said cylinder; a reversing lever; connections between said lever and said abutments for raising and lowering said abutments; connections between said lever and said valves for operat-
45 ing the same; an eccentrically mounted rotating piston in said cylinder; a rotating intake valve; an oscillating reversing valve concentric with said intake valve; connections between the same and said lever, a
50 throttle valve; a governor; and connections between each of said intake and throttle valves and said governor, substantially as described.
11. In a reversible rotary engine, the com-
55 bination of a frame provided with a plurality of steam jackets and a cylinder; a plurality of exhaust ports between said cylinder and jackets; valves in said ports; a plurality of pivoted abutments in said cylinder;
60 a reversing lever; connections between said lever and said abutments for raising and lowering said abutments; connections between said lever and said valves for operating the same; an eccentrically mounted ro-
65 tating piston in said cylinder; a rotating in-

take valve; an oscillating throttle valve; a governor connected to said throttle valve; an oscillating reversing valve; and connections between the same and said lever, substantially as described.

- 70 12. In a reversible rotary engine, the combination of a frame provided with a plurality of steam jackets and a cylinder; a plurality of exhaust ports between said cylinder and jackets; valves in said ports; a plu-
75 rality of pivoted abutments in said cylinder; a reversing lever; connections between said lever and said abutments for raising and lowering said abutments; connections between said lever and said valves for op-
80 erating the same; an eccentrically mounted rotating piston in said cylinder; a shaft on which the same is mounted; a rotating intake valve; an oscillating throttle valve; a governor connected to said throttle valve;
85 an oscillating reversing valve; connections between the same and said lever; gears on said shaft for operating said intake valve and said governor; and a lever 50 for oper-
90 ating said reversing valve independently of said governor, substantially as described.

13. In a reversible engine, the combination of a frame provided with a plurality of steam jackets; a cylinder; a plurality of ex-
95 haust ports between said cylinder and jackets; an exhaust pipe; an exhaust port 105, between said cylinder and said pipe; valves in each of said ports; a shaft passing through said cylinder; a piston eccentrically mounted on said shaft; packing bars for
100 said piston; packing rings for said piston; abutments in said cylinder adapted to contact with said piston one at a time; a reversing lever; connections between said lever and said abutments for raising and lower-
105 ing the same; connections between said lever and two of said valves for opening and closing the same; an intake valve; gears on said shaft for causing said intake valve to rotate with said piston; gears also on said
110 shaft for causing the valve controlling the port 105 to rotate with said piston; a throttle valve; a governor; gears on said shaft for operating said governor; connections between said governor and said throttle valve;
115 a lever for operating said throttle valve independently of said governor; a reversing valve; and connections between the same and said reversing lever, substantially as described.

- 120 14. In a rotary engine adapted to use steam expansively, the combination of a governor; a rotating piston; a continuously rotating intake valve; an oscillating throttle valve concentric with said intake valve
125 adapted to cut off the steam passing through said intake valve at a predetermined point in its revolution; independent connections between said governor and said intake and throttle valves; and means for driving said
130

intake valve in a fixed relation to said piston, substantially as described.

15 In a rotary engine, the combination of a piston; a governor connected therewith; a throttle valve; a pipe 46 connected to said valve; a mutilated gear 45 on said pipe; and a pair of racks controlled by said governor adapted to alternately engage said gear, substantially as described.

10 16. In a rotary engine, the combination of a piston; a governor operated thereby; an intake valve; a throttle valve; an oscillating pipe adapted to convey steam to said intake valve connected to said throttle valve; and connections between said pipe and said governor by which said pipe is oscillated, substantially as described.

17. In a rotary engine, the combination of a piston; a governor operated thereby; an intake valve; a throttle valve adapted to oscillate concentrically with said intake valve; an oscillating pipe adapted to convey steam to said intake valve connected to said throttle valve; and connections between said pipe and said governor consisting of a mutilated gear on said pipe, and a pair of racks controlled by said governor by which said pipe is oscillated, substantially as described.

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

WARD RISLEY.

Witnesses:

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FRANK A. HARRISON.