J. ROTHCHILD.

ENGINE VALVE.

APPLICATION FILED FEB. 18, 1908.

916,491.

Patented Mar. 30, 1909.

4 SHEETS—SHEET 1.

Fig. 1

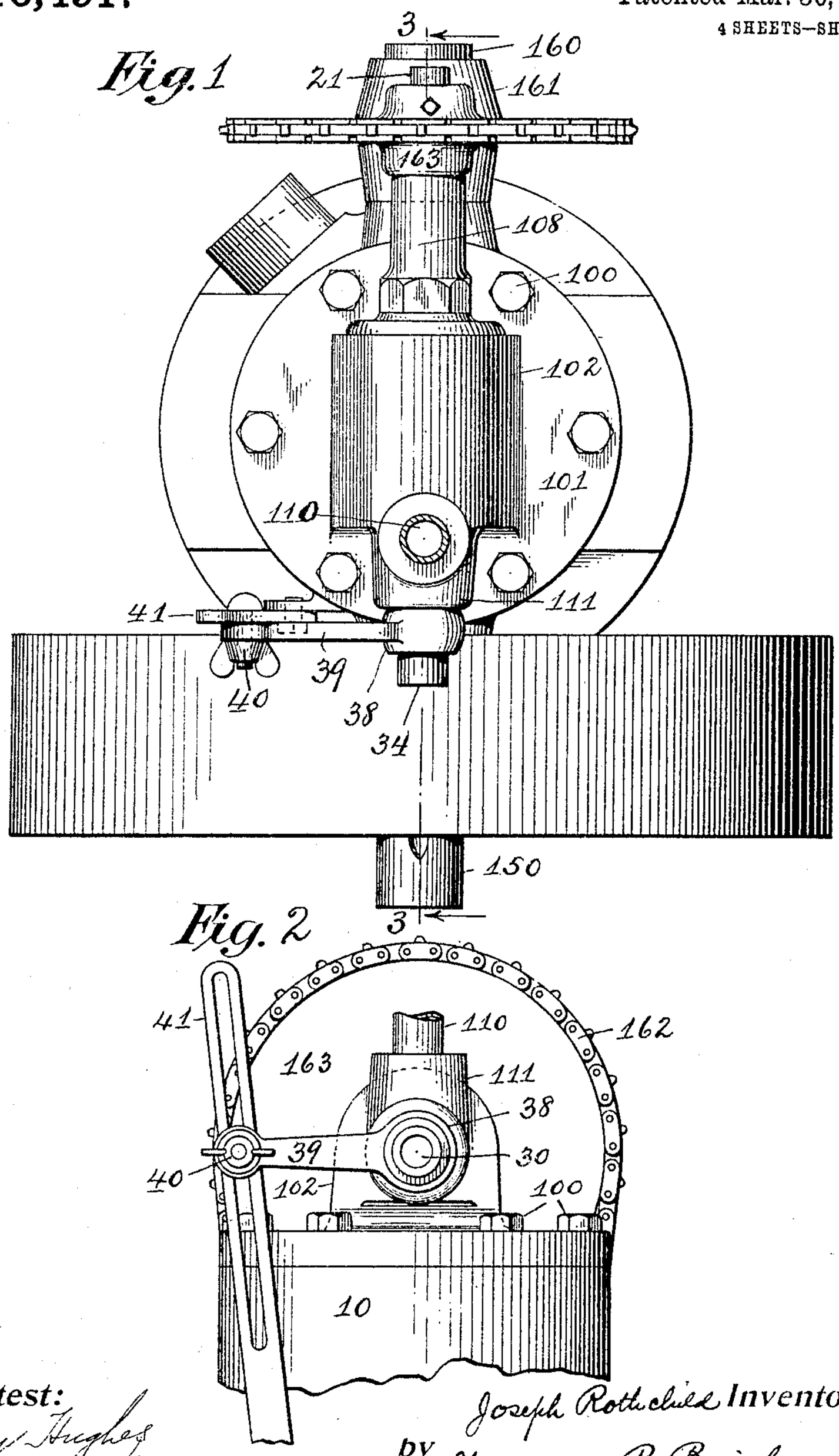

Fig. 2

Attest:

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Alan C. McDonnell.

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by William R. Baird

his Atty.

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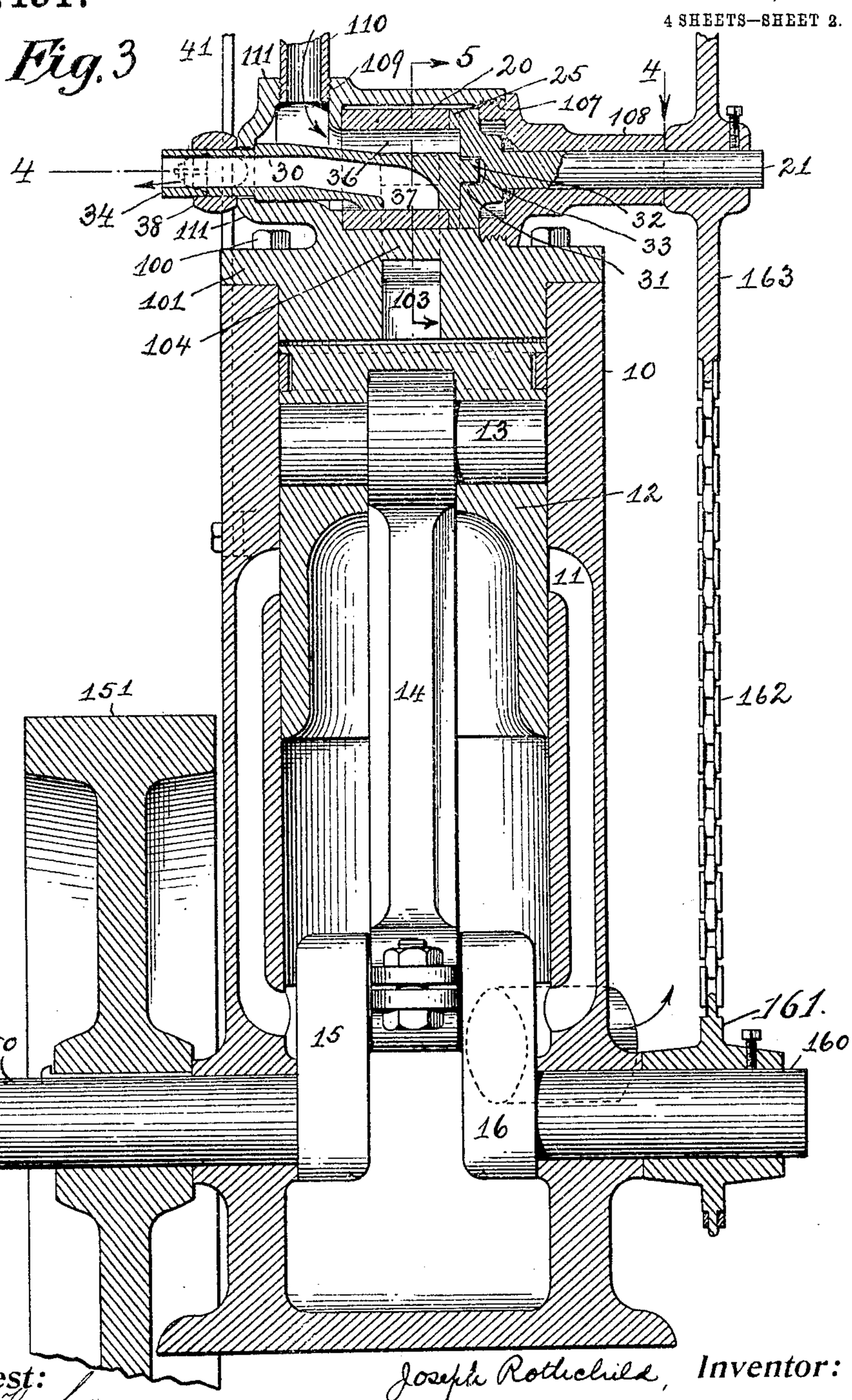
4 SHEETS—SHEET 2.

Fig. 3



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4 SHEETS—SHEET 3.

Fig. 4

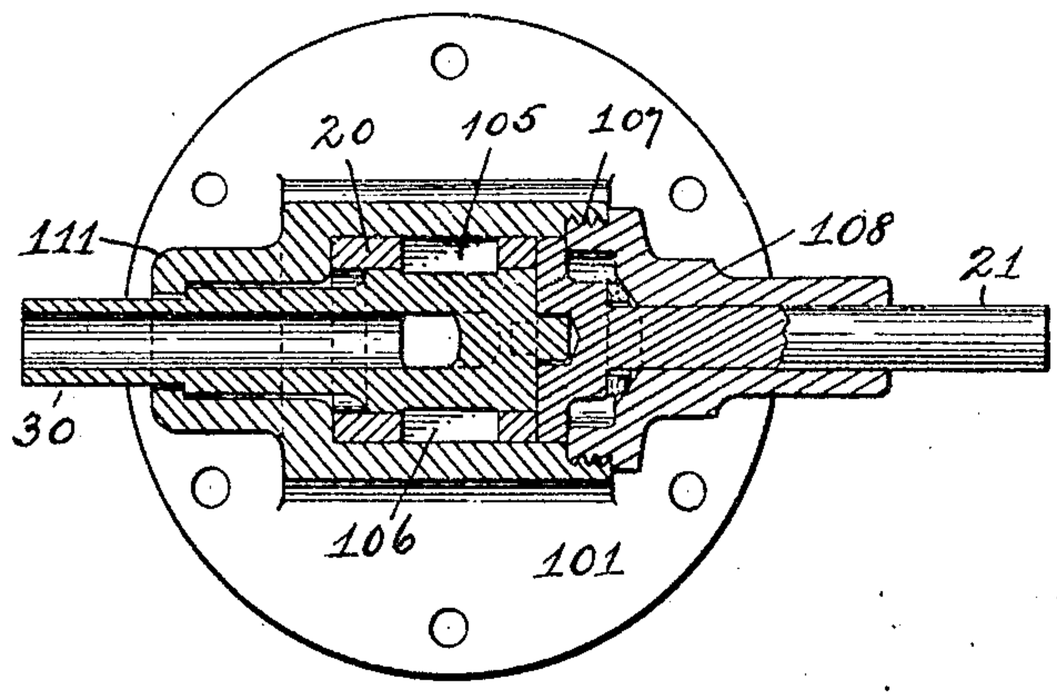


Fig. 5

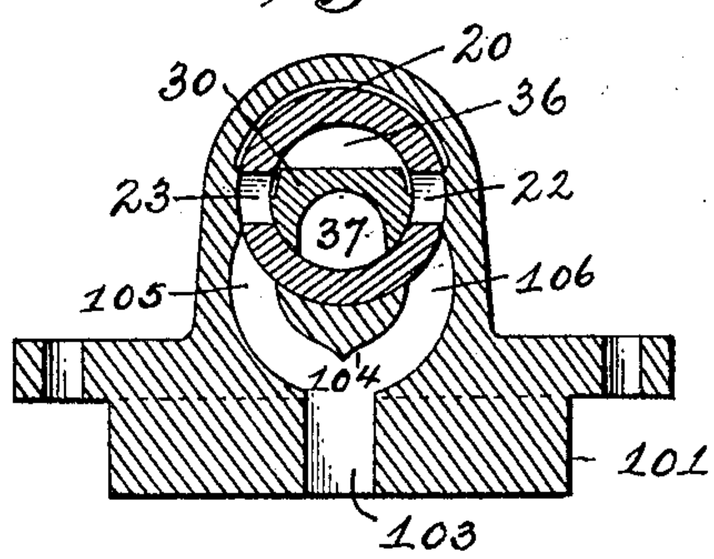


Fig. 6

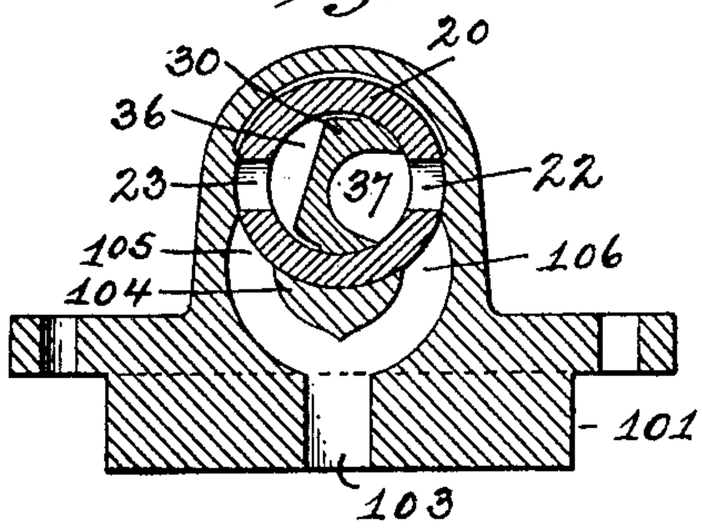
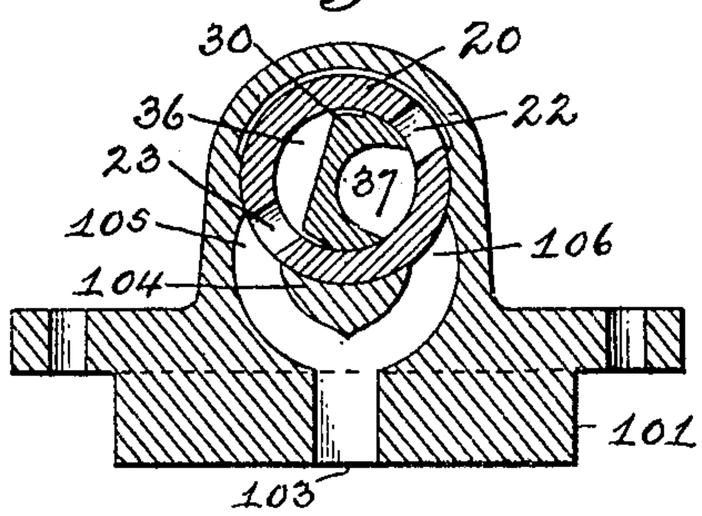


Fig. 7



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4 SHEETS—SHEET 4.

Fig. 8

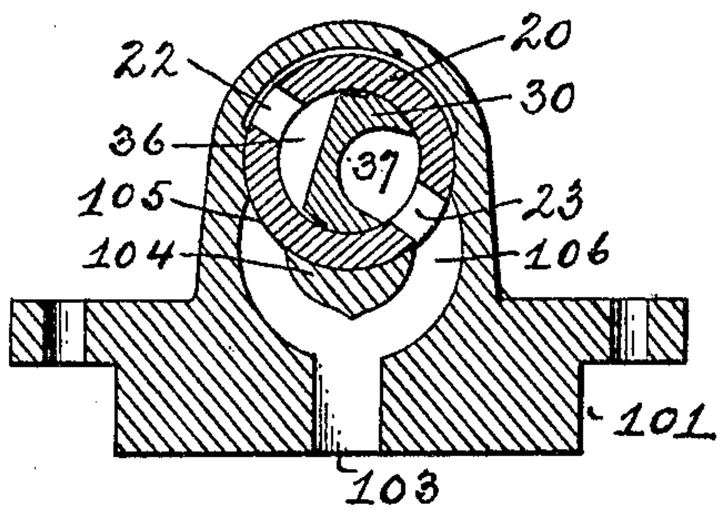


Fig. 9

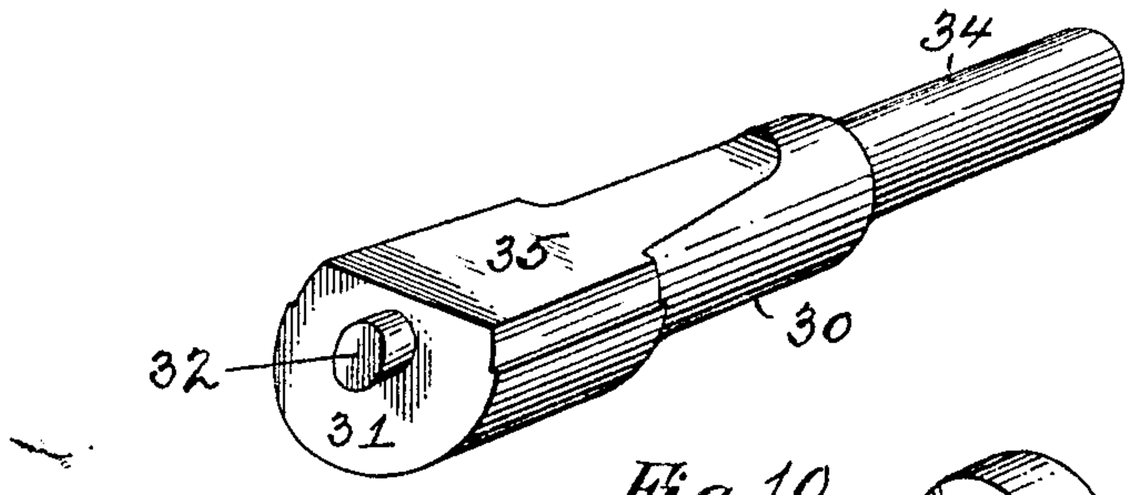


Fig. 10

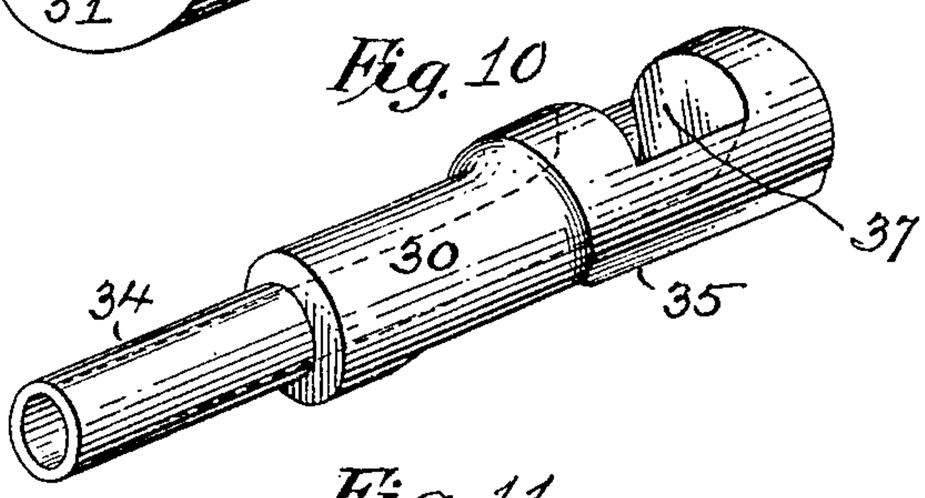
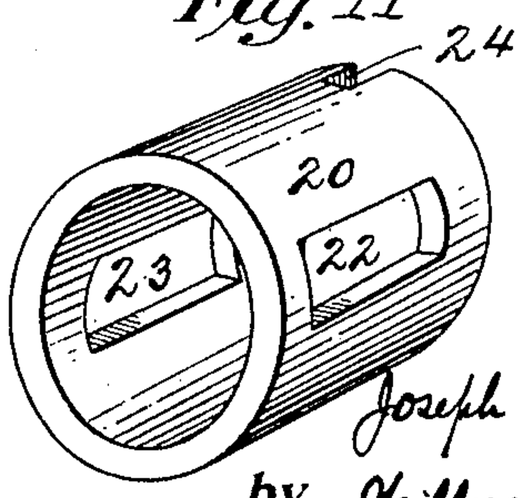


Fig. 11



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UNITED STATES PATENT OFFICE.

JOSEPH ROTHCHILD, OF BAYONNE, NEW JERSEY.

ENGINE-VALVE.

No. 916,491. Specification of Letters Patent. Patented March 30, 1909.

Application filed February 18, 1908. Serial No. 416,615.

To all whom it may concern:

Be it known that I, JOSEPH ROTHCHILD, a citizen of the United States, residing at Bayonne, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Engine-Valves, of which the following is a specification.

This invention relates to fluid motors, and more especially to those employing steam or similar expansible gas, and its novelty consists in the construction and adaptation of the parts as will be more fully hereinafter pointed out.

In the drawings, Figure 1 is a top plan view of an engine embodying the invention; Fig. 2 is a side elevation of the part of the same above the fly wheel looking from left to right in Fig. 3; Fig. 3 is a central vertical section on the plane of the line 3—3 in Fig. 1; Fig. 4 is a horizontal section on the plane of the line 4—4 in Fig. 3; Figs. 5, 6, 7 and 8 are vertical sections on the plane of the line 5—5 in Fig. 3 showing the parts in different relative positions; Fig. 9 is a perspective of the adjuster, and Fig. 10 is a perspective of the rotary valve. Fig. 11 is a perspective detail view of the valve.

In the drawings, 10 represents the cylinder of a reciprocating engine provided with ports 11.

12 is the piston adapted to reciprocate in the cylinder and provided with a wrist pin 13, and a connecting rod 14, the latter in turn being connected to two cranks 15 and 16, the former secured to the shaft 150 and the latter to the shaft 160. The shafts are adapted to rotate in suitable bearings in the usual manner. A fly-wheel 151 is mounted on the shaft 150. On the shaft 160 is secured a sprocket wheel 161 adapted to engage with a sprocket chain 162 which in turn communicates motion to a sprocket wheel 163, of double the diameter of wheel 161, mounted on the projecting rotatable stem 21 of a valve 20 located above the cylinder 10 of the engine.

Secured to the upper end of the cylinder 10 by any suitable means, as the bolts 100, is a cylinder head 101, provided with an upwardly extending housing 102 forming a valve casing. This is provided with a centrally arranged port or passage 103 leading to the interior of the cylinder 10 above the piston 12 and which is divided by a transverse bridge 104 into two steam ways or channels 105 and 106. The housing 102 is threaded internally at 107 to receive a hollow bearing 108 in which the valve stem 21 is adapted to rotate. It is also threaded internally at 109 to receive a steam inlet pipe 110 and it is provided with a projection or bracket 111 adapted to serve as a bearing for the adjuster 30 presently to be described.

The valve 20 is made in the form of a cylinder, is adapted to fit snugly within the casing 102 and is provided with two lateral ports 22 and 23 placed diametrically opposite each other. It is provided with two notches 24 diametrically arranged and which are adapted to engage with teeth 25 projecting from the edge of the stem 21 so that while the valve 20 and its stem 21 are not secured together the valve will be rotated by the rotation of its stem.

The adjuster 30 is in effect a long tube of peculiar form. Its innermost wall 31 is provided with a centering pin 32 adapted to rotate in a recess 33 formed in the valve stem 21, so that it will always be centered at that point. At its outer end it comprises a cylinder 34 adapted to rotate in bearings formed in the bracket 111. It is longitudinally truncated at 35 to form a space 36 between it and the inner surface of the valve 20 and its central aperture 37 is turned and carried through one of its walls to afford a discharge conduit for the exhaust steam, as hereinafter described.

At any convenient point along the cylinder 34 there is secured a collar 38 to which in turn is fastened an arm 39 provided at its other extremity with a clamp 40 slidably connected to a slotted rod 41 pivotally mounted, at its lower end, at any convenient point on the cylinder 10 or elsewhere on the frame of the engine. It is obvious that by sliding the clamp 40 along the rod 41 the adjuster 30 may within certain limits be circularly adjusted with respect to the casing 102 and the valve 20 and be securely held in place after adjustment. The slotted rod 41 is pivoted at its lower end, as it is necessary that it should swing over to the right of the vertical in reversing the engine.

Suppose that the parts are arranged as shown in Fig. 5, the adjuster 30 being so arranged that its truncated surface 35 is horizontal, and the valve 20 being so arranged that its ports are horizontal. Now, if steam is admitted through the inlet conduit 110 it passes into the space 36, within the valve

20 and above the adjuster 30, but it can go no further and does no work. Now suppose that the adjuster 30 is turned until it is in the position shown in Fig. 6, and steam is admitted to the space 36. Again it can go no further. But suppose that the valve 20 is now rotated by hand in the direction opposite to that of the hands of a watch or so that it will assume the position shown in Fig. 7, steam from the space 36 will pass through the port 23 into the steam way 105 and through the port 103 and into the cylinder and will push the piston 12 downward until it reaches the end of its stroke, when it will be found that the head of the piston has just reached the lower edge of the ports 11 and the steam under almost full pressure will for a moment rush into such ports and be conducted wherever it may be convenient. The momentum of the fly-wheel 151 will however carry the cranks 15 and 16 and the piston 12 upward and cause the valve stem 21 to continue to rotate. The parts are so adjusted and the body 104 is made of such a width that when the piston reaches its mid exhaust point the parts are in the position shown in Fig. 8 and the port 23 of the valve 20 is communicating with the steam way 106 to receive the exhaust steam which is conducted into the adjuster 30 and out through its cylinder 34 to be used as may be deemed best. The steam way 105 is closed from the inlet space 36 at this time.

In the use of the engine, the position of the adjuster 30 determines the direction of movement of the piston and its rate of speed. If the parts are in the positions shown in Fig. 5, where the truncated surface 35 of the adjuster is horizontal and steam is admitted to the space 36, it will be noticed that no steam can enter the cylinder because the ports 23 and 22 are closed by reason of the fact that the walls of the adjuster are opposite such ports. Of course, if the valve 20 is rotating and the adjuster is in this position a little steam would leak from the space 36 and into the ports 22 and 23, and thence into the passageways 105 and 106, but it would be negligible, and the ports could not be said to be open in any proper sense. Suppose now, that the adjuster is placed in the position shown in Fig. 6. This is done by moving the arm 39 after the clamp 40 has been loosened until the adjuster assumes the desired position when the clamp is tightened against the rod 41 and the adjuster will thereafter remain in that position until it has been manually moved to a new one. In this position the steam entering through the space 36 passes through the port 23 into the passageway 105 as soon as the valve 20 has rotated to bring the port 23 between this space 36 and passageway 105. The piston being at the top of its stroke and the valve moving contrary-clockwise, steam is just beginning to be admitted to the piston through the passageway 105. When the upper edge of port 23 has just coincided with the left-hand edge of the bridge 104, the piston should have arrived at a position where its upper edge just begins to open the ports 11. While the port 23 is then passing over and being blanked by the bridge 104, the piston passes down over the ports 11 and back again so that these ports are again just closed. By this time the lower or right hand edge of the port 23 will just begin to open to the port 106, and the engine will exhaust until the piston arrives at the top of its stroke and then the left-hand edge of the port 23 will just have closed the port 106; the port 22 then becomes active in exactly the same way, instead of the port 23. It will be noticed that when the ports are in this position shown in Fig. 6, the lower edge of the truncated surface 35, the lower edge of the port 23 and the left hand edge of the bridge 104 are all in line when the valve has been so rotated that the port 23 and passageway 105 coincide. In other words, the valve has not been throttled in any way from the inside. This position of the parts is best shown in Fig. 7 where the valve 20 is shown to have been rotated to permit the steam to pass through the apertures mentioned. Therefore, when the adjuster is in the position shown in Figs. 6 and 7, assuming that the valve 20 rotates in the opposite direction to that of the hands of a watch the engine would be moving full speed ahead.

The aperture 37 is about twice the width of the ports 22 or 23 and consequently always permits a free outlet of the steam from the passageway 106 into the exhaust pipe 34 through this passageway 37.

The proportions of the parts are so arranged and their movement is so timed that while the port 23, for example, is moving from the passageway 105 to the passageway 106 the piston has taken its full downward and return stroke, and the exhaust steam is discharged through the port 22 into the aperture 37 at the proper time. To preserve this proper timing of admission and exhaust, it is of course necessary that the relation of the pitch diameter of the sprocket wheel 161 to that of the wheel 163 should be as one is to two.

It is obvious that if the truncated surface 35 of the adjuster 30 be so arranged that its lower edge will be moved toward the left from the positions shown in Figs. 6 and 7, it will cut off part of the steam supply from the space 36 to the port 23. In other words, it will partially throttle that port and if it is in such position and the other parts are as shown in Figs. 6 and 7, the engine would be running part speed ahead and not full speed.

If the position of the adjuster be reversed from that shown in Figs. 6, 7 and 8, so that the discharge port 37 connects with the port

23 of the valve 20 and the steam space 36 and with the port 22 of this same valve, then it is obvious that the steam would first move down the passageway 106 instead of the passageway 105 and would be discharged from the passageway 105. In other words, if the other parts of the engine remain in the same positions as before and the adjuster merely is moved to the position indicated, the engine would move full speed backward, and if the adjuster was moved to throttle the passageway from the space 36 to the port 22 it would move part speed backward. In other words, the practical effect of the use of this adjuster is that merely by moving the adjuster up and down past the center (in which the parts would be in the position shown in Fig. 5) an engine can be caused to move at any desired speed, either backward or forward, a result which I believe has heretofore been impossible to accomplish by similar means. It will be noted that in effect this adjuster is a diaphragm impervious to the steam and which serves to divide the interior of the rotary valve 20 into two parts, through one of which the steam enters, and through the other of which it is discharged, and that merely by moving the diaphragm, the size of the inlet conduit for the steam into the cylinder is varied while the size of the outlet conduit remains uniform, so that it provides a means for manipulating a continuously rotating valve to vary the inlet cut off from the inside of the valve, without in any wise hindering the free discharge of the exhaust steam.

What I claim as new is:—

1. A casing having a plurality of ports, a continuously rotating valve having diametrically opposite openings adapted to register successively with said ports as the valve moves, a conduit for introducing steam to the interior of the valve and a movable adjuster adapted to control the size of said conduit relative to the valve openings.

2. A valve casing having a plurality of ports, a continuously rotating valve having diametrically opposite openings adapted to successively register therewith and an apertured adjuster arranged within the valve so that steam is admitted to the valve on one side of the adjuster and discharged therefrom on the other side thereof.

3. A valve casing having a plurality of ports, a continuously rotating valve having diametrically opposite openings adapted to successively register therewith, a diaphragm adapted to be placed across the interior of the valve, means for admitting steam to the valve on one side of the diaphragm, means for discharging steam from the valve on the other side of the diaphragm and means for moving the diaphragm.

4. A casing provided with a plurality of ports so placed that steam admitted at one will be discharged from the other, a rotary valve provided with a corresponding number of ports adapted to register with those of the casing, means arranged within the valve whereby steam may be supplied from the interior of the valve through one of its ports to one of the ports of the casing and exhausted through one of the ports of the casing and one of the ports of the valve into the interior of the valve.

5. A casing provided with a plurality of ports so placed that steam admitted at one will be discharged from the other, a rotary valve provided with a corresponding number of ports adapted to register with those of the casing, means arranged within the valve whereby steam may be supplied from the interior of the valve through one of its ports to one of the ports of the casing and exhausted through one of the ports of the valve into the interior of the valve, and means for separating the incoming and discharging columns of steam within the valve.

6. A casing provided with a plurality of ports so placed that steam admitted at one will be discharged from the other, a rotary valve provided with a corresponding number of ports adapted to register with those of the casing, means arranged within the valve whereby steam may be supplied from the interior of the valve through one of its ports to one of the ports of the casing and exhausted through one of the ports of the valve into the exterior of the valve and means for separating the incoming and discharging columns of steam within the valve, comprising a movable diaphragm.

7. A casing provided with a plurality of ports so placed that steam admitted at one will be discharged from the other, a rotary valve provided with a corresponding number of ports adapted to register with those of the casing, means arranged within the valve whereby steam may be supplied from the interior of the valve through one of its ports to one of the ports of the casing and exhausted through one of the ports of the valve into the interior of the valve and means for separating the incoming and discharging columns of steam within the valve, comprising an adjustable diaphragm and means for moving it from the outside of the casing.

8. A casing having a plurality of ports, a continuously rotating valve having diametrically opposite openings adapted to register successively with said ports as the valve moves and means for varying the size of the valve openings on the side away from the casing.

9. A casing having a plurality of ports, a continuously rotating valve having diametrically opposite openings adapted to register successively with said ports as the valve

moves, and means for varying the size of the valve openings on the side away from the casing, comprising a diaphragm placed within the valve and means for circularly adjusting its position.

10. A casing having a plurality of ports, a continuously rotating valve having diametrically opposite openings adapted to register successively with said ports as the valve moves and means for throttling the valve openings from the inside.

11. A casing having a plurality of ports, a continuously rotating valve having diametrically opposite openings adapted to register successively with said ports as the valve moves and means for throttling the valve openings from the inside, comprising a diaphragm placed within the valve and means for circularly adjusting its position.

12. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve, and means for admitting steam to one side of the diaphragm and discharging it from the other whereby as the valve revolves, it alternately affords a passage from the steam inlet through its openings to one of the casing ports and a passage from the other of the casing ports through its openings to the steam discharge.

13. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve, and means for admitting steam to one side of the diaphragm and discharging it from the other whereby as the valve revolves, it alternately affords a passage from the steam inlet through its openings to one of the casing ports and a passage from the other of the casing ports through its openings to the steam discharge, in combination with means for adjusting the diaphragm to vary the size of the steam inlet opening.

14. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve, and means for admitting steam to one side of the diaphragm and discharging it from the other whereby as the valve revolves, it alternately affords a passage from the steam inlet through its openings to one of the casing ports and a passage from the other of the casing ports through its openings to the steam discharge, in combination with means for adjusting the diaphragm to vary the size of the steam inlet opening while the size of the steam outlet opening remains uniform.

15. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve, and means for admitting steam to one side of the diaphragm and discharging it from the other whereby as the valve revolves, it alternately affords a passage from the steam inlet through its openings to one of the casing ports and a passage from the other of the casing ports through its openings to the steam discharge, in combination with means for adjusting the diaphragm to vary the size of the steam inlet opening, comprising an arm exterior to the diaphragm and the valve casing.

16. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve, and means for admitting steam to one side of the diaphragm and discharging it from the other whereby as the valve revolves, it alternately affords a passage from the steam inlet through its openings to one of the casing ports and a passage from the other of the casing ports through its openings to the steam discharge, in combination with means for adjusting the diaphragm to vary the size of the steam inlet opening and securing it in place after adjustment.

17. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve, and means for admitting steam to one side of the diaphragm and discharging it from the other whereby as the valve revolves, it alternately affords a passage from the steam inlet through its opening to one of the casing ports and a passage from the other of the casing ports through its openings to the steam discharge, in combination with means for adjusting the diaphragm to vary the size of the steam inlet opening and securing it in place after adjustment, comprising an arm secured to the diaphragm, a clamp thereon and a rod coöperating with the clamp.

18. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve comprising a hollow body made in the form of a truncated cylinder closed at one end and open at the other and with a lateral opening opposite its truncated side.

19. A casing having two ports spaced apart by a bridge and leading to a common passageway, a rotary valve within the casing having openings adapted successively to register with said ports, a diaphragm within the valve comprising a hollow body made in

the form of a truncated cylinder closed at one end and open at the other and with a lateral opening opposite its truncated side having a circumferential length substantially twice that of the valve opening.

20. A casing having one port leading from a source of steam supply and two other ports spaced apart by a bridge leading to a steam cylinder, in combination with an intermediate continuously rotating valve having diametrically opposite ports, an external uniform cut off, and an internal variable cut off for the column of inflowing steam.

21. A casing having one port leading from a source of steam supply and two other ports spaced apart by a bridge leading to a steam cylinder, in combination with an intermediate continuously rotating valve having diametrically opposite openings, an external uniform cut off, and an internal variable cut off for the column of inflowing steam and a uniform external and internal cut off for the column of outflowing steam.

22. A steam engine comprising a cylinder, a piston reciprocating therein, a valve connected to and operated by a moving part of the engine and having diametrically opposite openings, which valve regulates both the admission and discharge of the steam into and from the cylinder and is provided with a variable cut off on its inlet side and a uniform cut off on its outlet side.

23. A steam engine comprising a cylinder, a piston reciprocating therein, a valve connected to and operated by a moving part of the engine and having diametrically opposite ports, which valve regulates both the admission and discharge of the steam into and from the cylinder and is provided with a uniform cut off on its outlet side and means for varying the cut off on its inlet side, consisting of an internal diaphragm within the valve and means for moving it to throttle the valve opening on that side.

24. A steam engine comprising a cylinder, a piston reciprocating therein, a valve connected to and operated by a moving part of the engine and having diametrically opposite openings, which valve regulates both the admission and discharge of the steam into and from the cylinder and is provided with an internal controller and means for holding it in place after adjustment.

25. A steam engine comprising a cylinder, a piston reciprocating therein, a valve connected to and operated by a moving part of the engine and having diametrically opposite openings, which valve regulates both the admission and discharge of the steam into and from the cylinder and is provided with an internal controller consisting of a hollow body open at one end and one side and means for circularly moving it with respect to the valve.

26. The combination with a steam engine, comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder, of a valve connected to and operated by a moving part of the engine and controlling the conduit and which valve has two ports diametrically opposite to each other alternately communicating with the steam inlet and steam outlet.

27. The combination with a steam engine comprising a cylinder, a piston reciprocating therein, and a steam inlet and outlet conduit communicating with the cylinder, of a rotary valve having diametrically opposite openings, adapted to be rotated in unison with the reciprocation of the piston, and provided with an internal exhaust outlet, and with an adjuster by the mere movement of which the steam may be controlled to cause the engine to operate forward or backward at any desired speed.

28. The combination with a steam engine comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder, of a fixed casing intermediate the conduit and the source of steam supply, two steam ways therein, a rotary valve having diametrically opposite ports registering alternately with each steam way and means for throttling the inner side of one port of the rotary valve.

29. The combination with a steam engine comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder, of a fixed casing intermediate the conduit and the source of steam supply, two steam ways therein, a rotary valve having ports registering alternately with each steam way and means for throttling the inner side of one port of the rotary valve, and permitting the outer side of the same port and both sides of the other port to remain wide open.

30. The combination with a steam engine comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder, of a fixed casing intermediate the conduit and the source of steam supply, two steam ways therein, a rotary valve having diametrically opposite ports registering alternately with each steam way, and means for throttling the inner side of one port of the rotary valve, consisting of a diaphragm circularly adjustable within the valve.

31. The combination with a steam engine comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder, of a fixed casing intermediate the conduit and the source of steam supply, two steam ways therein, a rotary valve having diametrically opposite ports registering alternately with each steam way and means for throttling the inner side of one port of the rotary valve, and permitting the outer side of the same port

and both sides of the other port to remain wide open, and means for moving the throttling means.

32. The combination with a steam engine comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder, of a fixed casing intermediate the conduit and the source of steam supply, two steam ways therein, a rotary valve having ports registering alternately with each steam way and means for throttling the inner side of one port of the rotary valve, and permitting the outer side of the same port and both sides of the other port to remain wide open, and means for moving the throttling means and securing it in place after adjustment.

33. The combination with a steam engine comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder to supply and discharge steam at the same end, of a continuously rotating valve intermediate the steam supply and the cylinder having diametrically opposite ports, means for conducting the steam discharged from the cylinder to the interior of the valve and means for varying the amount of steam admitted to be supplied to the cylinder.

34. The combination with a steam engine comprising a cylinder, a piston reciprocating therein and a steam inlet and outlet conduit communicating with the cylinder to supply and discharge steam at the same end, of a continuously rotating valve intermediate the steam supply and the cylinder having diametrically opposite ports, means for conducting the steam discharged from the cylinder to the interior of the valve and means for varying the amount of steam admitted to be supplied to the cylinder, consisting of a hollow adjustable diaphragm within the valve having a truncated impervious surface on one side and an opening on the other.

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

JOSEPH ROTHCHILD.

Witnesses:

HERMAN MEYER,

ALAN C. MCDONNELL.