No. 650,079. Patented May 22, 1900.

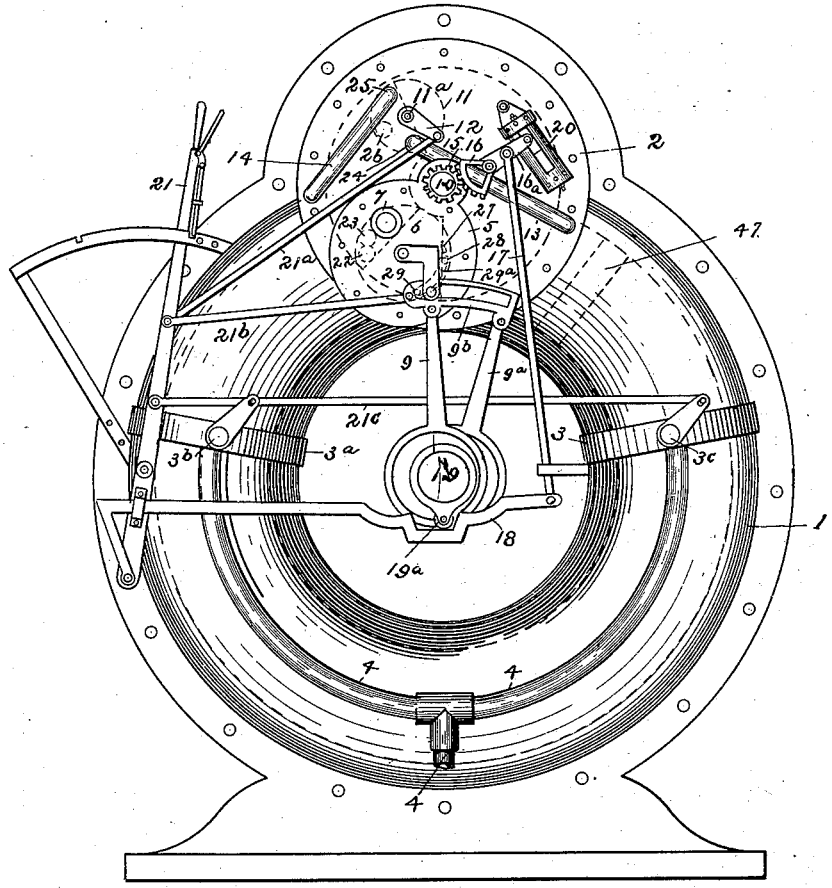
C. LORENZ.

ROTARY ENGINE.

(Application filed June 3, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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No. 650,079. Patented May 22, 1900.

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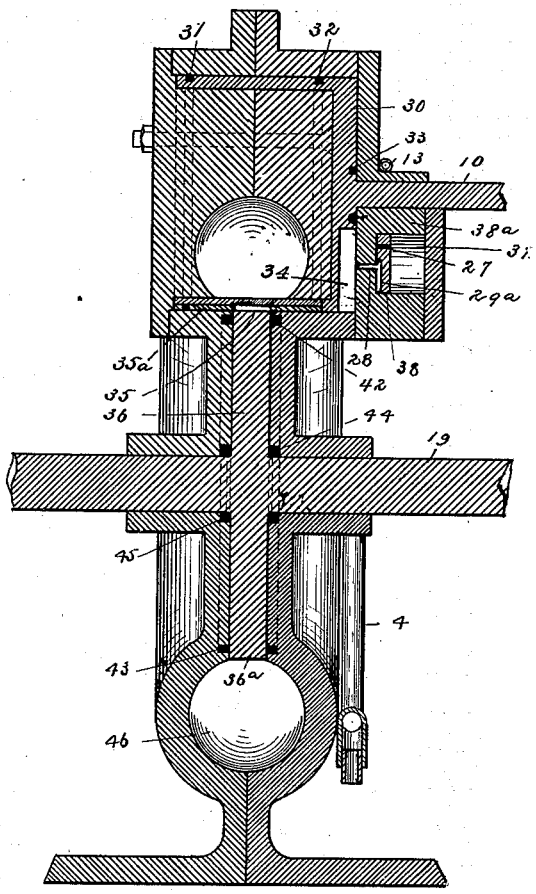
(Application filed June 3, 1899.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



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(Application filed June 3, 1899.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 3.

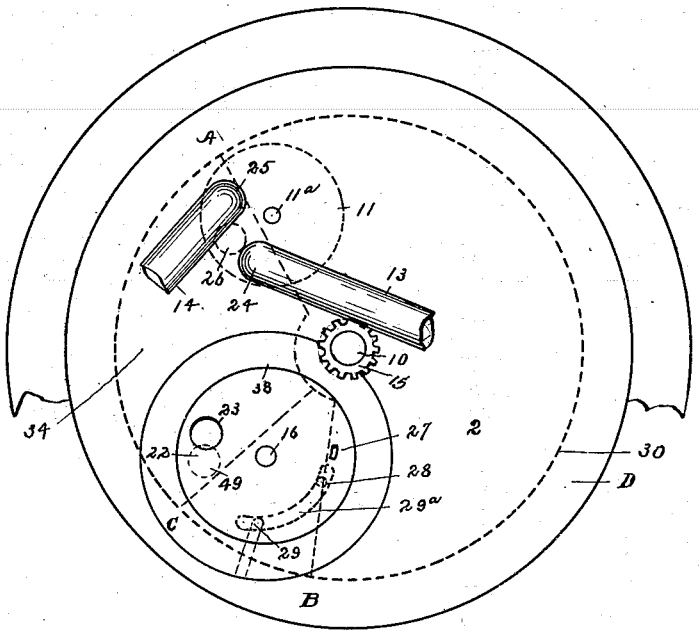
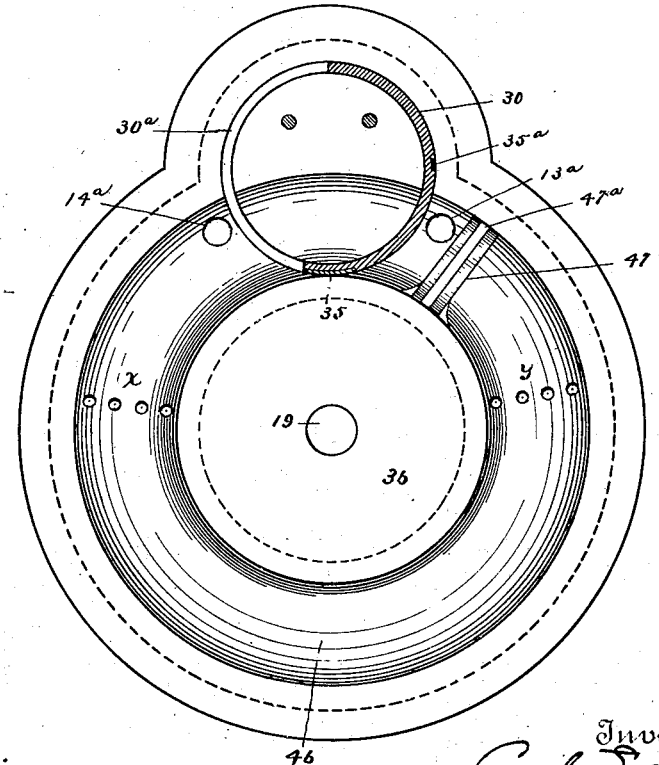


Fig. 4.



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(Application filed June 3, 1899.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 5.

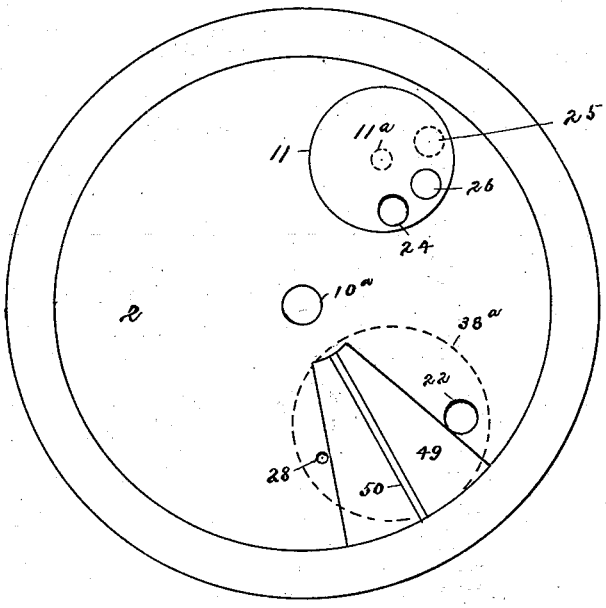


Fig. 6.

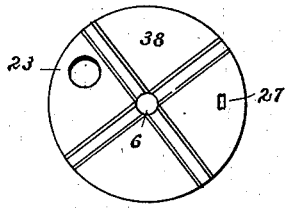


Fig. 7.

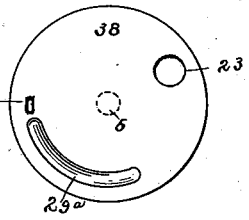


Fig. 8.

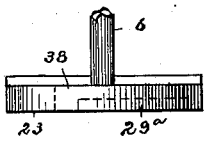
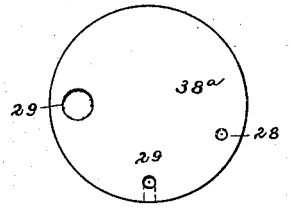


Fig. 9.



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UNITED STATES PATENT OFFICE.

CARL LORENZ, OF REDFERN, NEW SOUTH WALES.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 650,079, dated May 22, 1900.

Application filed June 3, 1899. Serial No. 719,321. (No model.)

To all whom it may concern:

Be it known that I, CARL LORENZ, residing at Redfern, near Sydney, in the Colony of New South Wales, 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 said invention, such as will enable others skilled in the art to which it most nearly appertains to make, use, and practice the same.

My invention relates to improvements in rotary engines.

The object of my invention is to provide a rotary engine (*a*) in which the steam or other motive power will be utilized to the greatest advantage; (*b*) that will be easily reversed; (*c*) in which full advantage is taken of the expansion of steam or other motive power; (*d*) which will work without the slide-bars, cross-head connecting-rods, and crank-axle now in use on reciprocating engines; (*e*) which will exhaust only once in each revolution; (*f*) which for a given power will occupy less space than those now in use, and (*g*) which will be light and cheaply constructed. To obtain these results, I construct an engine with an annular chamber instead of a cylinder; but as this annular chamber performs the same functions as the cylinder of a reciprocating engine I have hereinafter called it a "cylinder." The cross-section of this annular chamber or cylinder may be of any suitable shape, either square, oval, or, as shown in the accompanying drawings, circular. This annular chamber is so constructed that an opening or annular slot is left in the inner—that is to say, the smallest—circumference, the sides of which extend to the center and form bearings for the main shaft. The space between these sides is occupied by a disk which is concentrically keyed to the main shaft and whose periphery closes the annular slot in the cylinder. Attached to the periphery and forming part of this disk and placed at right angles thereto is a piston-head which fits inside the cylinder, so that as the piston revolves in the cylinder the disk and shaft revolve with it. The main shaft, disk, and piston-head may be constructed in one piece, if found desirable. In order that the steam or other motive power when introduced into the cylinder may cause the piston to revolve under full pressure, a shut-off valve is provided, which opens to let the piston-head pass and closes immediately after it has passed, thus forming a closed chamber behind the piston-head. This shut-off valve is operated by the steam or other motive power, the supply being governed by the action of the main valve, which is operated by the eccentric attached to the main shaft. This shut-off valve may be placed horizontally, as shown, or may be placed vertically. To insure that the shut-off valve will under all circumstances open at the proper time, a safety-guard is provided, which in the event of the shut-off valve failing to open will be operated by means of a cam fitted on the main shaft, thus providing against any possible failure of the valve. In order to reverse the engine, I provide a reversing-valve which when operated by reversing-lever admits the motive power into the cylinder on the opposite side of the piston, the said lever at the same time reversing the eccentrics, exhausts, and safety-guard, all of which are hereinafter fully described.

My engine may be made with one cylinder, as shown; but I prefer to use two or more on the same shaft to insure steady running of the machinery and in order that full advantage may be taken of the expansion of steam, which in this specification I desire to include compressed air or any other motive power. If considered desirable, my engine may be made compound.

In the accompanying drawings, Figure 1 is a view in side elevation, illustrating my improved engine. Fig. 2 is a transverse sectional view thereof. Fig. 3 is an enlarged view of the shut-off-valve cover with steam-chest cover removed. Fig. 4 is a sectional view illustrating the cylinder and its adjuncts. Fig. 5 is a view of the inner face of the shut-off valve. Figs. 6, 7, 8, and 9 are details.

Referring to the drawings, 1 is the body of the engine.

2 is a shut-off-valve cover.

3 and 3ª are exhaust-chambers.

4 is the exhaust-outlet.

5 is the steam-chest cover.

6 is the steam-valve spindle.

7 is the main steam-supply.

8 is the crank, by means of which the steam-

valve 6 is operated by the eccentric-rods 9 and 9ª.

10 is a shut-off-valve spindle.

11 is a reversing-valve.

11ª is the spindle of reversing-valve 11.

12 is a crank by means of which the reversing-valve 11 is operated.

13 is a pipe carrying steam to cylinder.

14 is a pipe carrying steam to cylinder when engine is reversed.

15 is a toothed wheel keyed on shut-off-valve spindle 10, which engages a toothed quadrant 16, which is connected by means of a connecting-rod 17 to the safety-guard 18.

19 is the main shaft, to which is keyed a cam attachment 19ª.

20 is an air-cushion the piston of which is connected with the quadrant 16 for the purpose of cushioning the shut-off valve. The toothed quadrant 16 and wheel 15 may be done away with and a crank keyed onto the shut-off-valve spindle and connected direct to the piston of cushioning-cylinder 20 substituted if the shut-off valve is constructed to close on the left side instead of on the right, as shown.

21 is the reversing-lever, which operates spindle 11ª of reversing-valve 11, eccentric reversing-link 9ᵇ, exhaust-valves 3ᵇ and 3ᶜ, and safety-guard 18 by means of the connecting-rods 21ª 21ᵇ 21ᶜ, the safety-guard being operated by the lower end of the reversing-lever.

22 is the main supply-port in valve-face.

23 is a corresponding port in valve.

24 is a port through which the steam enters pipe 13 from steam-chest.

25 is a port through which the steam enters pipe 14 when engine is reversed.

26 is a port in reversing-valve 11, through which steam is admitted to port 25 when the valve is reversed.

27 is a port in main valve which admits the steam through port 28 in the valve-face to open the shut-off valve.

29 is an exhaust for the steam which is used to operate the shut-off valve.

29ª is an exhaust-recess in under side of main valve.

30 is an approximately-circular shut-off valve mounted on a spindle 10.

31, 32, and 33 are expansion-rings let into the shut-off valve for the purpose of making steam-tight joints. Said shut-off valve is provided with an annular flange 30ª, broken away at 31ª and revolving in a recess 32ª, as shown.

34 is a chamber or recess which is constructed on the face of the shut-off valve for the purpose of operating it as hereinafter described.

35 is a block let into an expansion-strip 35ª in shut-off valve, which rests on and makes a joint with the periphery of the disk 36 when the shut-off valve is closed, as shown.

36 is a disk which may be an integral part of the main shaft 19 or may be keyed thereto.

36ª is the periphery of disk 36, which closes the aperture in cylinder 46. The piston is formed on the periphery of the disk 36 and at right angles to it and revolves in the cylinder 46.

37 is the steam-chest, in which main valve 38 is located.

38ª is a valve-face.

42 43 44 45 are expansion-rings let into the walls of the chamber in which the disk 36 revolves.

When valve 30 is shut, as shown, the chamber or recess 34, which is constructed on the face thereof, extends from A to B, the fixed stop occupying the space from C to B, so that in this position of the valve 30 the chamber 34 is on the left-hand side of the stop; but when the valve is revolved and in an open position the side A of chamber 34 meets the side C of stop and the side B travels to the point D, thus forming the chamber 34 on the right-hand side of the stop. This action of the shut-off valve 30 is caused by the alternate admission of the steam through ports 22 and 28, as hereinafter described.

13ª and 14ª are the main steam-supply ports into cylinder, only one of which is open at a time, 13ª being connected with pipe 13 and 14ª with pipe 14, Fig. 3.

47 is the piston-head, which forms part of and is at right angles to the disk 36.

47ª is the piston-ring, of which there may be one or more.

X and Y are the main exhaust-ports, only one of which is open at a time.

It is not essential that the valve 30 should occupy so much space in the recess 30ª as shown. It would be sufficient if it extended a little beyond the expansion-strip 35ª.

10ª is an aperture which fits over shut-off-valve spindle 10.

49 is a fixed stop which may be an integral part of the cover. This stop is shown in position by dotted lines in Figs. 1 and 3.

50 is an expansion-strip.

The method of operating my invention is as follows: Assuming that the piston 47 has just passed the shut-off valve 30—that is to say, in the position shown in Fig. 4—the steam-valve now admits steam through ports 23 and 22, which forces the shut-off valve 30 into the position shown in Figs. 3 and 4, and the steam filling the chamber or recess 34 thus formed on one side of the stop 49 passes through the port 24, pipe 13, and into the cylinder through port 13ª, which is between the piston in its present position and the valve 30, which is now shut. It is clear from this that no steam can pass through the ports 23 and 22 into the cylinder without first shutting the valve 30. After the steam thus admitted into the cylinder has moved the piston, say, ninety degrees or about half a revolution the steam-valve cuts off the steam and the piston is now propelled by the expansion of the steam about another forty degrees; but a little before the piston has arrived in this position the steam-

valve admits steam through ports 27 and 28 to the opposite or opening side of the stop 49 and opens the shut-off valve 30, the steam on the other or closing side of the stop exhausting at the same time through exhaust 29. The opening of the valve 30 occurs the moment the piston 47 has passed the main exhaust X. The piston now travels past the valve 30, and immediately it passes the steam from opening side of stop exhausts through port 29 and at the same time the steam is admitted through ports 23 and 22, thus closing the valve 30 and entering the cylinder as before, thus completing a revolution. In order to provide against any possible failure of the steam to open the valve 30, I provide a safety-guard, as shown in Fig. 1 and marked 18, one end of which is attached to the lower end of the reversing-lever 21 for the purpose of altering its position when the engine is running the reverse way. The other is attached by means of a connecting-rod 17 to a lever-crank 16^a, which has on one end a toothed quadrant 16, which engages a toothed wheel 15, keyed to spindle 10 of valve 30, while the other is attached to the piston of a cushioning-cylinder 20.

In order to operate the safety-guard, a cam attachment 19^a is keyed to the main shaft in such a position that should the steam fail to open the valve the cam will press on the safety-guard and by lowering the connecting-rod 17 cause the quadrant 16 to revolve the spindle 10 and so open the valve 30. The action of opening the shut-off valve by the steam is so arranged as to be slightly ahead of the cam attachment on main shaft, so that the mechanical movement only comes into operation if the steam fails to open the valve. The cushioning-cylinder 20 is provided for the purpose of cushioning the shut-off valve and prevent any knock against the fixed stop 49 as it opens and shuts.

Having now particularly described and ascertained the nature of my said invention and in what manner the same has to be performed, I declare that what I claim is—

1. In a rotary engine, a casing having an annular chamber or cylinder, a recess being formed in said casing, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk and fitting in said chamber or cylinder, a rotary shut-off valve having a flange working in said recess, and a stop arranged to engage the face of said valve and limit the movement thereof; substantially as set forth.

2. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve having an annular flange and provided with a chamber or recess in its face, and a fixed stop arranged to engage the walls of said chamber or recess; substantially as set forth.

3. In a rotary engine, a casing having an annular chamber or cylinder, a recess being formed in said casing, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve provided with a chamber or recess in its face and having an annular flange fitting in said recess, said flange being broken away, a fixed stop arranged to engage the walls of said chamber or recess, and means for automatically operating said valve; substantially as set forth.

4. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve provided with a chamber or recess in its face, a fixed stop arranged to engage the walls of said chamber or recess, a steam-chamber, a rotatable steam-valve located in said steam-chamber and having ports therein arranged to admit steam to said chamber or recess on either side of said stop, and means for operating said steam-valve; substantially as set forth.

5. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve provided with a chamber or recess in its face and having an annular flange fitting in said recess, said flange being broken away, a fixed stop arranged to engage the walls of said chamber or recess, a steam-chamber, a steam-valve located therein and provided with ports arranged to admit steam to either side of said stop, and means for automatically operating said steam-valve; substantially as set forth.

6. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve provided with a chamber or recess in its face, a steam-chamber, a fixed stop secured to the wall of said steam-chamber adjacent said shut-off valve, ports being formed in said wall on each side of said stop, and a steam-valve located in said steam-chamber and having ports designed to register with said former ports; substantially as described.

7. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve provided with a chamber or recess, a fixed stop therefor, a steam-valve arranged to admit steam to either side of said stop and provided with an exhaust-groove, and means for operating the said steam-valve; substantially as set forth.

8. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve provided with a chamber or recess, a fixed stop therefor, a steam-valve having a main port arranged to

admit steam on one side of said stop and an auxiliary port arranged to admit steam to the other side of said stop, an exhaust-groove being arranged adjacent said auxiliary port, and means for automatically operating said steam-valve; substantially as set forth.

9. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve having a chamber formed therein, means for automatically operating the same, a reversing-valve having ports communicating with said chamber and arranged to admit steam to either side of said piston, and means for operating said reversing-valve; substantially as set forth.

10. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve having a chamber or recess, means for automatically operating the same, steam-pipes leading to said chamber or cylinder and arranged to register with said chamber or recess, a rotatable reversing-valve having ports arranged to register with said pipes and said chamber or recess, whereby steam is admitted to either one of said pipes, and exhaust-openings leading from said chamber or cylinder; substantially as set forth.

11. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve having a pinion keyed to its spindle, a toothed quadrant pivotally mounted on said casing, a safety-guard, a rod connecting said quadrant and said guard, a cam on said shaft adapted to engage said guard and means for simultaneously shifting said guard and reversing the engine; substantially as set forth.

12. In a rotary engine, a casing having an annular chamber or cylinder, a shaft mounted in said casing, a disk carried thereby, a piston-head secured to the periphery of said disk, a rotary shut-off valve having a pinion keyed to its spindle, a toothed quadrant meshing therewith, a cushioning-cylinder secured to said casing, a piston working therein, and connected to said quadrant, a safety-guard, a pitman connecting said guard and said quadrant, means for automatically operating said guard, and a lever for simultaneously reversing the engine and shifting said guard; substantially as described.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

CARL LORENZ.

Witnesses:
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