

(No Model.)

2 Sheets—Sheet 1.

E. W. ELLSWORTH.
ROTARY STEAM ENGINE.

No. 258,732.

Patented May 30, 1882.

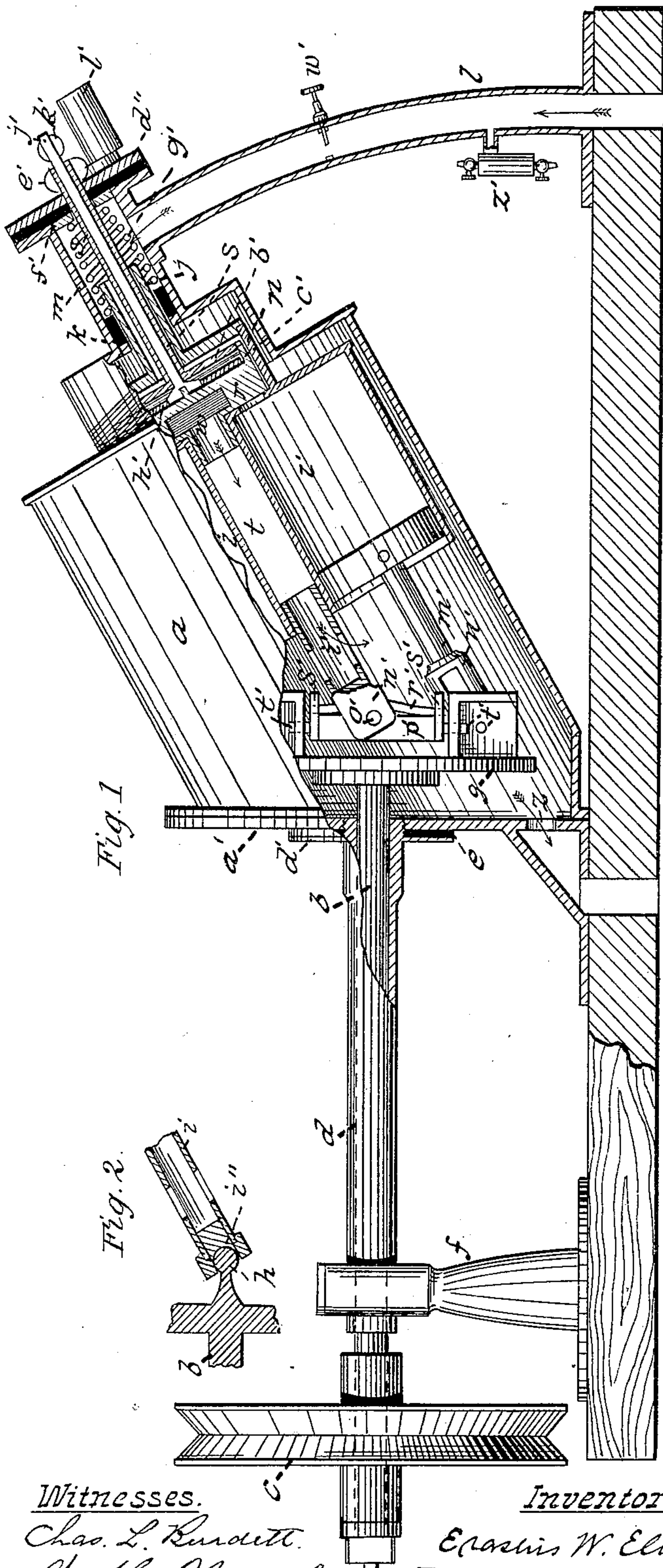


Fig. 1

Fig. 2

Fig. 4

Fig. 3

Fig. 7

Fig. 6

Fig. 5

Fig. 8

Fig. 9

Witnesses.

Chas. L. Burdett.

W. H. Marsh

Inventor.

Erasmus W. Ellsworth

By W. E. Simonds, Atty.

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2 Sheets—Sheet 2.

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Fig. 10.

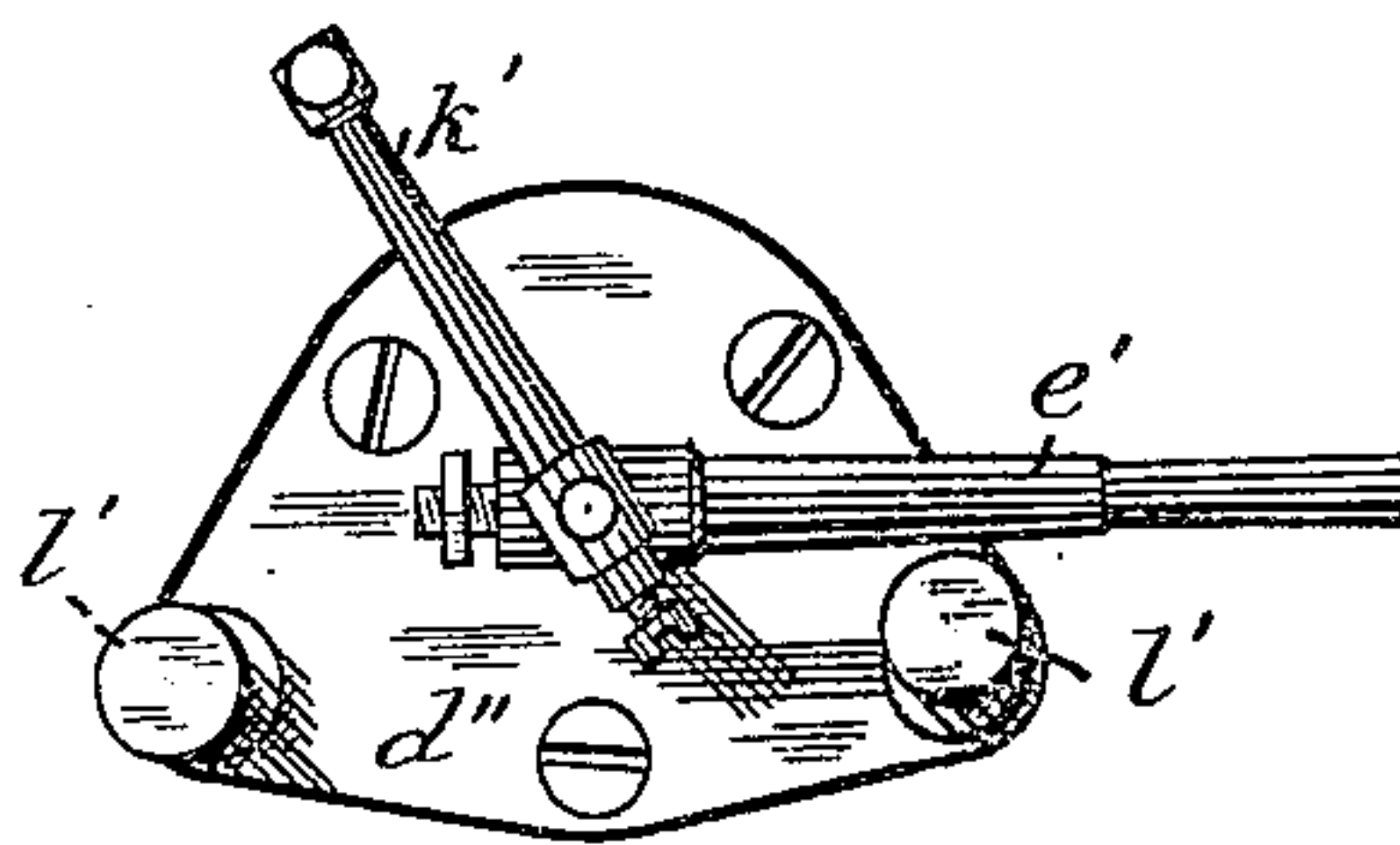
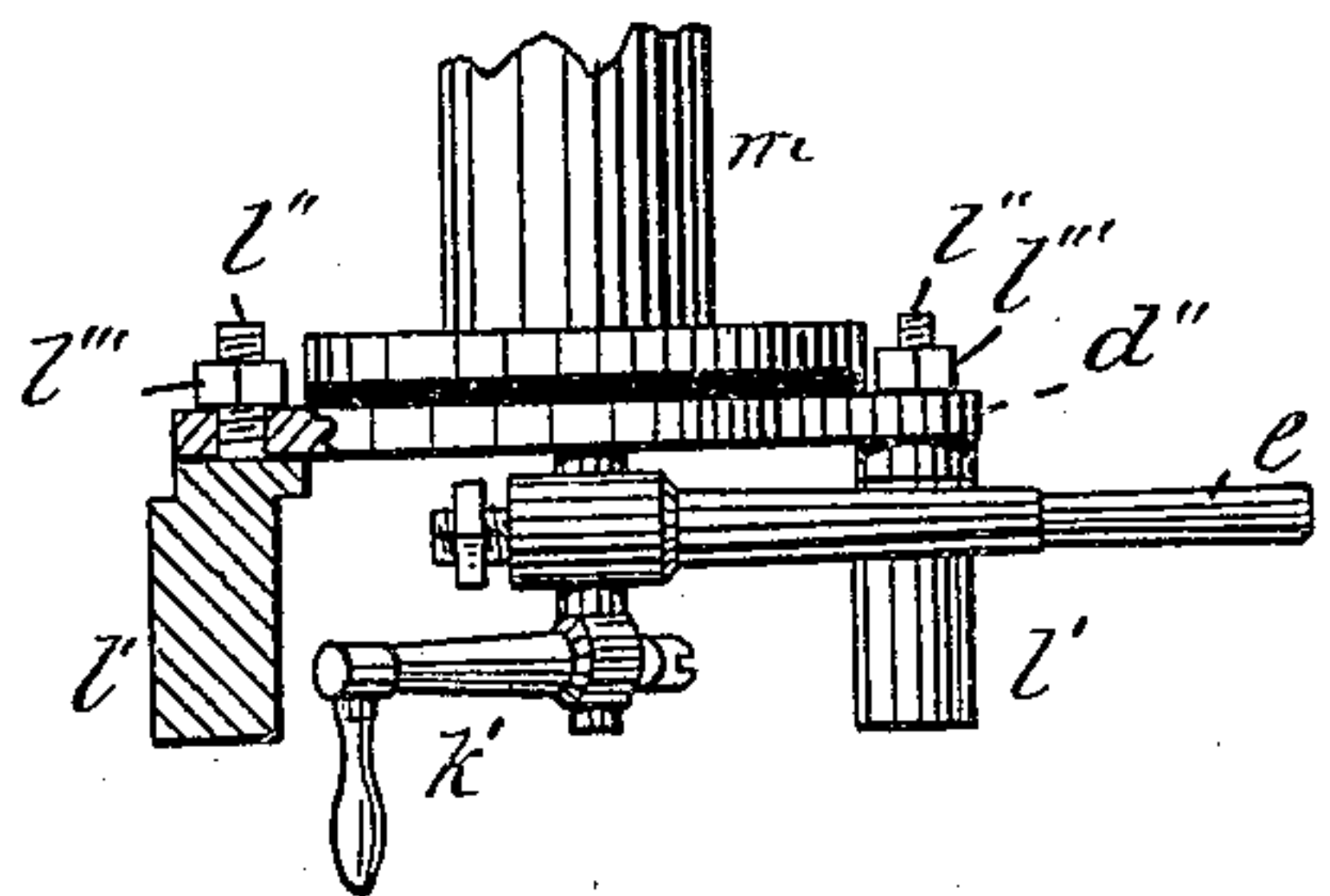


Fig. 11.



Witnesses.

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UNITED STATES PATENT OFFICE.

ERASTUS W. ELLSWORTH, OF EAST WINDSOR HILL, CONNECTICUT.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 258,732, dated May 30, 1882.

Application filed December 2, 1881. (No model.)

To all whom it may concern:

Be it known that I, ERASTUS W. ELLSWORTH, of East Windsor Hill, in the county of Hartford and State of Connecticut, have invented a certain new and useful Improvement in Rotary Steam-Engines, of which the following is a description, reference being had to the accompanying drawings, where—

Figure 1 is a side view of my improved engine, with a part shown in section to show construction, and with the course of steam therein denoted by arrows. Fig. 2 is a detail view, in section, of the ball-and-socket joint at the inner end of the main shaft. Fig. 3 is a face view of the disk, showing the arrangement of the pistons (one of the pistons is shown) and rods about the center. Fig. 4 is a face view of upper end of the cylinders and the steam-chest, the ports opening into the cylinders shown by dotted lines. Fig. 5 is a face (upper) view of the valve, showing the live-steam ports and the cut-off plate. Fig. 6 is a rear (under) view of the valve, showing the live-steam and the exhaust ports. Fig. 7 is a side view of the valve. Fig. 8 is an end view of the valve-rod with appurtenant arms and the cut-off rod. Fig. 9 is a side view of the valve-rod and the cut-off rod and the attached handles by which they are operated. Fig. 10 is a face view of the part showing the relative arrangement of the valve-rod handles and adjustable eccentric stop-pins. Fig. 11 is a top view of same, showing one of the adjustable eccentric stop-pins in section.

The letter *a* denotes a casing, which contains substantially all the operating parts.

b denotes the main shaft coming out of one end of the casing.

c denotes a driving-pulley on the main shaft.

The casing is set oblique to the main shaft, which passes through one head, *a'*, thereof. This shaft is incased for some distance in the sleeve *d*, which screws into the head *a'*, and is provided with a collar, *d'*, which compresses between it and the head *a'* the packing-disk *e*. The other end of this sleeve is supported by the standard *f*.

Inside the casing *a* there is fixed to the main shaft the disk *g*, to which the various piston-rods are pivotally attached. This disk bears centrally the ball *h*. A tubular shaft, *i'*, pro-

jecting from the cylinders *i*, has a corresponding ball-socket, *i''*, and by means of this ball-and-socket joint the disk *g* supports one end of the cylinders, the other end being supported by the hollow trunnion *j*, which projects from the steam-chest and rests in the bearing *k*. The cylinders *i* (four in number) are all fast together, and are set in the same oblique position as the casing *a*, their oblique position being the cause and occasion of the oblique position of the casing. These cylinders revolve about a common center, while the pistons reciprocate longitudinally in them and give rotary motion to the main shaft.

The live steam enters the engine through the pipe *l*, which is also a standard and support for the elevated end of the casing, the lower end being supported by the head *a'*. Passing through the pipe *l*, the steam enters the chamber *m*, appurtenant to the upper end of the casing, and thence through the hollow trunnion *j* enters the steam-chest *n* appurtenant to the cylinders.

What may be called the "floor" of the steam-chest is the rotary valve-seat *o*, perforated by four ports, *p*, one for each cylinder, opening directly into the cylinders.

The letter *r* denotes the valve, stationary except in reversing the rotary motion of the engine, lying flat on the valve-seat and held thereto by the pressure of the live steam, its attachment to its operating-rod *s* being such as not to interfere with this action of the steam. The valve *r* has on one side of the center a port, or preferably a series of ports, *u*, perforating the valve transversely thereof, and as the cylinder-ports *p* come in rotation to coincide with the ports *u* the steam passes into the cylinders, and, pushing the pistons downward, causes the disk *g* and main shaft to rotate. Each cylinder discharges its steam on its upward rotary movement through its port *p* into the port *w* in the valve, which carries it to the center of the valve, whence it passes into the duct *t* lying centrally of the cylinders, whence it passes into the open space in the casing *a*, and exhausts through the port *z*. When the valve-ports *u* are on one side of the center of the valve the cylinders revolve in one direction—that is, from above toward that side—and when the ports *u* are on the opposite side of the valve-

center the cylinders revolve in the opposite direction. From this it will be understood that the rotary motion of the engine is reversed by rotating the valve substantially a half-turn, which is effected by means as follows: The valve-rod *s* has a rotary motion only. It is a tubular rod, having on the lower end a radial arm or arms, *b'*, mortised to engage with the pins *c'* on the back of the valve, passing longitudinally through the hollow trunnion *j* to the outer air, where it is adjustably provided with the radial operating-arm *e'*, whereby it and the valve may be rotated.

The head *d''* is provided on the inner side with a stuffing-box, *f'*, for the valve-rod. In the lower end of the chamber *m* is a stuffing-box for the hollow trunnion *j*, and the one spring, *g'*, serves to press the packing of both these boxes to its seat.

The valve has a cut-off as follows:

The letter *h'* denotes the cut-off plate lying and having suitable rotary movement on the back of the valve. This cut-off plate may be set circumferentially to cut the steam off from the valve-ports *u* (including the entire cutting off thereof) at any desired point. This cut-off plate is reversed when the valve is reversed if its cutting-off services are needed. This cut-off plate has a square mortise at its center of motion, fitting upon the square end of the round rod *w''*, which passes through the tubular valve-rod to the outer air, where it is adjustably provided with the radial arm *k'*, by which to operate the cut-off plate.

The letters *l'* denote two rotary adjustable eccentric stop-pins for adjustably defining and limiting the rotary play of the radial arms which operate the valve and the cut-off. The eccentric stop-pins *l'* are secured to plate *d''*, and in any desired position by rotation, by means of the screws *l''* (appurtenant to the pins) and the nuts *l'''*, as seen in Fig. 11.

I remark at this point that the live-steam ports *u* of the valve are so cut and so located with reference to the cylinder-ports *p* as to admit steam to bear on the pistons just before the beginning of the outward or downward stroke, and to maintain such pressure till just after the completion of such stroke—this as a precaution against jarring in the universal joints between the piston-rods and the disk *g*. The usual rings and springs are not shown in the pistons as delineated in the drawings, as they are matters of common knowledge; but their use is contemplated.

The piston-rods *m'* are pivoted to the pistons. They have a forked end, *n'*, adjustably screwed thereon, carrying a journal-pin, *o'*, taking a bearing on the sleeve *p'*, and always held in contact with such bearing by the spring *r'*, which is pivotally attached by yokes *s'* to the arbor *t'*, which carries on it the sleeve *p'*, and is hung on (parts projecting from) the disk *g*—an arrangement which prevents jarring at this joint. The shaft *t'* is exteriorly threaded, (or circularly ridged,) and the sleeve *p'* is corre-

spondingly threaded (or ridged) on the interior—this to prevent undue endwise movement of the sleeve on the arbor.

The letter *w'* denotes a gate which controls the inlet of live steam to the engine, and *z'* denotes an oiler located on the inlet-pipe, which being filled, the oil passes into the engine, lubricates all the operating parts, and passes out at the exhaust-port with the steam and drip.

The operating parts, being contained in the casing *a*, need no exterior finish, and the casing is as well painted as otherwise finished.

I claim as my invention—

1. In a rotary engine, the combination of an eccentric adjustable stop-pin, *l'*, with the rotary arm *k'*, communicating through suitable intermediate mechanism with the rotary cut-off plate, substantially as described.

2. In a rotary engine, the combination of an eccentric adjustable stop-pin, *l'*, with the rotary arm *e'*, communicating through suitable mechanism with the rotary valve, substantially as described.

3. In a rotary engine, the combination of the eccentric adjustable stop-pins *l' l'* with the rotary arms *k'* and *e'*, communicating respectively, through suitable intermediate mechanism, with the rotary valve, substantially as described.

4. In a rotary steam-engine, the combination of the group of cylinders revolving about an axis parallel with the axis of each cylinder, the rotary and plane-surfaced valve-seat on the end of the cylinders, the flat-surfaced valve, and the rotary cut-off, all substantially as described.

5. In a rotary engine, the combination of the laterally-revolving cylinders, the rotary valve-seat upon the end thereof, the valve and its tubular rod, and the rotary cut-off with its rod passing through said tubular rod, all substantially as described.

6. In a rotary engine, the combination of the tubular steam-chest trunnion, the tubular valve-stem, the stuffing-boxes *m d'*, and the spring *g'*, pressing the stuffing of both, all substantially as described.

7. In a rotary steam-engine, the combination of the group of cylinders revolving about an axis parallel with the axis of each cylinder, the rotary and plane-surfaced valve-seat on the end of the cylinders, the plane-surfaced valve, and the semicircular and rotary cut-off plate having an independent movement on the back of the valve, all substantially as described.

8. In a rotary steam-engine, the combination of a group of cylinders revolving about an axis parallel with the axis of each cylinder, the central duct formed by the juxtaposition of the cylinders and running from end to end of the cylinders, the cylinder-ports, and the valve taking the exhaust-steam from the cylinders and delivering it into said central duct, all substantially as described.

9. In a rotary steam-engine, the combination of a group of cylinders revolving about an axis parallel with the axis of each cylinder, the rotary steam-chest on the end of the cylinders, and the tubular trunnion affording entrance to the live steam, all substantially as described.

10. In a rotary steam-engine, the combination of the pistons, the group of cylinders revolving about an axis parallel with the axis of each cylinder, the steam-ports of the cylinders, the plane-surfaced and rotary valve-seat upon the end of the cylinders, and the plane-surfaced valve having ports so cut and arranged relatively to the cylinder-ports as to put steam-pressure on the pistons just before

beginning their outward stroke and to maintain the pressure till just after the completion of such stroke, (to prevent jarring,) all substantially as described.

11. In a rotary engine, the combination of the piston-rods, disk *g*, arbors *t'*, sleeves *p'*, journal-pins *o'*, springs *r'*, and yokes *s'*, substantially as described.

12. In a rotary engine, the combination of a piston-rod, a disk, *g*, arbor *t'*, exteriorly threaded, and sleeve *p'*, interiorly threaded, substantially as described.

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Witnesses:

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