2 Sheets--Sheet 1.

E. SCHLENKER.

Steam-Engines.

No. 154,089. Patented Aug. 11, 1874.

Figure 1.

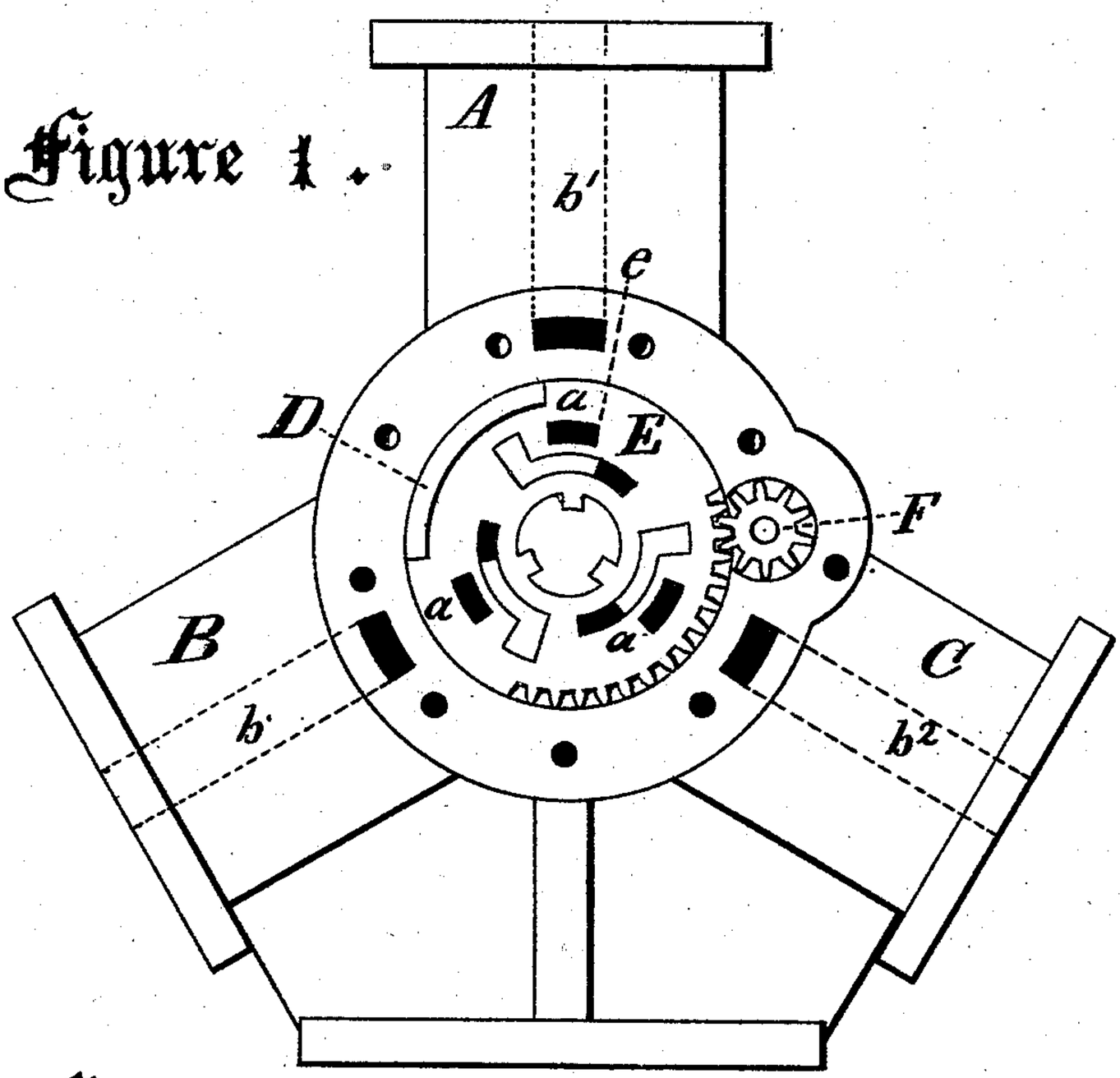


Figure 2.

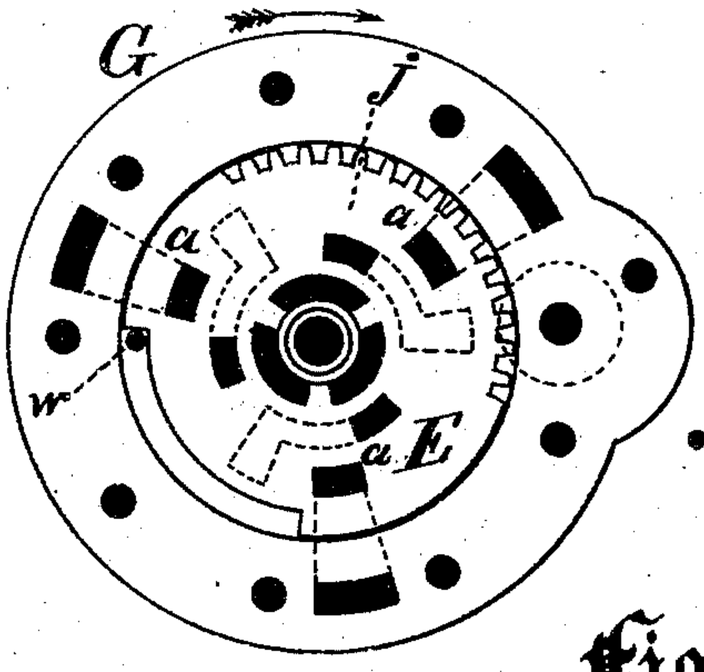


Figure 3.

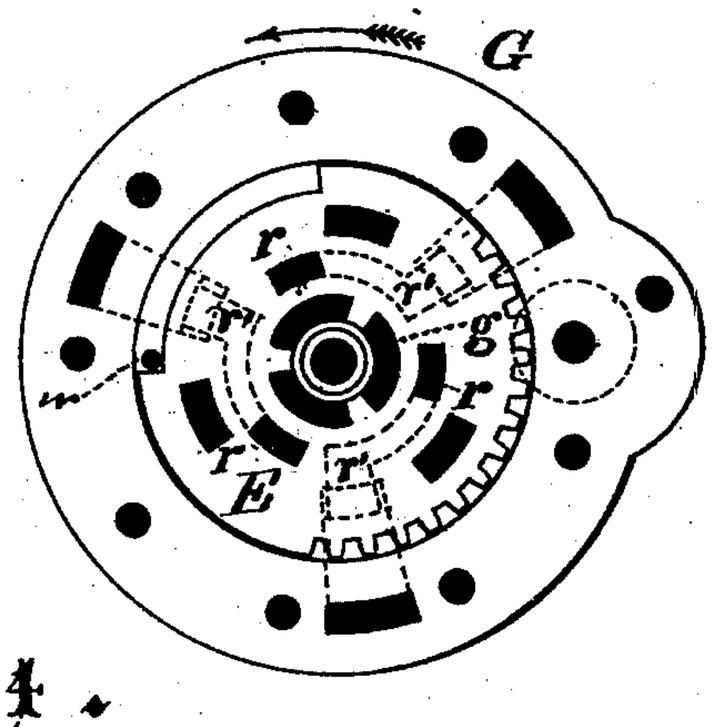
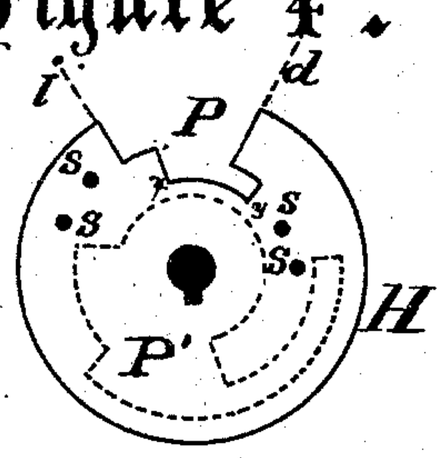


Figure 4.



Witnesses,
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D. D. Burtis.

Inventor,
Erhard Schlenker.

2 Sheets--Sheet 2.

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Steam-Engines.

No. 154,089. Patented Aug. 11, 1874.

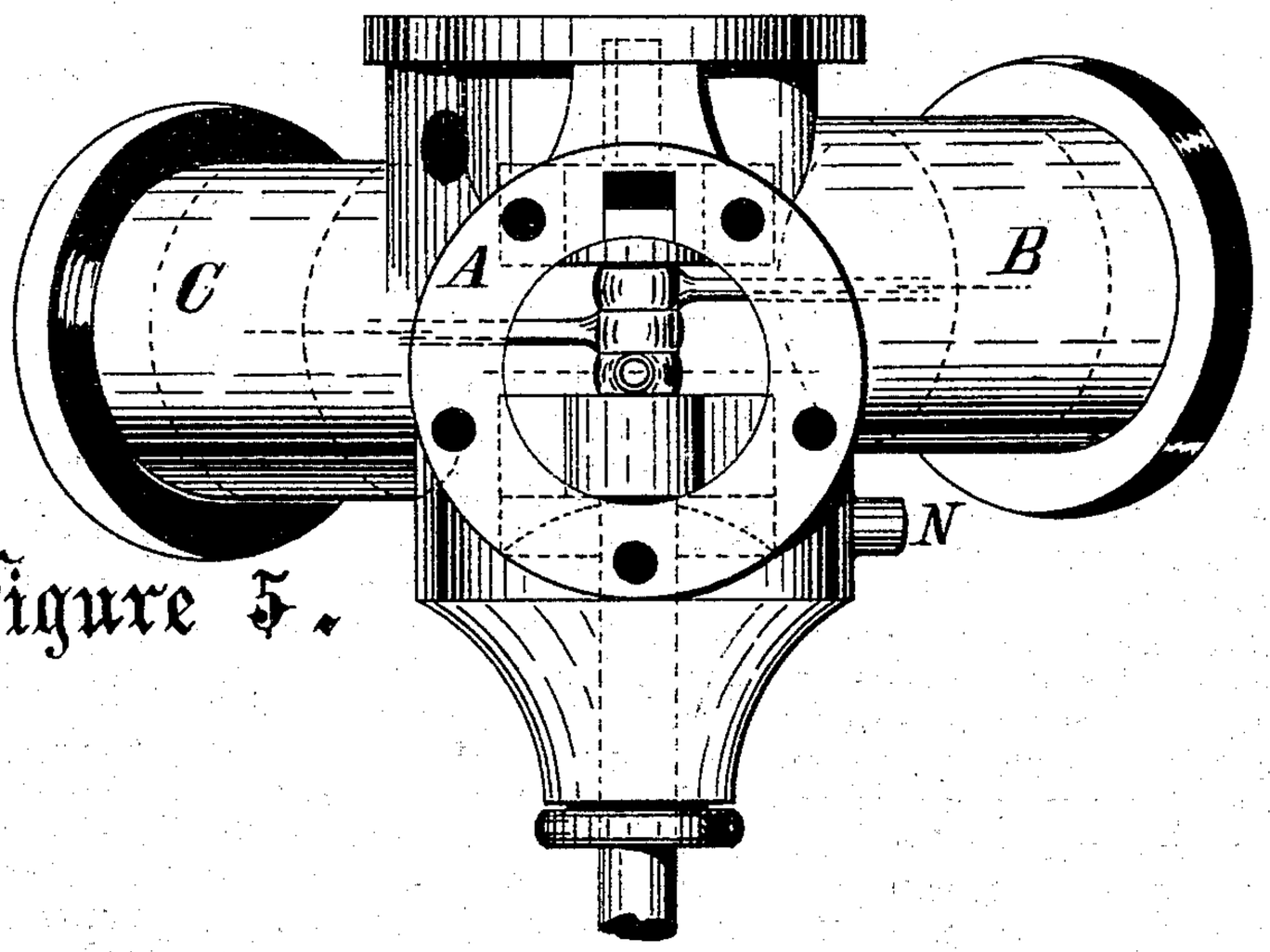

Figure 5.

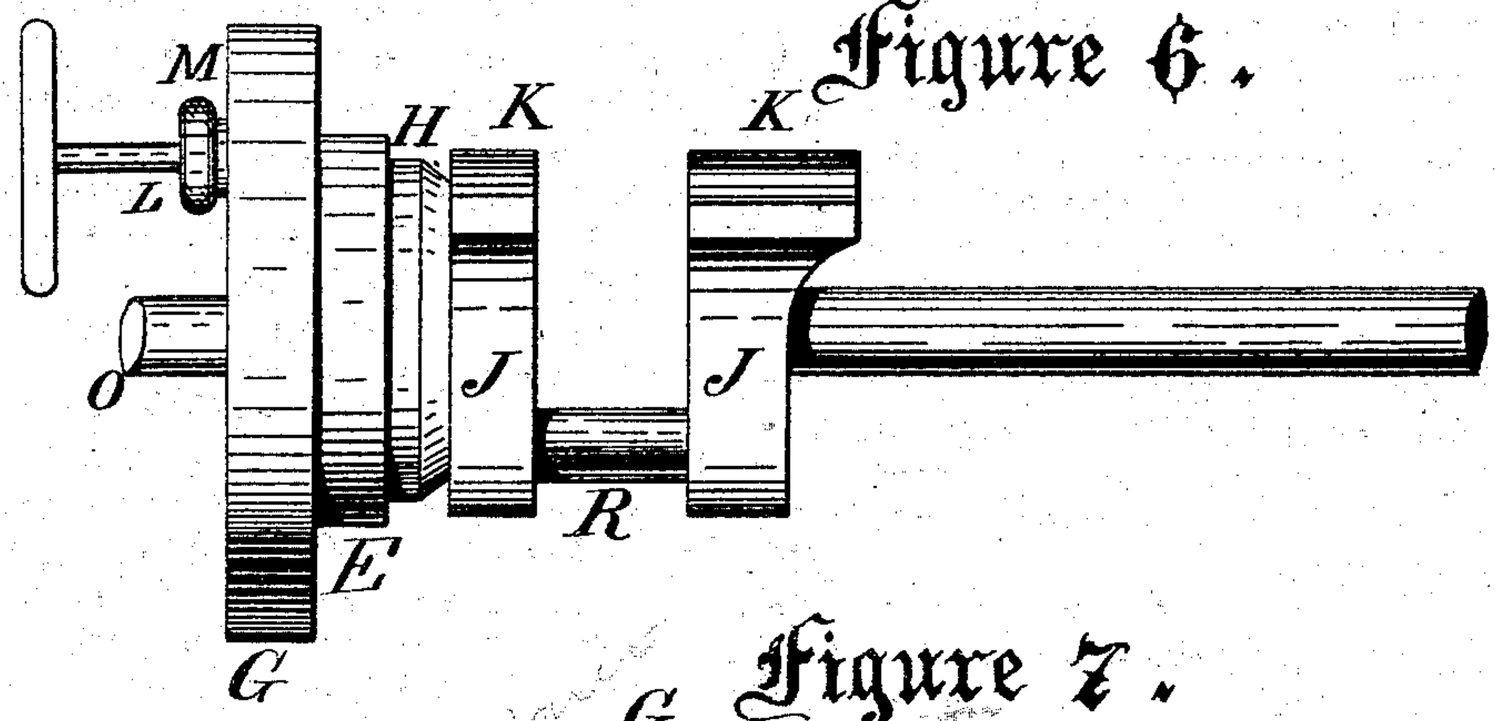

Figure 6.

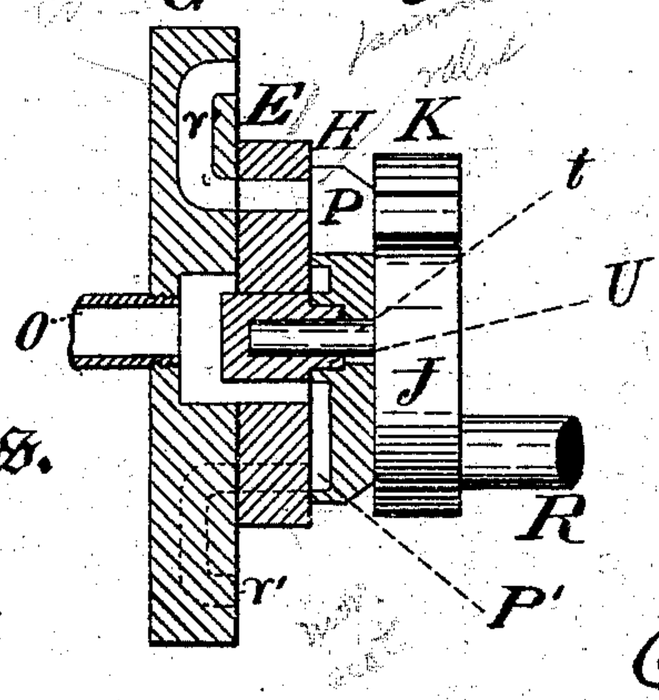

Figure 7.

Witnesses.

A. W. Soper

P. P. Curtis.

Inventor.

Erhard Schlenker

UNITED STATES PATENT OFFICE.

ERHARD SCHLENKER, OF BUFFALO, NEW YORK, ASSIGNOR OF ONE-HALF HIS RIGHT TO RUFUS L. HOWARD AND GIBSON F. HOWARD, OF SAME PLACE.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **154,089**, dated August 11, 1874; application filed April 22, 1874.

To all whom it may concern:

Be it known that I, ERHARD SCHLENKER, of Buffalo, in the county of Erie and State of New York, have invented certain Improvements in Steam-Engines, of which the following is a specification:

The first part of my invention relates to the construction and combined operation of a movable valve-seat, revolving valve, and steam-chest cover, all having ports so arranged that the engine may be controlled, started, reversed, stopped, and securely held in a stationary position by the adjustment of the movable valve-seat, all as hereinafter more fully set forth. The second part of my invention relates to the location of the cylinders on the central steam-chest so that the centers of each cylinder shall be placed a short distance, the one back of the center of the other, for the purposes hereinafter more particularly described. The third part of my invention relates to the shaft and the arrangement of its counter-balances and bearings with relation to the steam-chest cover and other parts of the engine, as hereinafter set forth. Lastly, the invention relates to a new and improved combination of devices, all co-operating in manner hereinafter specified.

Figure 1 is a front elevation, showing the cylinders and the movable valve-seat, and pinion by which it is operated. Fig. 2 is an internal view of the steam-chest cover, showing the movable valve-seat as arranged so as to move the engine in the direction shown by the arrow. Fig. 3 represents the same, showing the movable valve-seat arranged so as to move the engine in a direction opposite to the last, as shown by the arrow. Fig. 4 represents the revolving valve. Fig. 5 is a top view of the engine, with one of the covers of one of the cylinders removed, so as to show the connections, and also the arrangement of the cylinders on the steam-chest. Fig. 6 is a view of the crank, revolving valve, movable valve-seat, and the steam-chest cover; and Fig. 7 represents a section through the steam-chest cover, movable valve-seat, rotating valve, and a fragment or part of the crank-shaft, the steam-chest, and exhaust-pipe.

The engine consists of three cylinders, A, B, and C, cast in one casting, having open ends connected with a steam-chest, D. The outer ends are closed by a cast cover. The center of each cylinder is arranged on the steam-chest, so that the center of each will be within the center of its connecting-rod, as shown in Fig. 5. The cylinder B, being arranged near the front face of the steam-chest, so that the connecting-rod will be in line with cylinder C, is set far enough on one side to allow its connecting-rod to be placed in the center of the same, and cylinder A is set far enough to one side of cylinder C so that its connecting-rod will be placed in its center; or the position of the cylinders may be reversed, the arrangement being such that the three connections may be placed or connected, one along the side of the other, on the crank-pin without the necessity of being bent, offset, or forked. The movable valve-seat E is operated and controlled by the pinion F, as shown in Fig. 1, a section of the outer periphery of the valve-seat being formed with teeth or cogs for that purpose. It is also provided with ports *r* and *a* for the passage of the steam. Letter G represents the cover of the steam-chest, in Figs. 2, 3, 6, and 7; and letter H represents the revolving valve, in Figs. 4, 6, and 7. The steam-chest cover G is provided with ports *r'*, and the valve H with an opening or port, P, and a depression or chamber, P'. Letter *j* in Figs. 6 and 7, represents the crank, and letters K K represent the counter-balance on the crank, for the purpose of balancing the weight of the piston and rod. The piston for each of the cylinders is an ordinary trunk or bucket piston, having the usual piston-packing. Letter L in Fig. 6 represents the shaft, connected in the pinion F in Fig. 1, for operating the movable valve-seat E in starting, stopping, and reversing the engine, and also in controlling the cut-off. Letter M in Fig. 6 represents the stuffing-box for shaft L, and letter N in Fig. 5 represents the inlet for steam into the steam-chest; and O, in Figs. 6 and 7, the outlet for the exhaust. Letter R in Fig. 6 represents the crank-pin. Letter *t* in Fig. 7 represents crank-shaft bear-

ing, working within the sleeve U in the steam-chest cover, for the purpose of supporting that end of the crank, and for operating the revolving valve, to which it is fastened by a key or feather. The movable valve-seat is also kept in place by the sleeve U, upon which it turns; and W in Figs. 2 and 3 represents a pin or stop in steam-chest cover, for the purpose of limiting the movement of the valve-seat.

The operation of the engine, when moving in the direction shown by the arrow in Fig. 3, is as follows: Steam being admitted through the opening P in the revolving valve H, Fig. 4, passes through one of the ports *a* in the movable valve-seat, and through corresponding port *r'* in the steam-chest cover G, (shown by dotted lines,) and from thence, through the port *b'*, in the direction shown by the dotted lines in Fig. 1, to the outer end of the cylinder A, thereby moving the piston. The side of the opening *d* of valve H, Fig. 4, is now at the point *e*, as shown by dotted line in Fig. 1, having uncovered the port and placed the cylinder C under exhaust, the exhaust-steam passing out of the next port *a* in the movable valve-seat E, and through the depression or chamber P' in the under side of revolving valve H, as shown by dotted lines in Fig. 4; and from thence through the opening *g* in the movable valve-seat, Fig. 3, and out of the pipe O in the center of the steam-chest cover, (shown in Figs. 6 and 7,) while the steam is partly cut off in cylinder B.

It will be readily seen that, as the revolving valve H continues its movement, the same operation will be repeated from cylinder to cylinder, causing the engine to move in the direction shown.

By operating the movable valve-seat by means of the pinion F, and its connection with the toothed section of said valve, so that the port *a'* will be in the position shown by the dotted line *j* in Fig. 2, steam will be shut off from the outer ends of the cylinders, and the engine will be stopped without cutting off the pressure of the steam in the steam-chest, and sufficient steam will be shut up within the cylinders to hold the engine rigid and immovable, thereby securing all the advantages of a brake.

In order to reverse the engine, the movable valve-seat is brought into the position shown in Fig. 3; the steam enters one of the ports *r*, in place of port *a*, and, following the opening shown by the dotted lines, it passes, as before, through the port in the steam-chest cover, which connects with the cylinder, placing the cylinder B under exhaust instead of cylinder C, as in the former movement, thereby reversing the action.

The arrangement for cutting off steam at different points of the stroke is effected by the peculiar form of the revolving valve, as shown in Fig. 4. It is arranged so as to cut off steam without interfering with the exhaust; but the point of cut-off may be varied by increasing or decreasing the distance from *i* to *d*, and without interfering with the point of cutting off in the reverse movement; but, if desired, the point of cutting off in the reverse movement may be varied, also, by decreasing the distance between the points *x* and *y*, Fig. 4.

The holes *s s* in revolving valve H, Fig. 4, serve to admit steam sufficient to start the engine slowly, in case the engine should be stopped at any time in a position not to take steam through the opening P, Fig. 4.

Having thus described my invention and its operation, I claim as follows:

1. The movable valve-seat E, having ports *a* and ports *r*, operating in combination with the revolving valve H, having ports P P', and with cover G, having ports *r'*, substantially as and for the purpose specified.

2. The arrangement of two or more steam-cylinders around a central steam-chest, so that the centers of the connections, when placed one alongside of the other on the crank-pin, will be within or near the center of each cylinder, substantially as described.

3. The arrangement of counter-balances K K upon the shaft, and its outer bearing *t* in sleeve attached to steam-chest cover, as and for the purposes and substantially as described.

4. The combination of the steam-chest cover G, movable seat E, and revolving valve H with the pinion F and cylinders A B C, all operating substantially as and for the purpose specified.

ERHARD SCHLENKER.

Witnesses:
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P. P. BURTIS.