

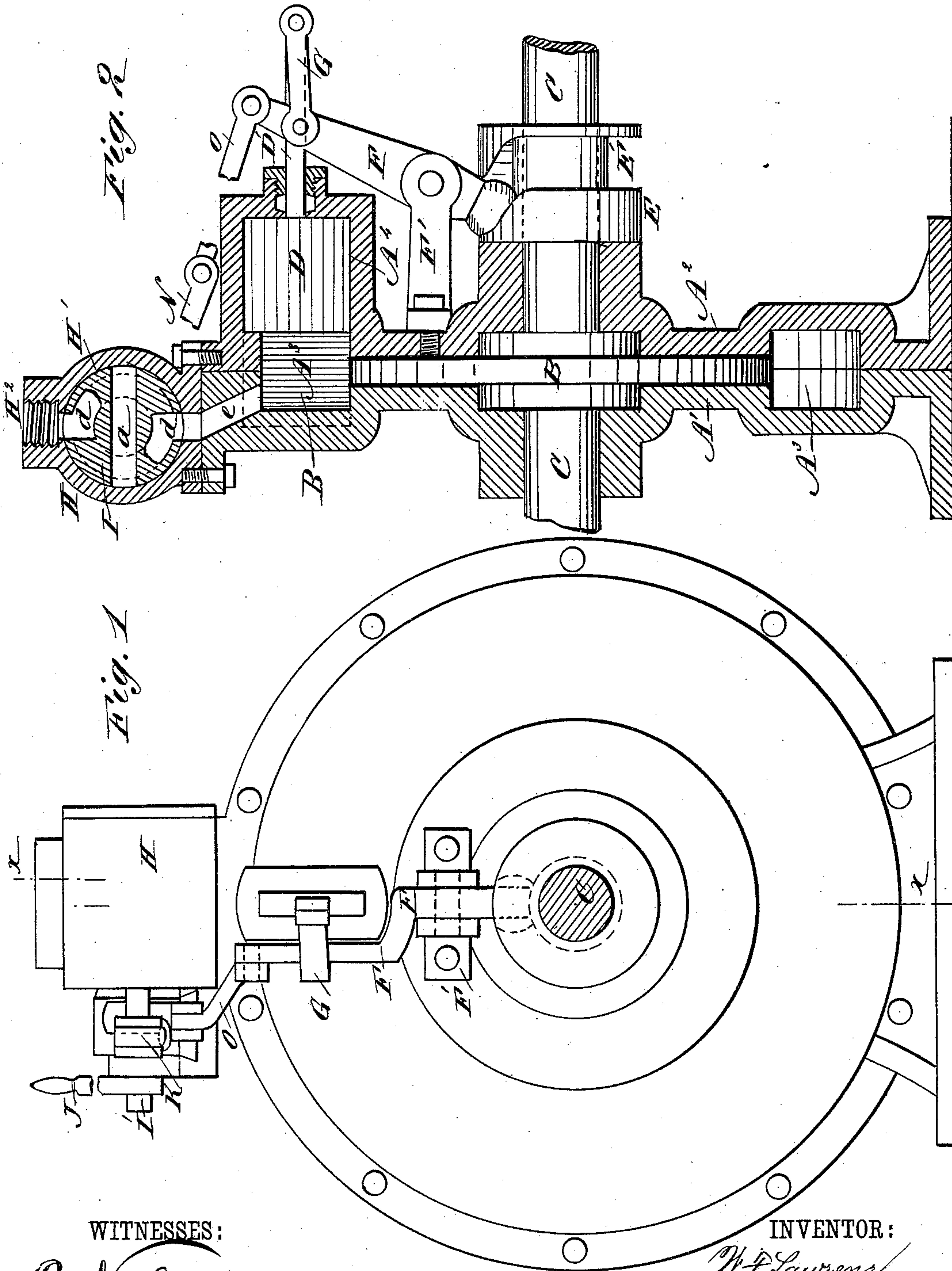
(No Model.)

2 Sheets—Sheet 1.

W. F. LAWRENZ.  
ROTARY STEAM ENGINE.

No. 349,108.

Patented Sept. 14, 1886.



WITNESSES:

*C. Neveu*  
*G. Sedgwick*

INVENTOR:

*W. F. Lawrenz*  
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ATTORNEYS.

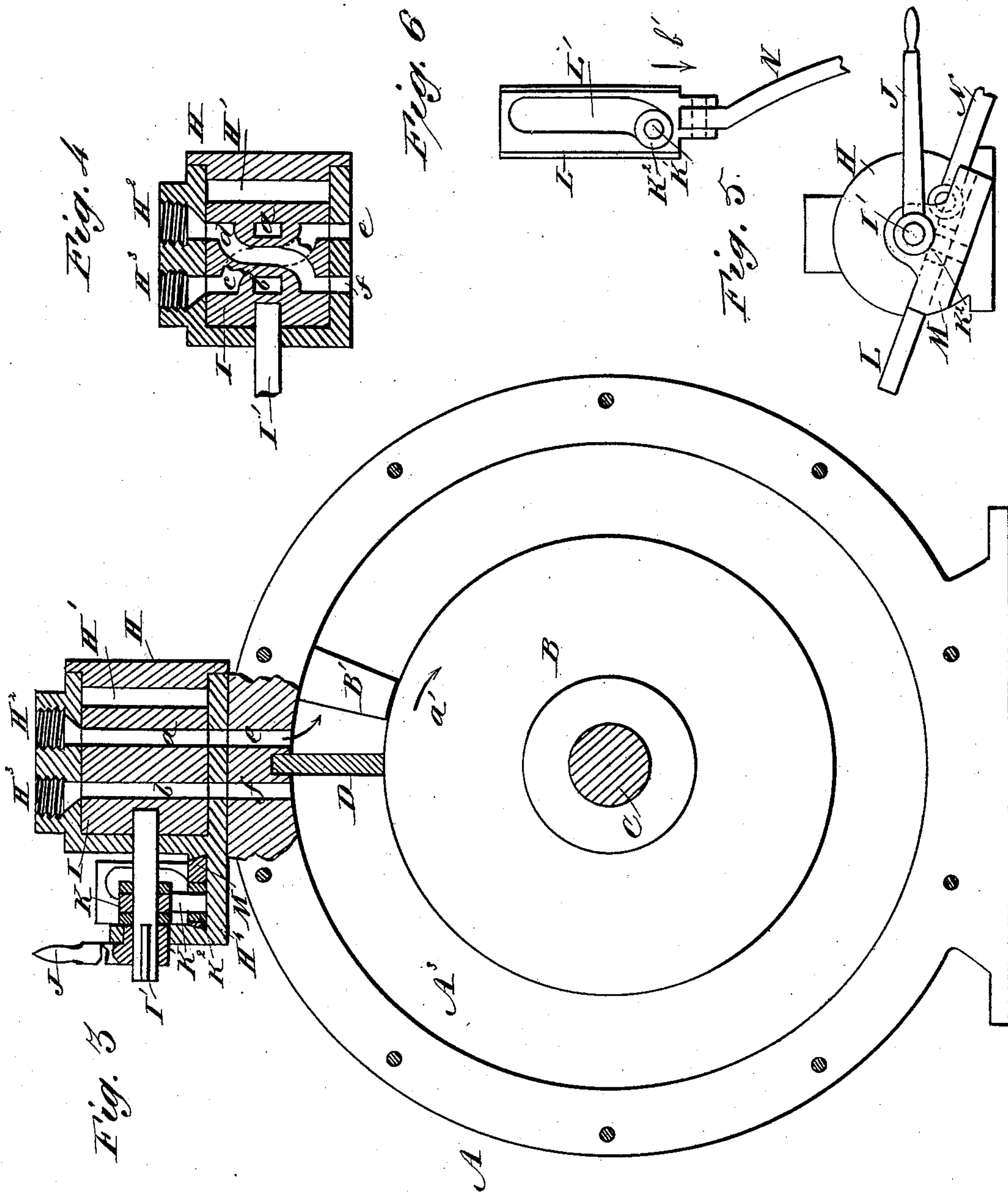
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# UNITED STATES PATENT OFFICE.

WILLIAM F. LAWRENZ, OF DULUTH, MINNESOTA.

## ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 349,108, dated September 14, 1886.

Application filed February 17, 1886. Serial No. 192,216. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM F. LAWRENZ, of the city of Duluth, St. Louis county, and State of Minnesota, have invented a new and Improved Rotary Steam-Engine, of which the following is a full, clear, and exact description.

The object of my invention is to provide a new and improved rotary steam-engine which is simple in construction, direct in its action, and can be reversed at any point of its stroke.

The invention consists of a concentric disk and shaft, of a valve provided with inlet, outlet, and reversing ports, and of devices which operate the valve from the main shaft.

The invention also consists of various parts and details, and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is an end elevation of my improved rotary engine. Fig. 2 is a cross sectional elevation on the line *xx*, Fig. 1. Fig. 3 is a sectional end elevation, with part of the casing removed. Fig. 4 is a sectional view of the valve and the steam-chest. Fig. 5 is an end view of the valve and connections and the steam-chest. Fig. 6 is a plan view of the slide operating the valve.

The casing A of my rotary engine is made in two parts or plates, A' and A<sup>2</sup>, each provided with an annular recess, A<sup>3</sup>. Between the parts A' and A<sup>2</sup> is fitted a disk, B, having a projecting piston, B', moving in the recesses A<sup>3</sup> of the plates A' and A<sup>2</sup>. The disk B is mounted on a shaft, C, which has its bearings in the side plates, A' and A<sup>2</sup>, of the casing A.

The part A<sup>2</sup> of the casing A is provided with a recess, A<sup>4</sup>, which opens into the annular recess A<sup>3</sup>, and in which moves the slide D, operated from the main shaft C by means of the cam E, having a groove, E', in which works the ball-shaped lower end of the lever F, pivoted on an arm, F', attached to the part A<sup>2</sup> of the casing and connected by a link, G, to the slide-rod D'.

To the top of the casing A is secured the steam-chest H, having a cylindrical valve-seat, H', in which is placed the cylindrical valve I,

provided with the straight inlet-port *a*, the outlet *b*, and at right angles to the same the ports *c* and *d*, which cross each other. The valve-seat H' connects with the annular recess A<sup>3</sup> in the casing A by means of the ports *e* and *f*, each placed at one side of the recess A<sup>4</sup>, in which the slide D operates. The valve-seat H' is provided on top with a steam-inlet, H<sup>2</sup>, and a steam-exhaust, H<sup>3</sup>.

To the valve I is attached the valve-rod I', which extends to the outside of the steam-chest H, and is provided on its extreme outer end with a handle, J, by means of which the valve I can be turned in its valve-seat H'. To the valve-rod I' is also fastened a collar, K, having a downwardly-projecting lug or pin, K', to which is attached a friction-roller, K<sup>2</sup>, placed in the groove L' of the slide L, which slides in the transverse guide M, formed on the extension H<sup>4</sup> on one side of the steam-chest H. The slide L is connected by the links N and O to the upper end of the lever F.

The operation is as follows: When the rotary engine is to be started, the several parts are in the position shown in Fig. 3, and the steam entering the inlet H<sup>2</sup> passes through the port *a* in the valve I to the port *e*, and into the annular recess A<sup>3</sup>, where it exerts a pressure against the piston B' in the direction of the arrow *a'*, as the slide D prevents the steam from passing around the annular recess A<sup>3</sup> in the inverse direction of the arrow *a'*. The piston B' consequently rotates in the annular recess A<sup>3</sup>, and carries with it the disk B and the shaft C. Before the piston reaches the port *f* the slide D is withdrawn from the annular recess A<sup>3</sup> into the recess A<sup>4</sup>, by the action of the lever F and the groove E' in the cam E, attached to the shaft C, and at the same time the valve I slides to the right in the valve-seat H', thereby disconnecting the respective ports *a* and *b* in the valve I from the ports *e* and *f*, leading to the annular recess A<sup>3</sup> by means of the lever F pulling the slide L in the direction of the arrow *b'*, (see Fig. 6,) whereby the friction-roller travels to the left and carries with it the valve-rod I', and consequently the valve I. As soon as the piston B has passed the ports *f* and *e*, the slide D is again moved into the annular recess A<sup>3</sup>, and the slide L and the valve I are drawn back to the positions shown in Fig. 3 by means of the lever F, so



as to connect the parts *a* and *b* of the valve I with the ports *e* and *f*, leading to the annular recess *A*<sup>3</sup> again. The steam exhausts in the forward movement of the piston *B'* by the ports *f* and *b* to the exhaust *H*<sup>3</sup>.

The engine can be reversed at any point of its stroke by giving a quarter-turn to the handle-lever *J*, so that the crossed ports *c* and *d* are connected with the ports *e* and *f*, leading to the annular recess *A*<sup>3</sup>, and with the outlet and inlet openings *H*<sup>3</sup> and *H*<sup>2</sup> in the steam-chest *H*. The operation is the same, only in the inverse order, as described above.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In a rotary steam-engine, the casing *A*, having the annular recess *A*<sup>3</sup>, the recess *A*<sup>4</sup>, the ports *e* and *f*, and the valve *I*, having the ports *a* and *b*, in combination with the disk *B*, provided with the piston *B'*, the shaft *C*, and the slide *D*, substantially as herein shown and described.

2. In a rotary steam-engine, the casing *A*, having the annular recess *A*<sup>3</sup>, the recess *A*<sup>4</sup>, and the ports *e* and *f*, the disk *B*, provided with the piston *B'*, the shaft *C*, and the slide *D*, in combination with the steam-chest *H*, having the valve-seat *H'*, and the valve *I*, having the ports *a*, *b*, *c*, and *d*, substantially as herein shown and described.

3. In a rotary steam-engine, the casing *A*, the disk *B*, provided with the piston *B'*, the

shaft *C*, the slide *D*, the slide-rod *D'*, and the valve *I*, in combination with the cam *E*, having a groove, *E'*, the lever *F*, the links *G*, *O*, and *N*, the slide *L*, having a groove, *L'*, the friction-roller *K*<sup>2</sup>, and the collar *K*, attached to the valve-rod *I'*, substantially as herein shown and described.

4. In a rotary steam-engine, the casing *A*, having the ports *e* and *f*, the steam-chest *H*, having the valve-seat *H'*, and the ports *H*<sup>2</sup> and *H*<sup>3</sup>, and the valve *I*, having the straight ports *a* and *b* and the crossed ports *c* and *d*, in combination with the valve-rod *I'*, the collar *K*, the slide *L*, having a recess, *L'*, the friction-roller *K*<sup>2</sup>, and the lever *J*, substantially as herein shown and described.

5. In a rotary steam-engine, the casing *A*, the disk *B*, provided with the piston *B'*, the shaft *C*, the slide *D*, the slide-rod *D'*, the link *G*, and the steam-chest *H*, having a valve-seat, *H'*, in combination with the valve *I*, having the straight ports *a* and *b* and the crossed ports *c* and *d*, the valve-rod *I'*, the lever *J*, the collar *K*, the friction-roller *K*<sup>2</sup>, the slide *L*, having a groove, *L'*, and operated by means of the links *N* and *O* from the lever *F*, actuated by the cam *E*, having a groove, *E'*, substantially as herein shown and described.

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Witnesses:

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EMIL HARTMANN.