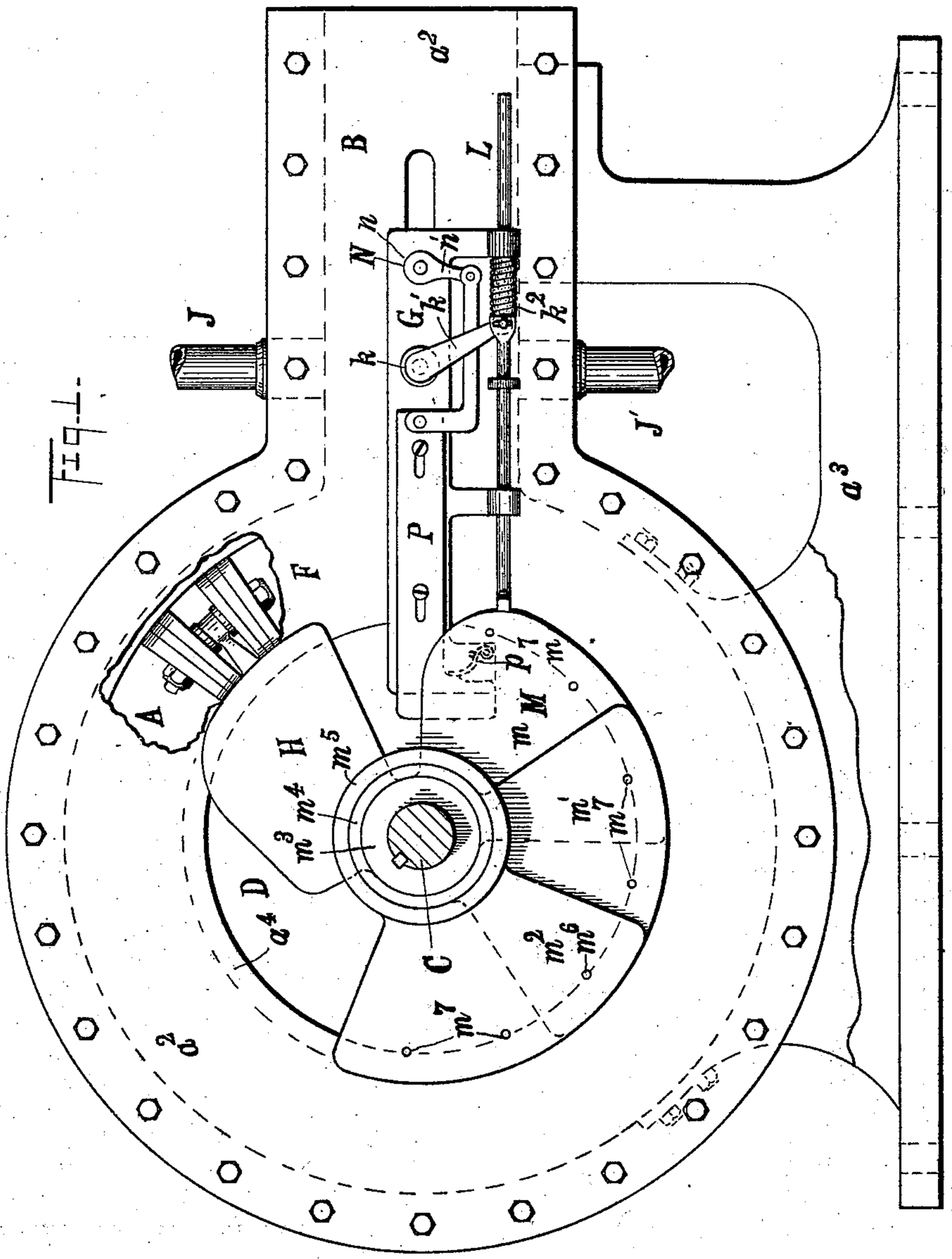
(No Model.) 3 Sheets—Sheet 1.

F. D. SWEET.

ROTARY ENGINE.

No. 531,481. Patented Dec. 25, 1894.



WITNESSES.

Belle S. Lowrie.

H. Griswold.

INVENTOR.

Frederick D. Sweet

By Wing & Thurston

his attys.

(No Model.) 3 Sheets—Sheet 2.

F. D. SWEET.

ROTARY ENGINE.

No. 531,481. Patented Dec. 25, 1894.

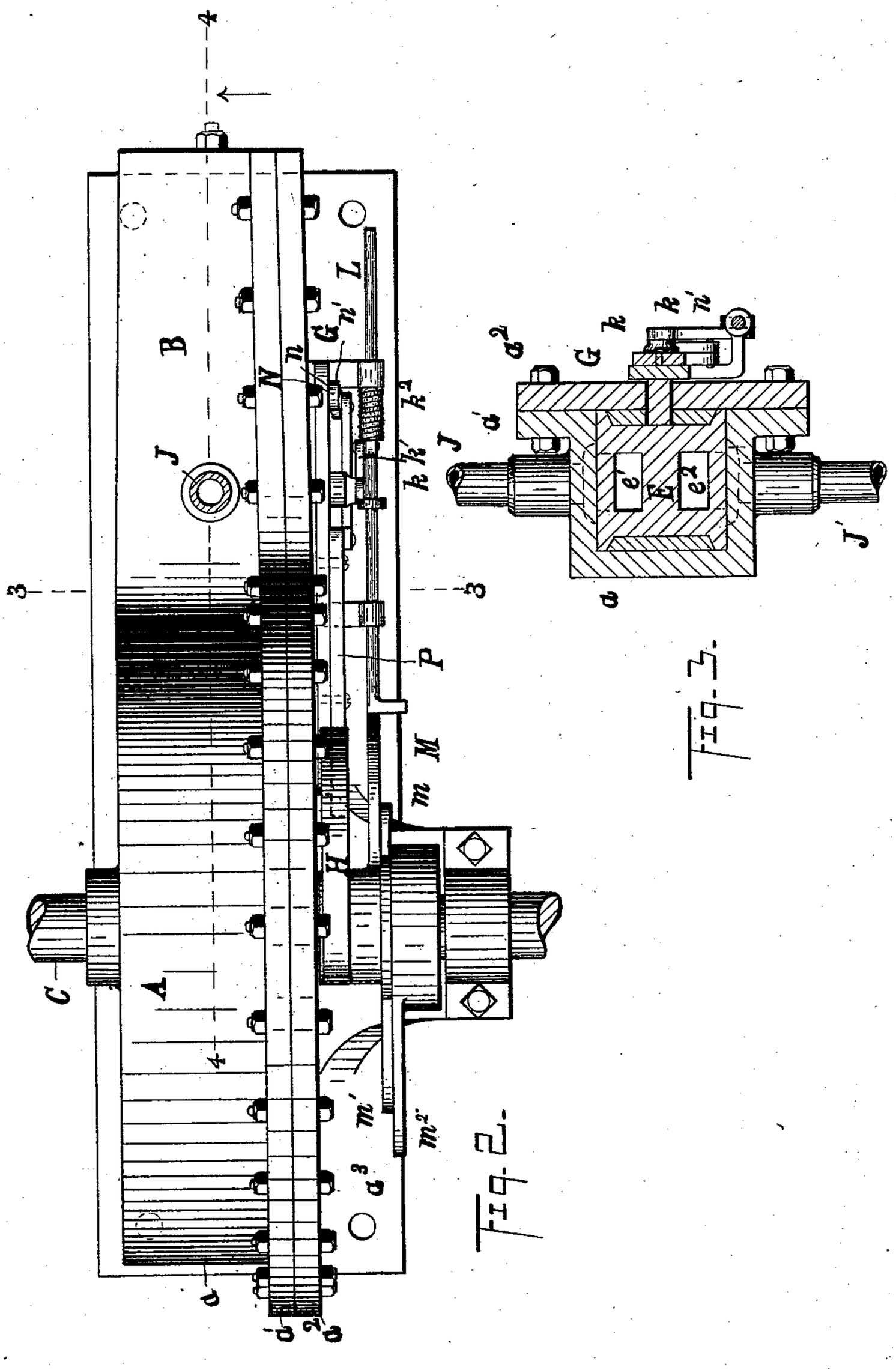


FIG. 2.

FIG. 3.

WITNESSES.

Belle S. Lowrie.

F. St. Griswold.

INVENTOR.

Frederick D. Sweet

By Wing & Thurston

his attys

(No Model.) 3 Sheets—Sheet 3.

F. D. SWEET.

ROTARY ENGINE.

No. 531,481. Patented Dec. 25, 1894.

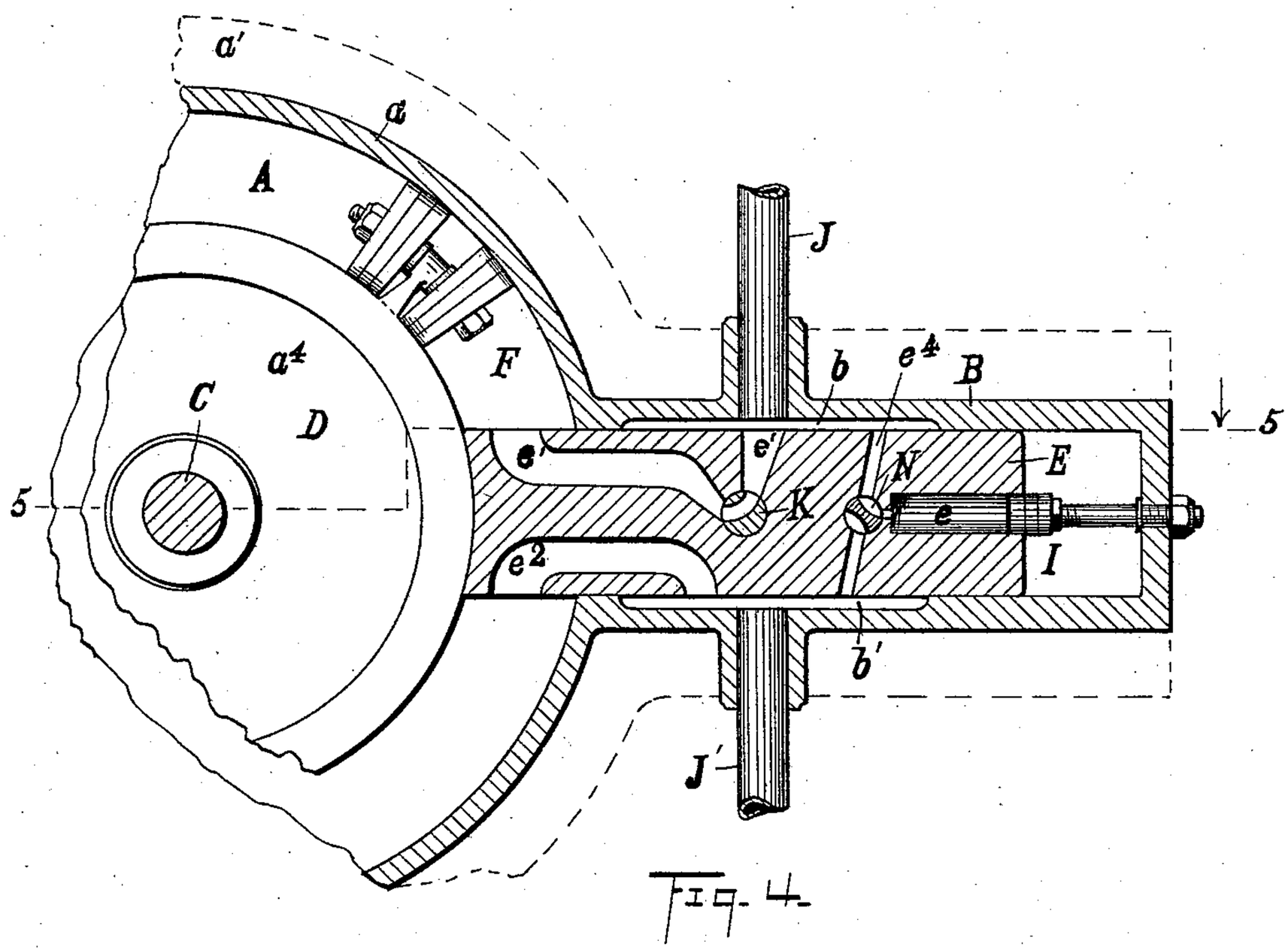


FIG. 4.

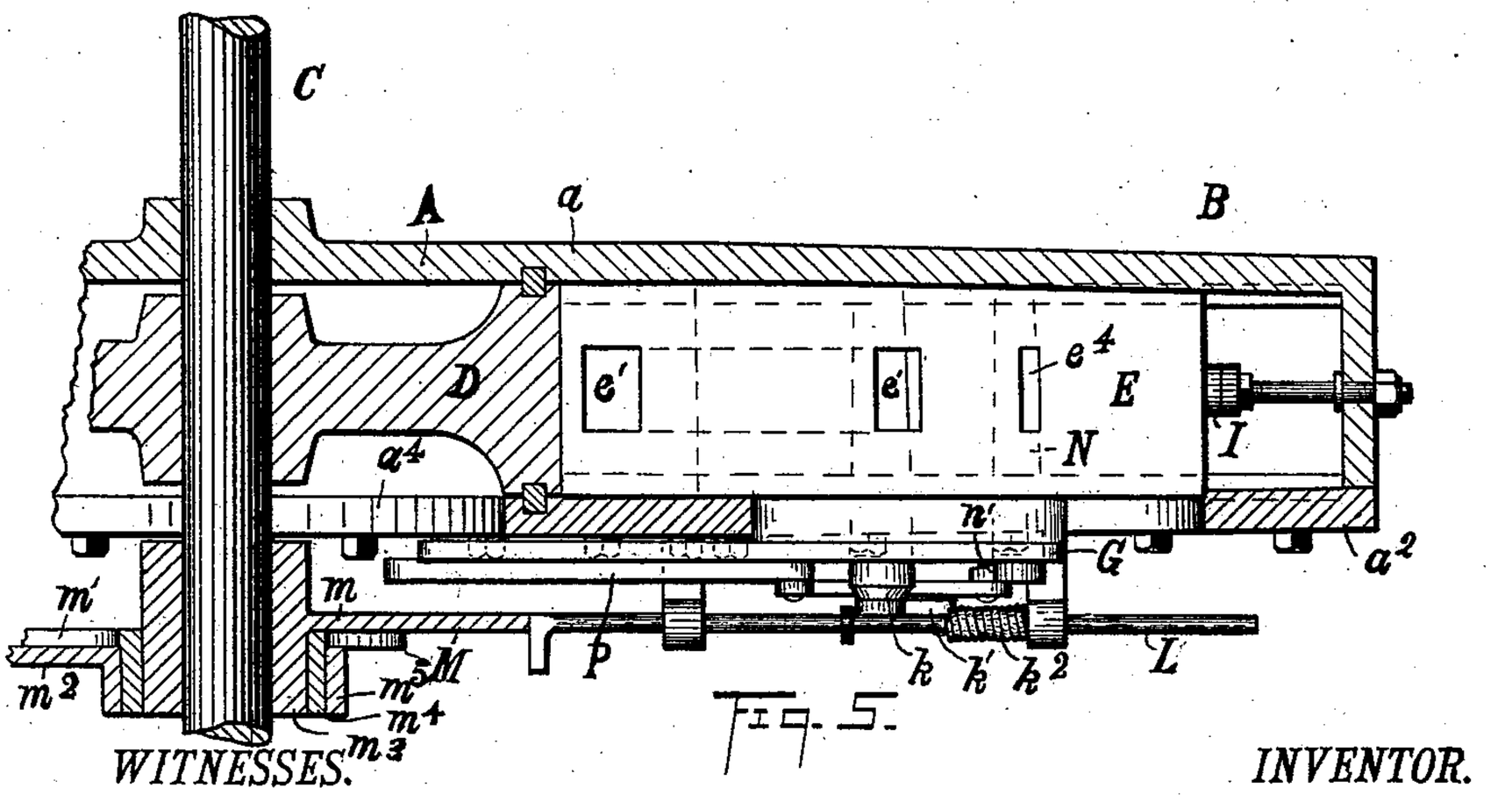


FIG. 5.

WITNESSES.

Belle S. Lowrie.

F. C. Griswold.

INVENTOR.

Frederick D. Sweet

By Wing & Thurston

his attys.

UNITED STATES PATENT OFFICE.

FREDERICK D. SWEET, OF ELYRIA, OHIO.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 531,481, dated December 25, 1894.

Application filed March 2, 1894. Serial No. 502,086. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK D. SWEET, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, 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 the invention, such as will enable others skilled in the art to which it appertains, to make and use the same.

The invention relates to certain improvements in rotary engines; and it consists in the combination with an annular cylinder and a rotary piston, of a sliding abutment having inlet and exhaust ports for the steam; in the mechanism for operating the abutment; in the construction and arrangement of the valves and the mechanism for operating said valves; and in the construction and combination of certain parts of the engine to be presently described, all of which will be pointed out in the claims.

Figure 1 is a side elevation of my improved engine. Fig. 2 is a plan view thereof. Fig. 3 is a transverse section through the box on line 3—3. Fig. 4 is a longitudinal vertical section through the box and cylinder on line 4—4 of Fig. 2; and Fig. 5 is a horizontal section on line 5—5 of Fig. 4.

I will now proceed to describe the construction shown in the drawings.

A represents an annular cylinder; and B a horizontal box communicating therewith. The cylinder and box are formed of a shell, a, having an external flange a', and a plate a^2, which is bolted to said flange. The said cylinder and box are supported by a base a^3 of any suitable form. A shaft C is mounted centrally with respect to the cylinder in suitable bearings, passing through the shell a and disk a^4. A circular disk D is keyed, or otherwise secured, to the shaft C, lying between the plate a^2 and the side of the shell a; and the outer edge fits closely against the sides of said plate and shell, thereby closing the inner periphery of the cylinder A. Suitable packing is interposed between the sides of the disk and the plate and shell to prevent the escape of steam from the cylinder. In the cylinder A and secured to the disk D is the piston F.

In the box B a sliding abutment E is placed, which abutment is adapted to enter and form a steam tight barrier across the cylinder, or to be retracted into the box B, leaving the cylinder free for the passage of the piston. On one side of the abutment is a rib which projects out through the side of the box, and to this rib is bolted a bar G, which bar extends toward the shaft to a point where it may be acted upon by the cam H,—said cam being rigidly secured to the shaft. The function of this cam is to push the abutment out of the cylinder. In the rear end of the abutment is a socket e which serves as a cylinder, in which lies the fixed piston I.

In the box B, above and below the abutment, are the steam chambers b and b' respectively. The upper chamber is in communication with the steam inlet pipe J, while the lower chamber b' is in communication with exhaust pipe J'.

In the abutment are two ports e' e^2. The port e' is the inlet port. Both openings of this port are through the upper side of the abutment, one near the inner end thereof, so that, when the abutment is in the cylinder, the port discharges into the cylinder, and one near the middle thereof in communication with the chamber b. The openings of the other port are in the lower side of the abutment,—one near the inner end thereof in communication with the cylinder when the abutment is in it, and the other near the middle in communication with the chamber b'.

In the port e' is a valve K,—the stem k of which extends sidewise out of the box B. An arm k' secured to the valve stem is connected by means of a slot and pin with the sliding bar L, which bar is mounted in brackets secured to the bar G. The end of this bar extends toward the shaft to a position to be struck and operated by the cam M which is secured to the shaft C. A spring k^2 moves the bar L in the direction to close the valve K; and the cam moves it in the opposite direction, against the spring, thereby opening the valve and permitting the passage of steam through the port e'.

A port e^4 extends through the abutment, one end being in communication with the chamber b and one with chamber b'. Near

its middle this port connects with the cylinder *e*, and at the point of connection a valve N is placed, by means of which the said cylinder may be placed in communication with either of the chambers *b b'*. The stem *n* of this valve extends out through one side of the box, and an arm *n'* which is secured thereto is connected with and operated by a slide P. This slide is connected to the side of the bar G, and its end projects toward the shaft a little distance beyond the end of the bar G. A spring *p* exerts its force to move the slide in the described position relative to the bar G; and when in this position, the valve N is turned so that steam is admitted to the cylinder *e* from the chamber *b*. The pressure of the steam thus admitted moves the abutment into the cylinder A and holds it there. The inner end of the slide P lies close to the bar G so that it will be engaged by the same cam H.

The operation of the described mechanism is as follows: When the parts are in the position shown in Fig. 4 the abutment is being held in the cylinder A by the pressure of steam in cylinder *e*. The valve K is being held open by the action of the cam M on the bar L, and steam is being admitted through the port *e'*. The piston F being connected with the shaft through the disk D, the movement of the piston around in the cylinder revolves the shaft C. When the shaft carries the cam M out of the way of the bar L, the spring k^2 moves the bar, thereby closing the valve and cutting off the steam. The cylinder A, in front of the piston, is in open communication with the exhaust chamber *b'*, through the port e^2, so long as the abutment is in cylinder A. When the piston in its movement nears the abutment, the cam H first strikes the slide P, thereby moving it backward. This turns the valve N so that the cylinder *e* is in communication with the exhaust chamber *b'*. The cam then strikes the bar G, and forcibly pushes it backward, and this moves the abutment out of the cylinder, back into the box, where it is held by the cam until the piston passes. When the cam H moves away from the slide P and bar G, the spring *p* moves the slide forward, thereby turning the valve N so that steam enters the cylinder *e* and through port e^4 from the steam chamber *b;* and the steam pressure in said cylinder *e* forces the abutment forward into the cylinder A. Immediately thereafter the cam M strikes the bar L, thereby opening valve K and admitting steam to the cylinder A. The cam M is adjustable in size, whereby it may be made to hold the valve K open for any desired part of the revolution of the piston. This adjustability is secured by the following construction: The cam is made up of several parts *m m' m²*, all of which are provided with hubs m^3 m^4 m^5 respectively. The hub m^3 of the cam *m* is fast to the shaft. The hub m^4 of cam *m'* is loosely mounted on the hub m^3, and the hub m^5 of cam m^2 is loosely mounted on the hub m^4. In the parts of the cam are holes m^7 through which pins m^6 may be passed. The cams *m'* m^2 may be moved into any desired position relative to each other, and held in said position by the pins m^6 lying in the said holes m^7.

The arrangement of the cams may be substantially as shown in the drawings, when they are spread out, like a fan, and engage with the bar L for about three quarters of the revolution of the shaft and piston, or they may be closed together so that they engage with said bar for about one quarter of a revolution of the shaft; or they may occupy any intermediate position between those named, and thereby the engine may be made to take steam into its cylinders for any desired part of the movement of the piston.

Having described my invention, I claim—

1. In a rotary engine, the combination of an annular cylinder, a revoluble shaft, a disk secured to the shaft entering and closing a slot in the inner periphery of the cylinder, a piston secured to said disk and movable in the cylinder, with a sliding abutment having the inlet port *e'*, the exhaust port e^2, a valve in said inlet port and a cam secured to the shaft for operating said valve, substantially as and for the purpose specified.

2. In a rotary engine, the combination of an annular cylinder, a revoluble shaft, a disk secured to the shaft entering and closing a slot in the inner periphery of the cylinder and a piston secured to said disk lying in the cylinder, with a box in communication with the cylinder, a sliding abutment lying in said box and movable into and out of said cylinder, said abutment having two ports *e' e²*, an inlet chamber in the box above the abutment, an exhaust chamber in the box below the abutment, a valve in the inlet port *e'*, means for operating said valve, and means for operating the abutment, substantially as and for the purpose specified.

3. In a rotary engine, the combination of an annular cylinder, a revoluble shaft, a disk secured to the shaft entering and closing a slot in the inner periphery of the cylinder and a piston secured to said disk lying in said cylinder, with a sliding abutment having two steam ports *e' e²* in communication respectively with the inlet and exhaust pipes, a valve in said inlet port and a cam variable in size secured to the shaft and adapted to operate said valve, substantially as and for the purpose specified.

4. In a rotary engine, the combination of an annular cylinder, a revoluble shaft, a disk secured to the shaft entering and closing a slot in the inner periphery of the cylinder and a piston secured to said disk and movable in said cylinder, with a sliding abutment and means for moving the same into and out of the cylinder, said abutment having a cylinder in its rear end, a fixed piston lying in said cylinder, a port e^4 in the abutment adapted to permit the entrance and

escape of steam from said cylinder, a valve in said port, a bar secured to the side of the abutment, a slide mounted on said bar, suitable connection between said slide and valve, and a cam on the shaft adapted to strike the ends of said slide and bar, substantially as and for the purpose specified.

5. In a rotary engine in combination with the inlet valve, a rotary shaft and a cam secured to said shaft composed of two or more parts, one part having a hub which is secured to the shaft, the other parts having hubs loosely mounted on the hub of the first part, said parts having holes for the reception of a pin and suitable mechanism connected with the valve, whereby said valve is operated by said cam, substantially as and for the purpose specified.

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

FREDERICK D. SWEET.

Witnesses:

E. L. THURSTON,

MOSES BEAL.