(No Model.)

5 Sheets—Sheet 1.

A. B. BULLOCK.

ROTARY STEAM ENGINE.

No. 377,143. Patented Jan. 31, 1888.

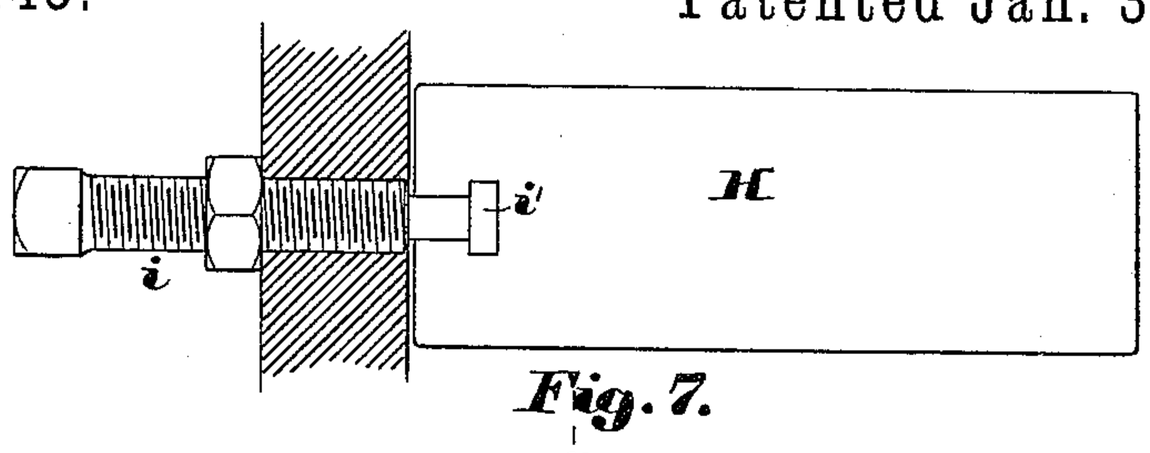

Fig. 7.

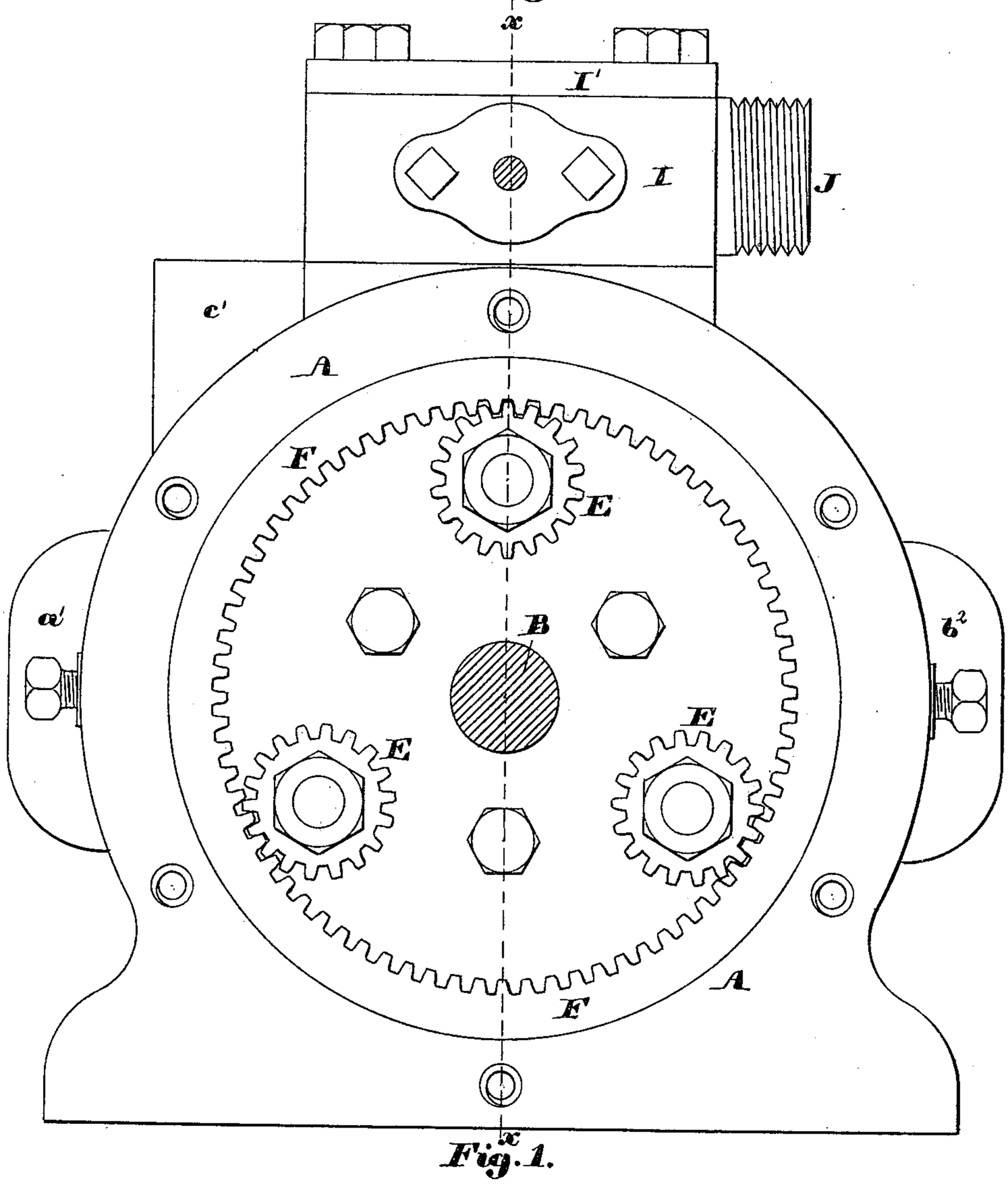

Fig. 1.

Witnesses:
Walter E. Lombard.
James H. Russell.

Inventor:
Alanson B. Bullock,
by N. E. Lombard
Attorney.

(No Model.)

5 Sheets—Sheet 2.

A. B. BULLOCK.

ROTARY STEAM ENGINE.

No. 377,143. Patented Jan. 31, 1888.

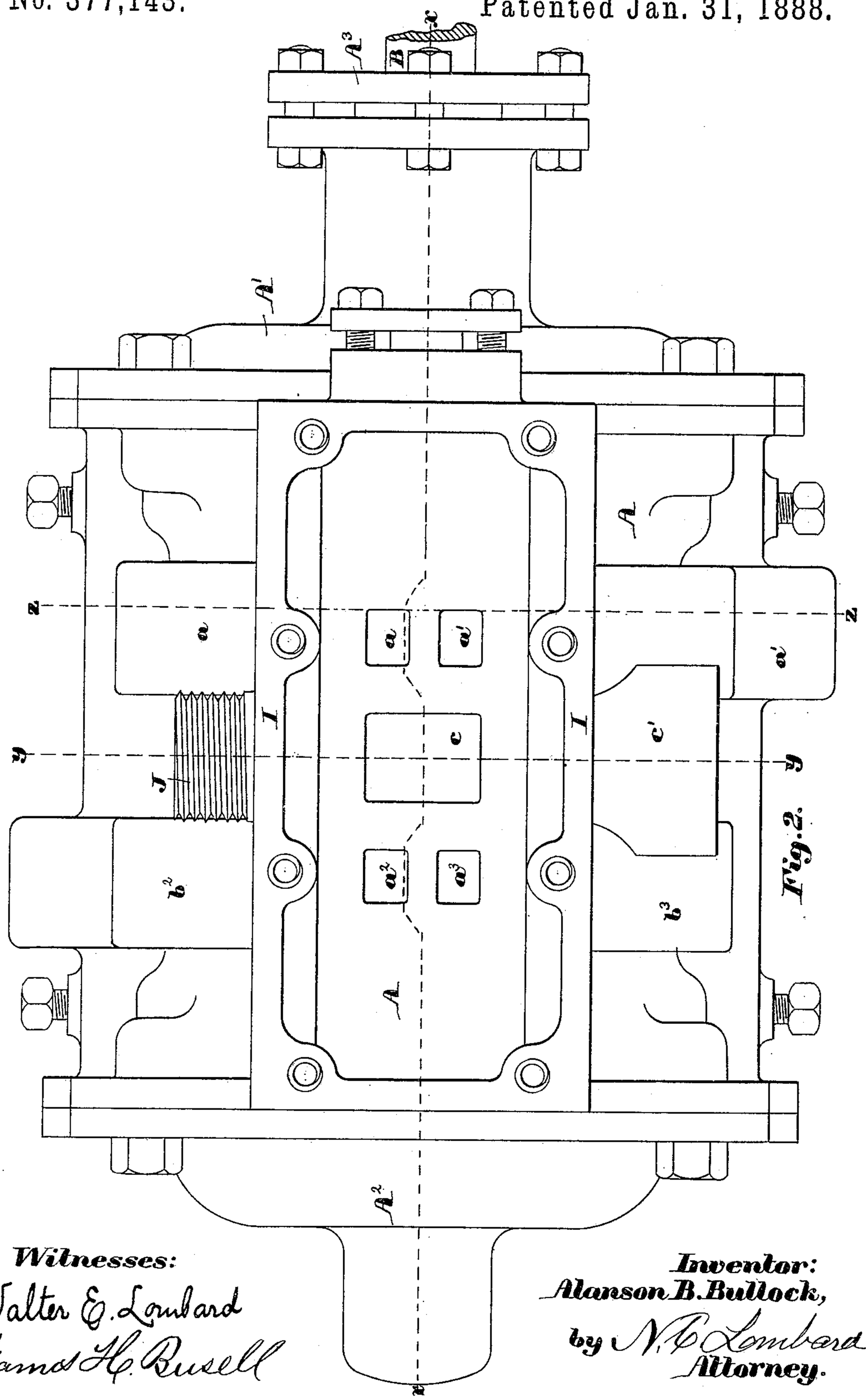

Fig. 2.

Witnesses:

Walter E. Lombard

James H. Russell

Inventor:

Alanson B. Bullock,

by N. C. Lombard

Attorney.

(No Model.)

5 Sheets—Sheet 3.

A. B. BULLOCK.

ROTARY STEAM ENGINE.

No. 377,143. Patented Jan. 31, 1888.

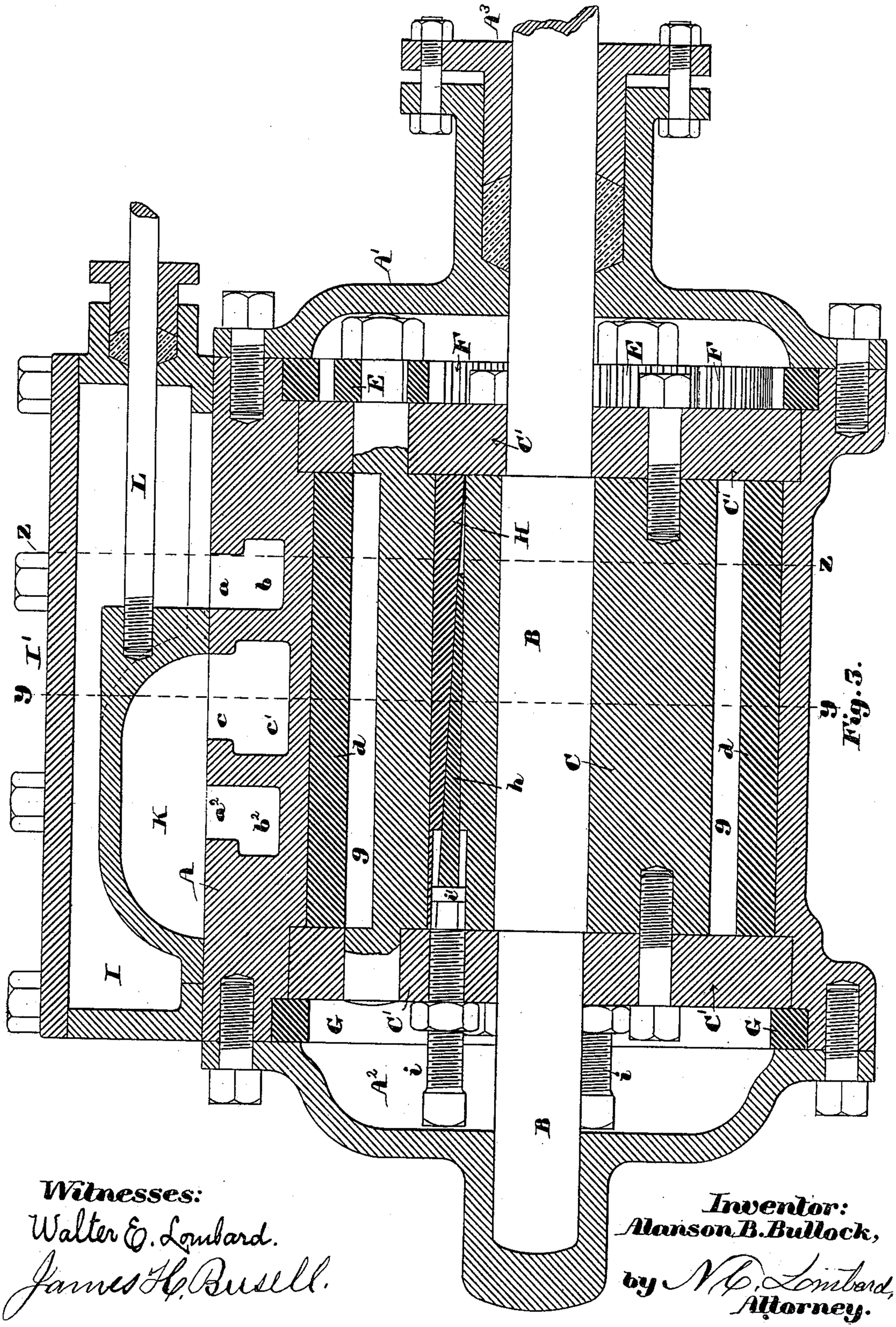

Fig. 3.

Witnesses:
Walter E. Lombard.
James H. Bissell.

Inventor:
Alanson B. Bullock,
by W. C. Lombard,
Attorney.

(No Model.) 5 Sheets—Sheet 4.

A. B. BULLOCK.

ROTARY STEAM ENGINE.

No. 377,143. Patented Jan. 31, 1888.

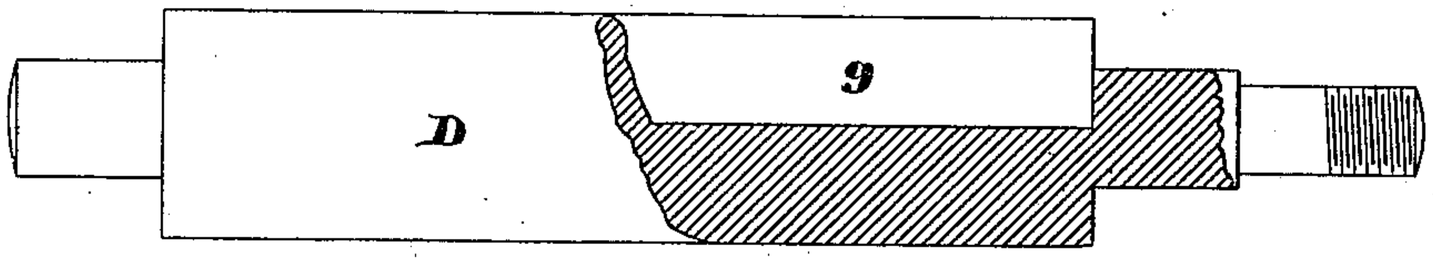

Fig. 6.

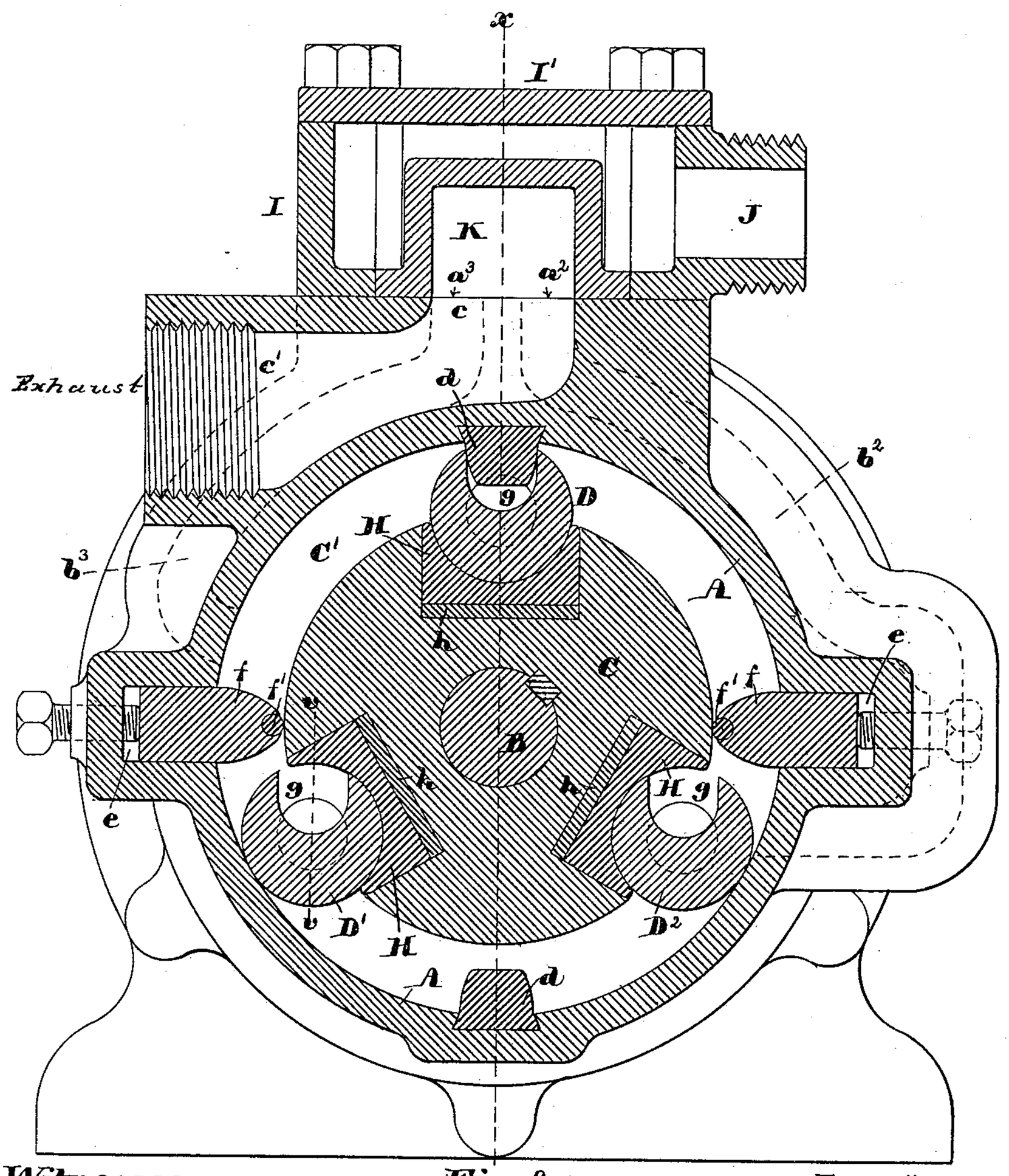

Fig. 4.

Witnesses:
Walter E. Lombard.
James H. Bissell

Inventor:
Alanson B. Bullock,
by N. C. Lombard
Attorney.

(No Model.) 5 Sheets—Sheet 5.

A. B. BULLOCK.

ROTARY STEAM ENGINE.

No. 377,143. Patented Jan. 31, 1888.

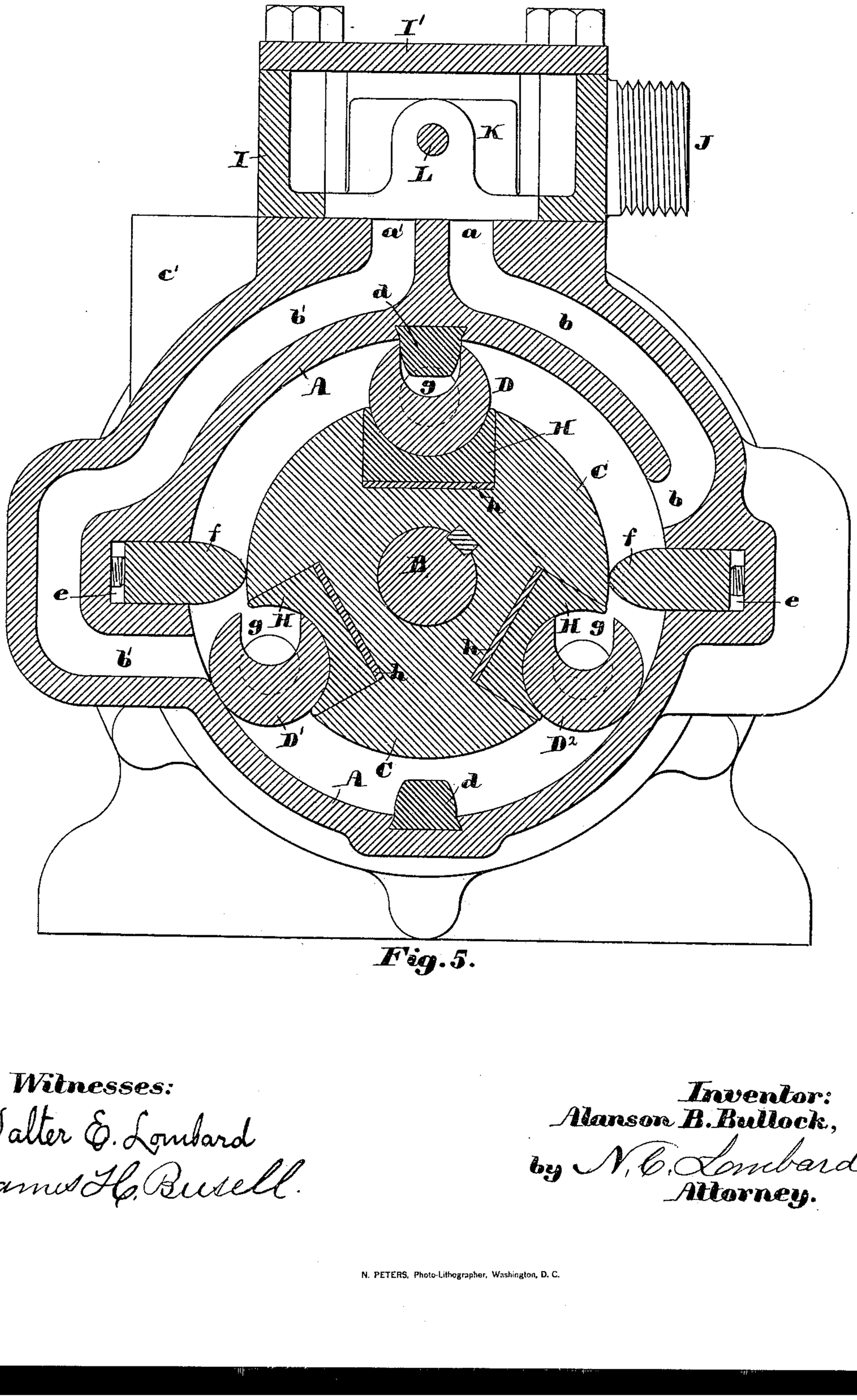

Fig. 5.

Witnesses:
Walter E. Lombard
James H. Bissell.

Inventor:
Alanson B. Bullock,
by N. C. Lombard,
Attorney.

UNITED STATES PATENT OFFICE.

ALANSON B. BULLOCK, OF CANTON, MASSACHUSETTS.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 377,143, dated January 31, 1888.

Application filed May 23, 1887. Serial No. 239,071. (No model.)

To all whom it may concern:

Be it known that I, ALANSON B. BULLOCK, of Canton, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Rotary Steam-Engines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to rotary steam engines; and it consists in certain novel features of construction, arrangement, and combination of parts, which will be readily understood by reference to the description of the drawings, and to the claims to be hereinafter given.

Figure 1 of the drawings is an end elevation of an engine illustrating my invention, with one of its heads removed and the shaft shown in section. Fig. 2 is a plan of the same with the reversing-valve and the valve-chest cover removed. Fig. 3 is a longitudinal section on line *x x* on Fig. 1. Fig. 4 is a transverse section on line *y y* on Figs. 2 and 3. Fig. 5 is a similar section on line *z z* on Figs. 2 and 3. Fig. 6 is a longitudinal sectional elevation of one of the rotary piston-abutments, the cutting plane being on line *v v* on Fig. 4; and Fig. 7 is a plan of the wedge for adjusting the piston-abutment rolls and the screw for operating the same.

In the drawings, A is the steam-cylinder, provided with the steam-ports *a*, *a'*, *a²*, and *a³*, leading to the inlet-passages *b*, *b'*, *b²*, and *b³*, and with the exhaust-port *c*, leading to the discharge-orifice *c'*, in which an exhaust-pipe (not shown) is to be screwed to convey the exhaust-steam to any desired point. The interior of the steam-cylinder A has formed therein two dovetailed grooves extending longitudinally thereof, in which are secured in fixed positions the inwardly-projecting gear-teeth *d d*, said teeth being arranged upon opposite sides of the axis or center of the cylinder, as shown. Said cylinder is also provided with two rectangular grooves, *e e*, of considerable depth, arranged equidistant from the teeth *d d* and directly opposite to each other, which grooves extend longitudinally of said cylinder, and have fitted therein, so as to be adjustable toward and from the center of said cylinder, the abutments *f f*, the inner edges of which may have mounted therein a roll, *f'*, as shown in Fig. 4, or be simply rounded, as shown in Fig. 5.

B is a shaft mounted in bearings formed in the heads A' A² of the cylinder A, so as to be revoluble therein, the head A' being provided with a stuffing-box, A³, through which the shaft B projects to any desired distance, and may have secured thereon a pulley for transmitting power; or a screw-propeller may be mounted on said projecting shaft in a well-known manner.

C is the main body of the piston, firmly secured to the shaft B and having bolted to its ends the heads C', having diameters somewhat greater than the interior diameter of the cylinder, said heads being fitted to and revolving in an annular enlargement of said cylinder A, as shown in Fig. 3.

D, D', and D² are revoluble piston-abutments mounted in bearings in the heads C', and each having firmly secured upon one end of its shaft, outside of the head C', a toothed pinion, E, which engages with the teeth of an internal or ring gear, F, secured in a fixed position between the head A' and an annular shoulder formed in the cylinder, as shown in Fig. 3.

G is a ring secured in a fixed position between the head A² and an annular shoulder formed in the cylinder A, and serves to aid in packing the piston-head.

Each of the piston-abutments D, D', and D² has formed therein a longitudinal groove, *g*, extending inward to the axis of said abutment, and having a semicircular bottom, as shown, said groove serving to receive the teeth *d d* and the abutments *f f* in succession as the piston is revolved, it being understood that the diameters of the piston-abutment rolls are such that they will each make four complete revolutions to each revolution of the piston and its shaft. Each piston-abutment roll D, D', and D² has its periphery fitted to a semicircular concavity or seat formed in a bar, H, which extends from end to end of the main body of the piston C, and is fitted to a rectangular groove formed in said piston, so as to be adjustable radially therein by means of the wedge *h*, fitted in the bottom of said groove beneath said bar, the bottom of which is inclined to fit said wedge, as shown in Fig. 3. The wedge *h* is moved endwise by means of the

screw *i*, having a collar, *i'*, upon its inner end, which fits a T-shaped groove in the end of the wedge, as shown in Fig. 7. A steam-chest, I, is bolted to the valve-seat of the cylinder, and is provided with the cover I' and the threaded hub J, to which is to be coupled the steam-supply pipe. (Not shown.)

K is a slide-valve fitted to said valve-seat, and arranged to cover the exhaust-ports, as shown, and connected to the inner end of the valve-stem L, by which and any suitable mechanism (not shown) said valve may be moved to the opposite end of the steam chest when it is desired to reverse the rotation of the engine, as would be necessary if used for driving a screw-propeller.

When the ports *a* and *a'* and passages *b* and *b'* are used for the admission of steam with the valve in the position shown in the drawings, the ports a^2 and a^3 and passages b^2 and b^3 are used for the discharge of the exhaust-steam; but if the valve be moved to the opposite end of the steam-chest the steam will enter the cylinder through the ports a^2 and a^3 and passages b^2 and b^3 and will escape through the passages *b b'* and ports *a*, *a'*, and *c*, and the revolution of the piston and shaft will be reversed.

Any desired number of cylinder-abutments *f*, teeth *d*, and rotary piston-abutments D, from one upward, may be used, though I prefer an even number of cylinder-abutments *f* and teeth *d* and an odd number of the piston-abutments D, for the reason that by such an arrangement I avoid dead-points.

It will be observed that the two passages which admit steam to the cylinder at the same time enter the cylinder upon opposite sides of the cylinder, one above the abutment *f* and the other below it, as shown in the drawings.

The valve K, besides being used for reversing the revolution of the piston, may be also used for stopping the revolution of the piston by moving it to a central position to cover all the ports and shut off the supply of steam to the cylinder.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination with a steam-cylinder provided with both steam and exhaust ports upon opposite sides thereof, a revolving piston-body of less diameter than the bore of said cylinder, two cylinder-abutments bridging the annular space between said piston-body and cylinder upon the opposite sides of the axis of said piston, two inwardly-projecting rib-like teeth set in said cylinder upon the opposite sides of the axis of revolution of the piston and equidistant from said non-revolving abutments, but not bridging the annular space between the piston-body and cylinder, and a plurality of revoluble piston-abutments mounted in bearings in the piston-heads and revolving therewith at the same time that they revolve about their own axes, and each provided with a longitudinal groove to engage in succession with each of said non-revolving abutments, and inwardly-projecting rib-like teeth, substantially as described.

2. In combination with a fixed steam-cylinder provided with both steam and exhaust ports upon each of two opposite sides thereof, the revoluble piston-body C, provided with the heads C', the cylinder-abutments *f f*, the teeth *d d*, the revoluble piston-abutments D, D', and D², each provided with the groove *g* and mounted in bearings in the heads C', the pinions E, the internal gear F, and the shaft B, all constructed, arranged, and adapted to operate substantially as described.

3. The combination of the cylinder A, the revolving piston-body C, provided with the heads C', the cylinder-abutments *f f*, the fixed teeth *d d*, the revoluble piston-abutments D, D', and D², each provided with the longitudinal groove *g*, the semicircularly-grooved bar H, the wedge *h*, and the screw *i*.

4. The combination of the cylinder A, the fixed abutment *f*, the rotary cylinder-body C, and the revoluble piston-abutment D, provided with the longitudinal groove *g*, constructed and arranged to engage with said abutment *f* as it is revolved with said piston-body.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 19th day of May, A. D. 1887.

ALANSON B. BULLOCK.

Witnesses:
N. C. LOMBARD,
WALTER E. LOMBARD.