

(No Model.)

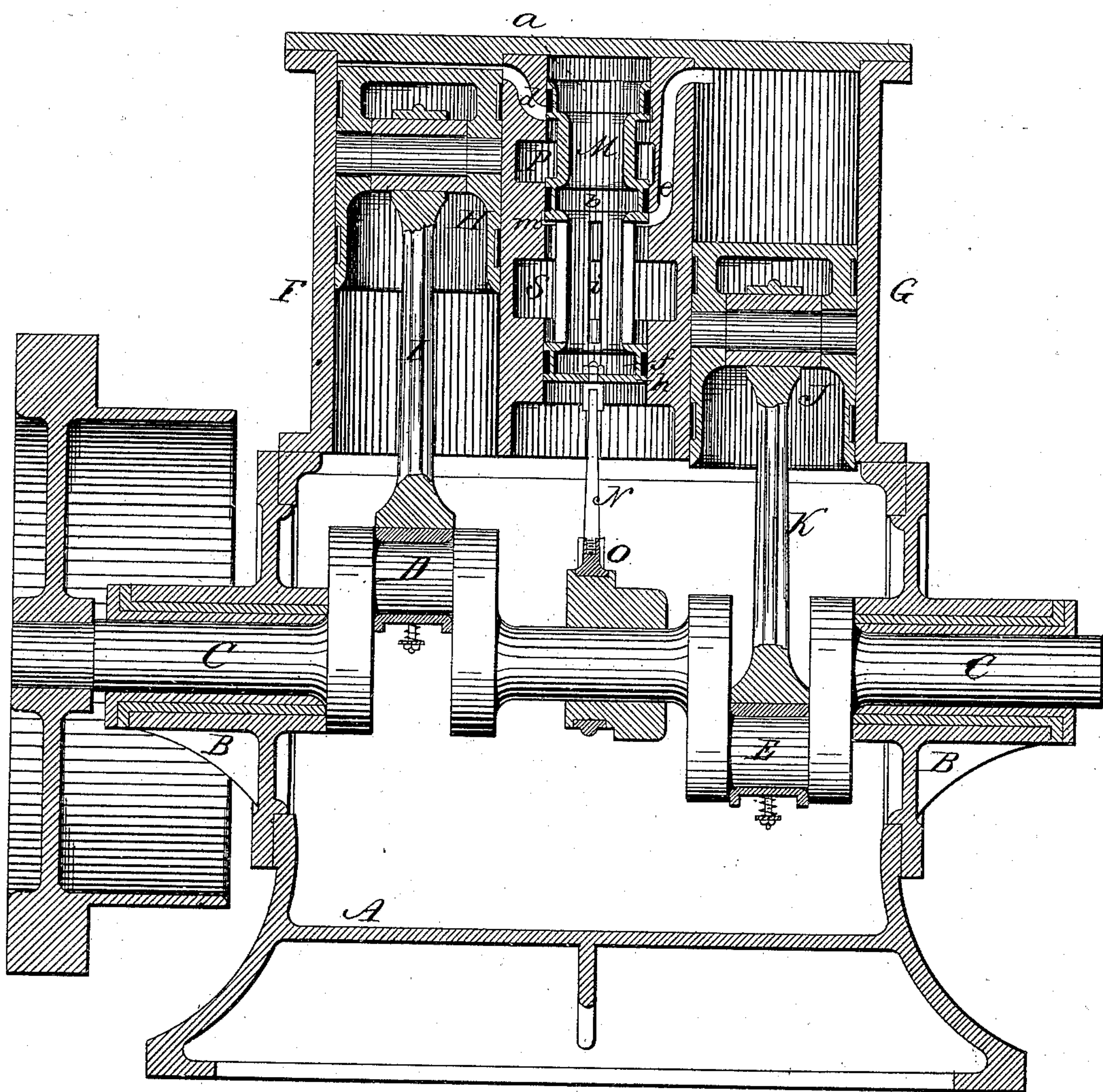
4 Sheets—Sheet 1.

G. W. BIGELOW.
DIRECT ACTING ENGINE.

No. 335,884.

Patented Feb. 9, 1886.

Fig 1



Witnesses
J. H. Shumway
J. C. Carle

George W. Bigelow
Inventor
By Atty
J. C. Carle

(No Model.)

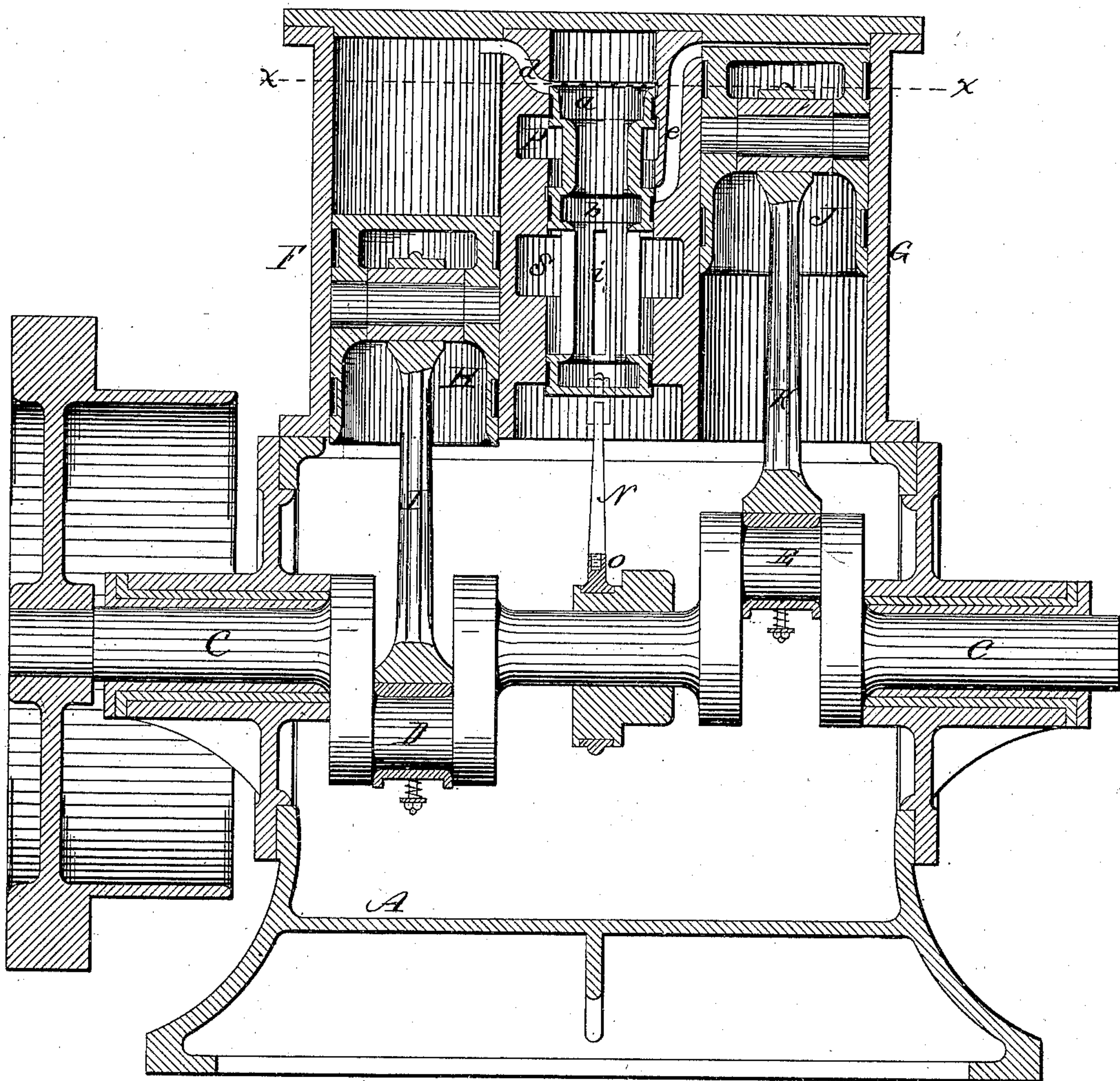
4 Sheets—Sheet 2.

G. W. BIGELOW.
DIRECT ACTING ENGINE.

No. 335,884.

Patented Feb. 9, 1886.

Fig 2



Witness
J. R. Shumway
J. C. Earle

George W. Bigelow
By atty. Inventor
J. C. Earle

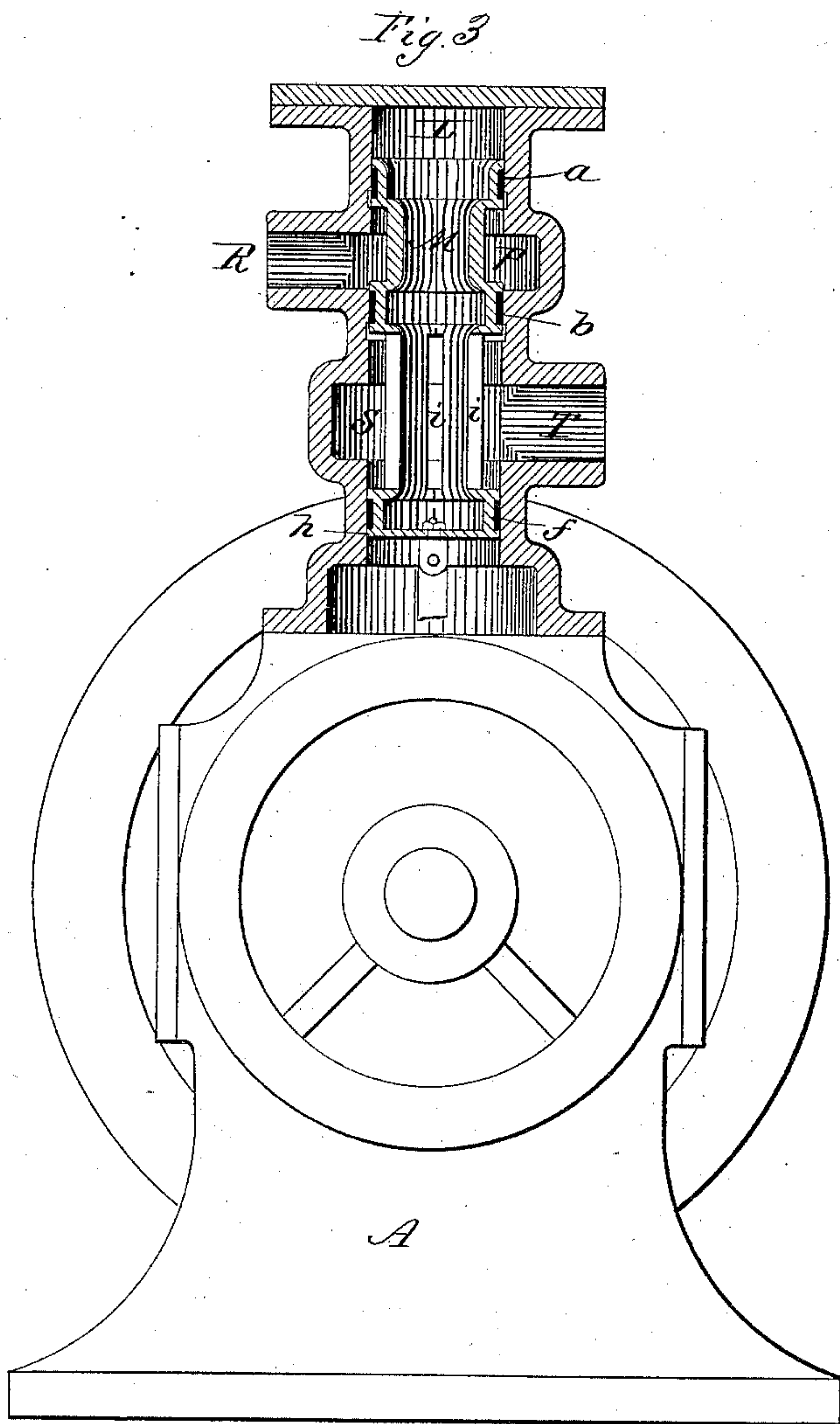
(No Model.)

4 Sheets—Sheet 3.

G. W. BIGELOW.
DIRECT ACTING ENGINE.

No. 335,884.

Patented Feb. 9, 1886.



Witnesses
J. P. Sumner
Jos. C. Earle

George W. Bigelow
Inventor
By Atty
Wm. C. Miller

(No Model.)

4 Sheets—Sheet 4.

G. W. BIGELOW.
DIRECT ACTING ENGINE.

No. 335,884.

Patented Feb. 9, 1886.

Fig. 4

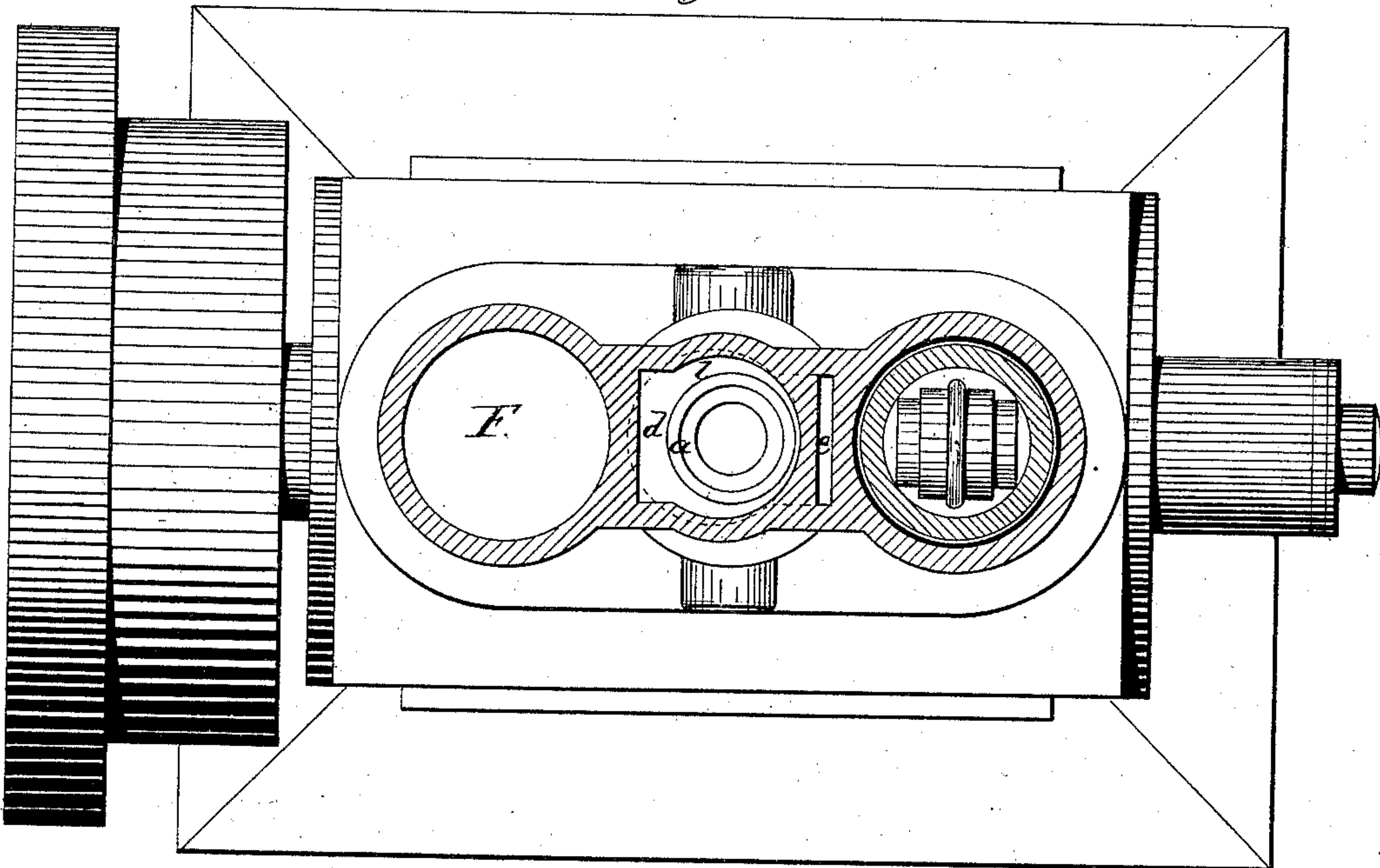


Fig. 5

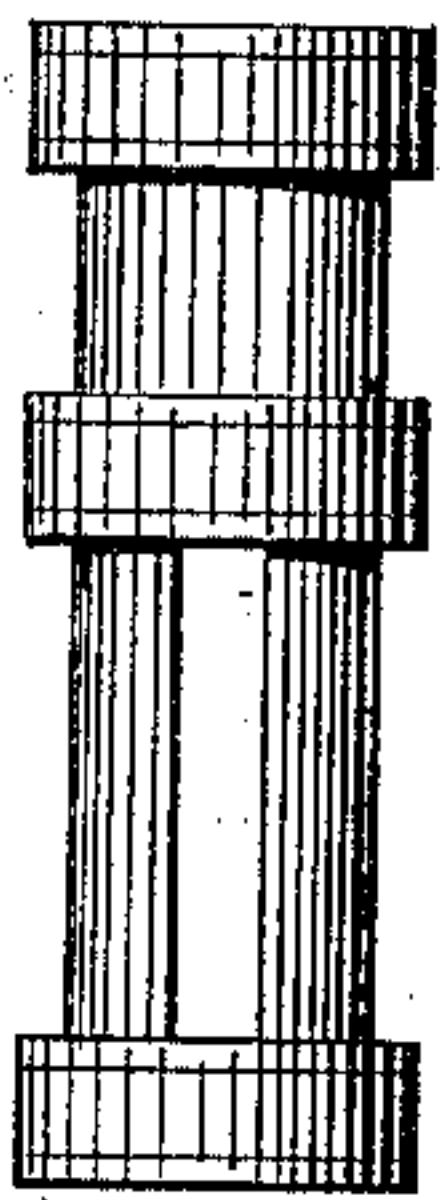
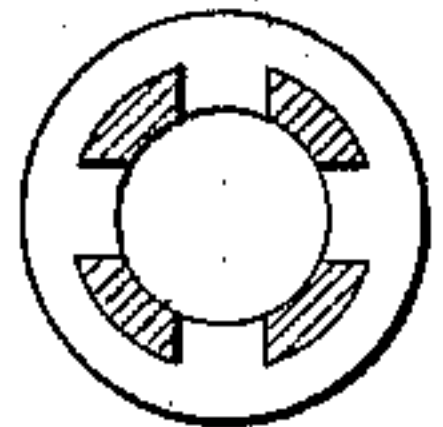


Fig. 6



Witnesses
J. H. Shumway
J. C. Baile

George W. Bigelow
By Atty. Inventor
Wm. R. Enders

UNITED STATES PATENT OFFICE.

GEORGE W. BIGELOW, OF NEW HAVEN, CONNECTICUT.

DIRECT-ACTING ENGINE.

SPECIFICATION forming part of Letters Patent No. 335,884, dated February 9, 1886.

Application filed September 15, 1884. Serial No. 143,064. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. BIGELOW, of New Haven, in the county of New Haven and State of Connecticut, have invented a new
5 Improvement in Direct-Acting Engines; and I do hereby declare the following, when taken in connection with accompanying four sheets of drawings and the letters of reference marked thereon, to be a full, clear, and exact
10 description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a vertical central sectional view showing the two pistons at one extreme; Fig.
15 2, a like view showing the pistons at the other extreme; Fig. 3, a vertical section through the valve-chamber, showing an end view of the bed; Fig. 4, a horizontal section on line *xx* of Fig. 2; Fig. 5, a side view of the valve; Fig. 6, a
20 horizontal section of the valve through the exhaust-openings.

This invention relates to an improvement in direct-acting steam-engines, particularly to that class which are commonly called "trunk-engines," the object of the invention being a
25 simple and cheap construction with great facility for inlet and exhaust steam, whereby a very rapid movement may be attained; and the invention consists in the construction of
30 the valve and its chamber with relation to the port of the respective cylinders, and in details of construction, as more fully hereinafter described, and particularly recited in the claims.

A represents the bed of the machine, in
35 which, in suitable bearings, B, the shaft C is arranged, on which are two diametrically-opposite cranks, D E. On the bed two cylinders, F G, are arranged over the shaft in a vertical position. The one cylinder, F, carries
40 a trunk-piston, H, which is connected by a rod, I, with the crank D. In the other cylinder, G, is a like piston, J, connected to the crank E by a rod, K. Between the two cylinders is the valve-chamber L. This valve-
45 chamber is in the form of a cylinder parallel with the two cylinders F G. In this chamber the valve M is arranged to work freely up and down, and is connected by a rod, N, with an eccentric, O, on the driving-shaft, through
50 which a vertical reciprocating movement is

imparted to the valve. In the valve-chamber the steam-chamber P is formed. This steam-chamber is an annular recess surrounding the valve. Near its upper end the valve is constructed to form one piston, *a*, above the
55 chamber, and a like piston, *b*, below the steam-chamber, the pistons being respectively packed, and so as to prevent the escape of steam above the piston *a* or below the piston
60 *b*. From the valve chamber above the steam-chamber P a passage, *d*, leads to the upper end of the cylinder F, and from below the steam-chamber P a passage, *e*, leads to the up-
per end of the cylinder G.

R represents the inlet-passage for steam to
65 the steam-chamber. Below the steam-chamber is the exhaust-chamber S, which, like the steam-chamber, is an annular recess surrounding the valve. The piston *b* is above the ex-
haust-chamber, and on the valve is a like pis-
70 ton, *f*, below the exhaust-chamber. The valve is of tubular form, its lower end closed by a head, *h*. That part of the valve between the two pistons *a b* is reduced in diameter, as is the part of the valve between the pistons *b*
75 and *f*, and through the reduced part of the valve between the pistons *b f* several apertures, *i*, are formed, more or less in number.

At the port or opening from the valve-chamber into the passage *d* to the cylinder F an
80 annular recess, *l*, is formed around the cylinder, but eccentric thereto, as seen in Fig. 4, the narrowest part of the recess being opposite the cylinder, it gradually expanding from that point to the port. At the opening from
85 the valve-chamber into the passage *e* a like eccentric recess, *m*, is formed. The two recesses *l m* in height correspond to the heights of the ports opening into the passages *e d*.

Supposing the pistons to stand in the posi-
90 tion seen in Fig. 1—F at its extreme up position, J at its extreme down position—the valve is now on the ascent, and the piston *a* has risen to open the port from the valve-chamber into the port *d*. This opening per-
95 mits steam to pass from the steam-chamber P through the passage *d* into the cylinder above the piston, and in thus flowing to the passage *d* the annular space *l* forms an opening en-
100 tirely around the piston *a*, increasing in ex-

tent from the point opposite the passage around to the port, and so that steam will flow freely through this passage *l* to the port, and thence through the passage *d* to the cylinder, thus giving a large free way for the steam to the port. The piston *J* is at this time at its lowest point, the valve has risen to open the passage *e* from the cylinder *G* below the piston *b*, as seen in Fig. 1, and so that the steam which had previously driven the piston *J* downward is now permitted to escape through the passage *d* below the piston *b* into the exhaust-chamber *S*, from whence it escapes through the passage *T*. The valve continues its ascent, as indicated in broken lines, Fig. 1, and finally returns, and in returning the piston *a* passes below the port of the passage *d* as the piston *H* reaches its down position, as seen in Fig. 2. At the same time the piston *b* passes below the port opening to the passage *e*, as also seen in Fig. 2. In this condition the steam escapes from above the piston *H* through the passage *d* above the piston *a*; thence it passes downward into the valve and out through the apertures *i* into the exhaust-chamber *S*. The steam is now admitted from the steam-chamber *P* above the piston *b* into the passage *e*, thence to the cylinder above the piston *J*, to impart the downward movement to that piston, the valve continuing its descent to fully open the respective ports, and returns to the position seen in Fig. 1 as the pistons arrive at their other extreme. By this construction and arrangement of the valve between the two cylinders, with the eccentric recess in the valve-chamber opening to the ports, the utmost freedom is given for the inlet and escape of steam, for the reason that, as the piston of the valve opens the passage entirely around the chamber, that passage, increasing in size from the point opposite the port each way around to the port, makes room for the free flow of steam from the entire opening of the valve, both for the inlet and exhaust.

In describing my invention I have represented but two cylinders. It will be understood that the number of cylinders may be increased, if desired, as in other engines of this character.

The eccentric annular recess in the cylindrical valve-chamber in the same plane as and opening into the passages to the cylinder may be employed in connection with double-acting engines. I therefore do not wish to limit this part of my invention to single-acting engines.

While I prefer to close the lower end of the valve and make the exhaust through apertures between the lower piston and the intermediate piston into an annular exhaust-chamber, the lower end of the piston may be open and the exhaust made into the crank-chamber below, as in other constructions of engine. In such case the third or lower piston

may be omitted. I therefore do not wish to limit my entire invention to single-acting engines having the annular exhaust-chamber and the valve with its lower end closed.

I claim—

1. In a pair of single-acting engines, the combination of the two cylinders, a cylindrical valve-chamber between them, an annular steam-chamber in said valve-chamber, a passage opening from the valve-chamber from above the steam-chamber to one of the cylinders, and a like passage from below the steam-chamber to the other cylinder, an annular exhaust-chamber below the steam-chamber, and a valve consisting of three connected pistons—one above the steam-chamber, one below the exhaust-chamber, and one between the steam and exhaust chambers—the said valve open at its upper end and downward, closed at its lower end, and constructed with apertures opening from between the lower piston and the intermediate piston into the exhaust-chamber, substantially as described.

2. In a direct-acting steam-engine, a cylindrical valve-chamber constructed with an annular eccentric recess around the inside of said chamber, the said recess forming the steam-chamber *P*, with a passage leading direct from the said valve-chamber to the cylinder, and a cylindrical valve adapted to work in said valve-chamber and to open and cut off communication between said recess and the said passage, substantially as described.

3. In a pair of single-acting engines, the combination of the two cylinders, a cylindrical valve-chamber between the two cylinders, and an annular eccentric recess around the inside of said valve-chamber, the said recess forming the steam-chamber *P*, with a passage opening from said valve-chamber above the said eccentric steam-chamber to one cylinder, and a like passage opening from said valve-chamber below the said eccentric steam-chamber to the other cylinder, with a cylindrical valve adapted to work in the said cylindrical valve-chamber, the said valve consisting of two connected pistons, the one above the said eccentric steam-chamber and the other below said eccentric steam-chamber, arranged and operating to close and open communication between said eccentric steam-chamber and the said passages to the respective cylinders, substantially as described.

4. In a pair of single-acting engines, the combination of the two cylinders, a cylindrical valve-chamber between the said two cylinders, an annular eccentric recess around the inside of said chamber, the said recess forming the steam-chamber *P*, with a passage opening from said valve-chamber above the said eccentric steam-chamber to one cylinder, and a like passage opening from the said valve-chamber below the said eccentric steam-chamber to the other cylinder, and an annular exhaust-chamber around the inside of the valve-cham-

ber below the steam-chamber, with a cylindrical valve in said valve-chamber, consisting of three connected pistons—one piston above the steam-chamber, one below the exhaust-chamber, and one between the steam and exhaust chambers—the said valve being of tubular shape, open at the upper end and closed at the lower end, with apertures between the lower and intermediate pistons, substantially as described.

GEO. W. BIGELOW.

Witnesses:

JOHN E. EARLE,
LILLIAN D. KELSEY.