

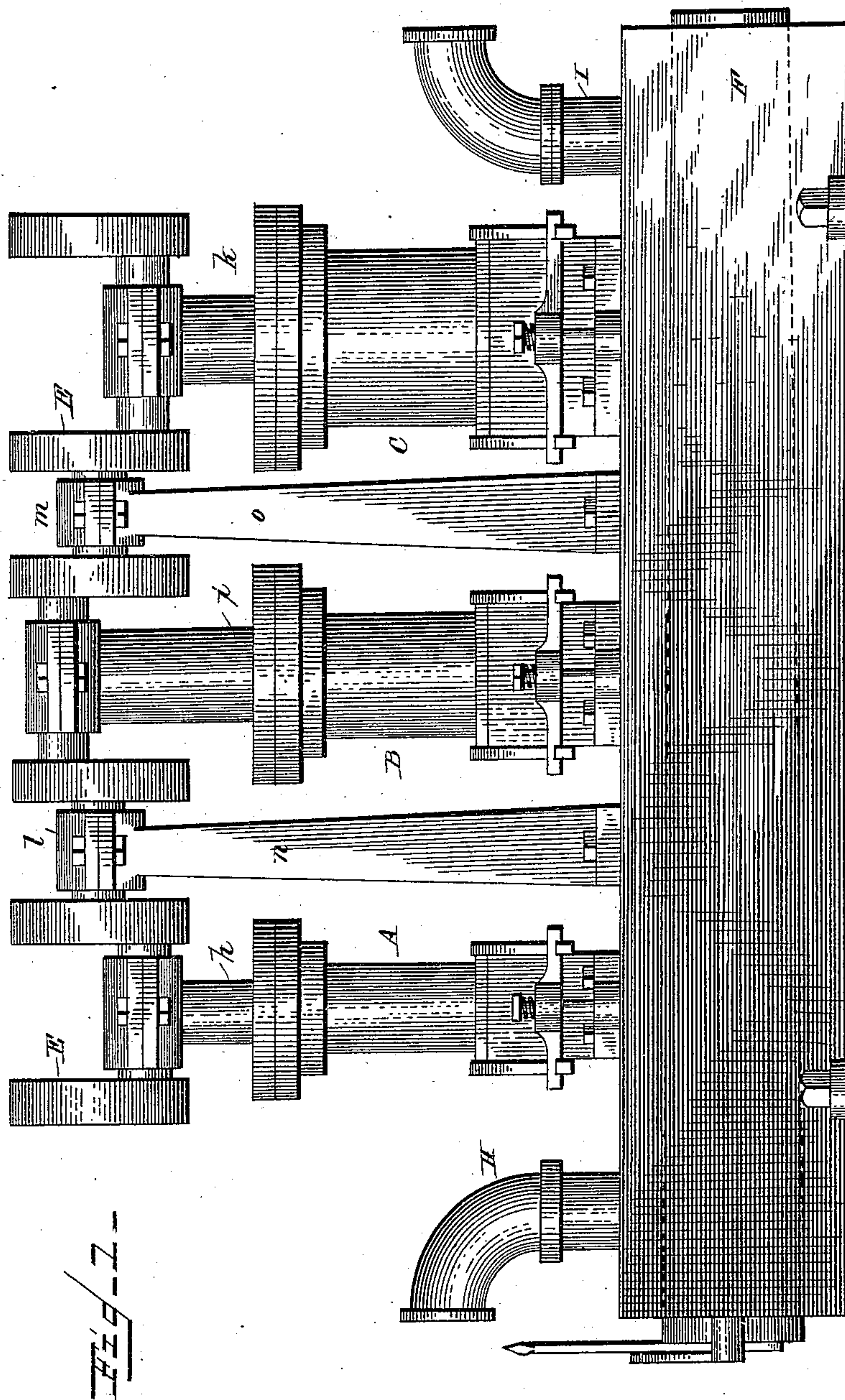
(No Model.)

2 Sheets—Sheet 1.

E. ANDREWS.
COMPOUND ENGINE.

No. 354,823.

Patented Dec. 21, 1886.



WITNESSES

Edwin D. Jewell,
Wm E. Dyne

INVENTOR

E. Andrews
By Johnston, Reinohl + Dyne
his Attorneys

(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

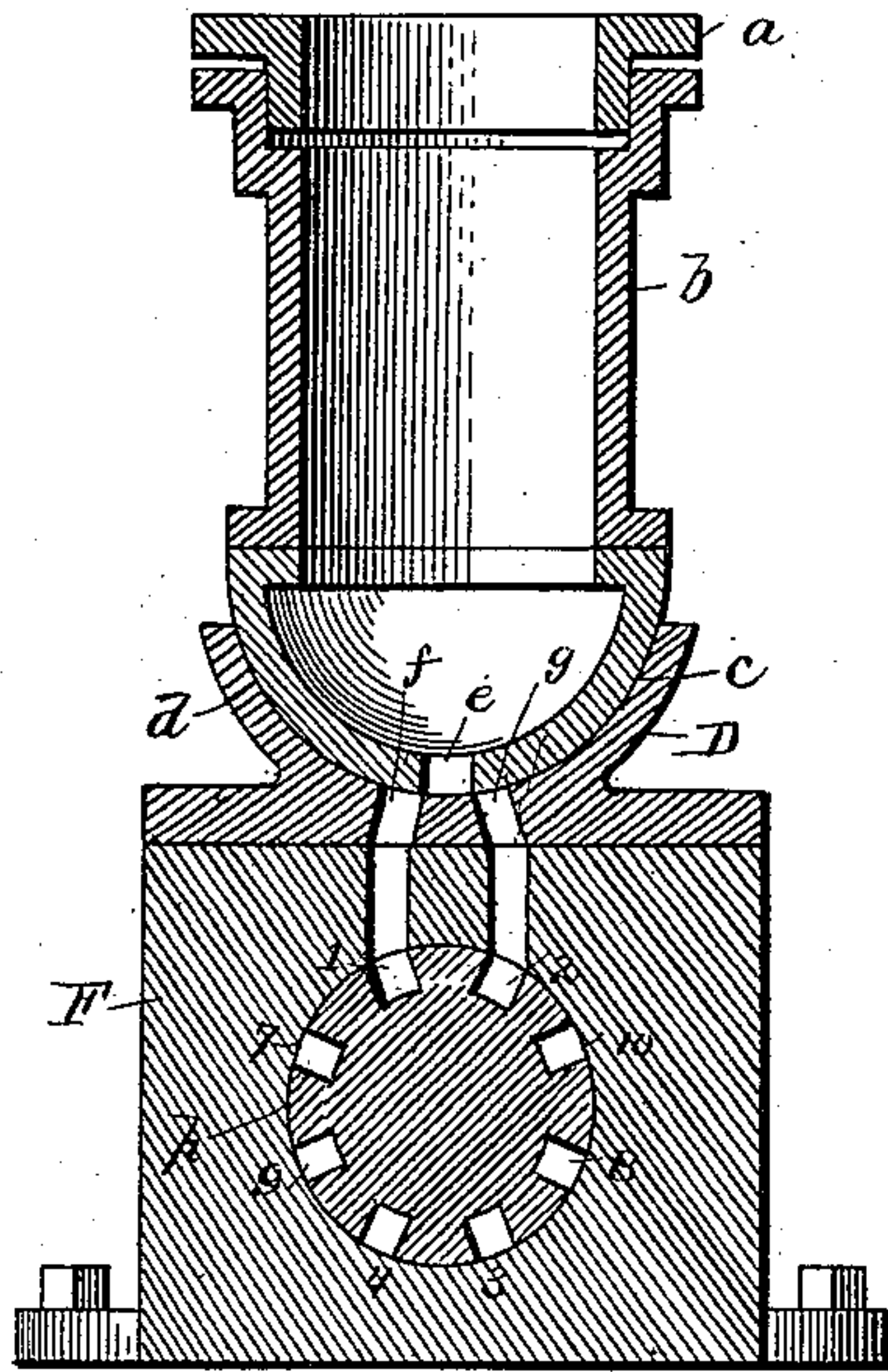


Fig. 3.

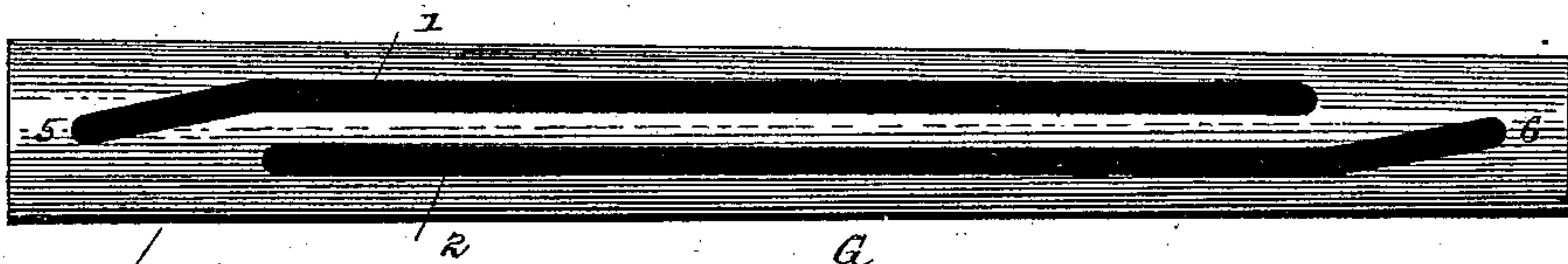


Fig. 4.

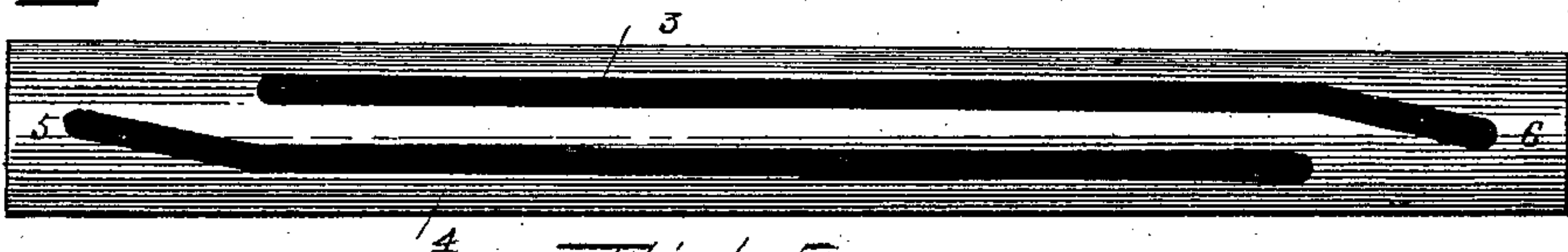


Fig. 5.

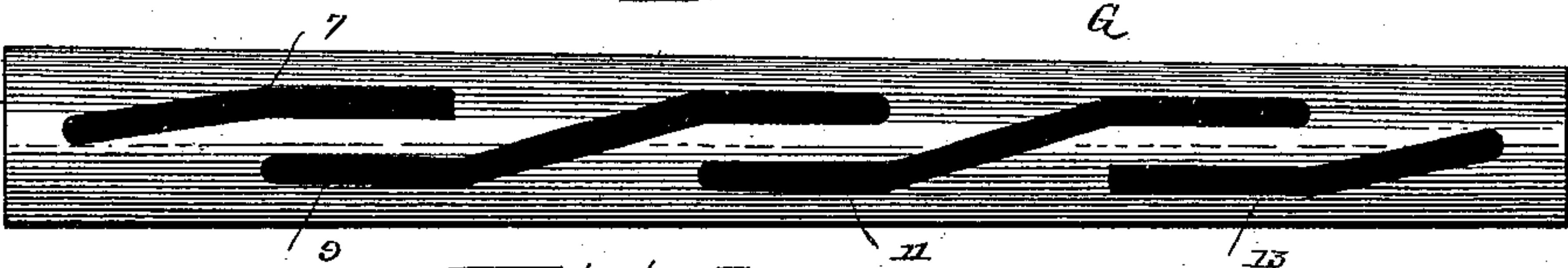
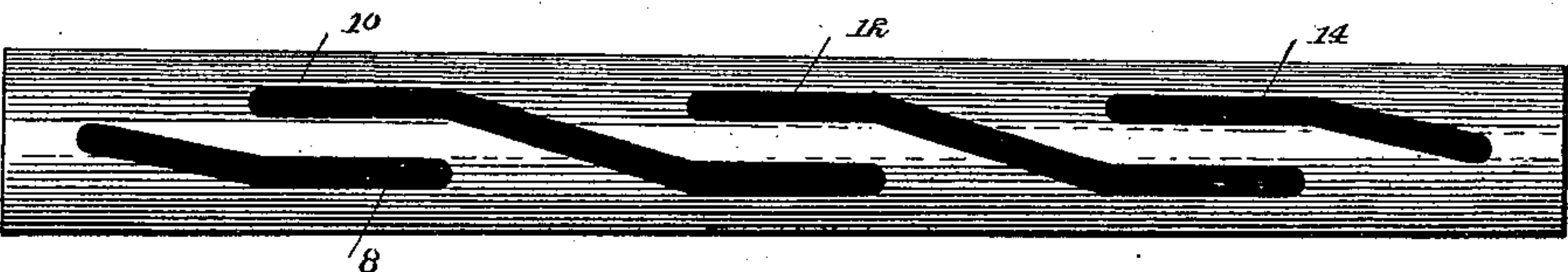


Fig. 6.



WITNESSES

Edwin T. Yewell,
Wm. J. Huntmann.

INVENTOR

E. Andrews
By Johnston, Reinohl & Dyre
his Attorneys

UNITED STATES PATENT OFFICE.

EDWARD ANDREWS, OF POTTSVILLE, ASSIGNOR OF ONE-HALF TO ROBERT
H. COLEMAN, OF CORNWALL, PENNSYLVANIA.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 354,323, dated December 21, 1886.

Application filed September 28, 1886. Serial No. 214,776. (No model.)

To all whom it may concern:

Be it known that I, EDWARD ANDREWS, a citizen of the United States, residing at Pottsville, in the county of Schuylkill and State of Pennsylvania, have invented certain new and useful Improvements in Compound 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.

My invention relates to compound engines, and has for its object the construction of a simple compact engine at a very small cost; and it consists, principally, in the construction of a valve for controlling the supply of a motor-fluid and for reversing the engine.

The invention will be hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a side elevation of my compound engine. Fig. 2 is a transverse vertical section of one of the engines. Figs. 3 and 4 are views showing the ports or channels in the valve for reversing the engine. Figs. 5 and 6 are views showing the ports or channels for conducting the motor-fluid to and from one engine to another.

Reference being had to the drawings and the letters thereon, A B C represent the cylinders of my compound engine, and are graduated in the ratio as 5, 7, and 10 are to each other. The fluid by which the engines are propelled is admitted into A, and exhausted from it into B, and exhausted from it into C, from which it may be conducted to a condenser in the usual manner.

The cylinders are constructed in sections *a* *b*. The lower one, *b*, of each cylinder is convex on its end *c*, and has its bearing in a detachable seat, D, which is provided with a concave bearing-surface, *d*. A single rectangular port or passage, *e*, is formed in the end of each cylinder, and the seats D are each provided with two corresponding passages, *f* *g*, with which the ports *e* in the cylinders communicate alternately as the engines vibrate in their seats, and through which the motor-fluid is admitted and exhausted.

Each lower section, *b*, of the cylinders is

provided with trunnions, to which an equalizing-yoke is attached and secured to the bed-plate of the engine. The construction of the cylinders and the equalizing-yoke is fully set forth and claimed in another application of the same date of filing, numbered 214,778, and need not, therefore, herein be further elucidated.

E represents the crank-shaft, to which the several pistons *h i k* are directly attached, and is supported in journal-boxes *l m* on the standards *n o*, which rest upon and are secured to the bed-plate.

F represents the bed-plate of the engines, to which the seats D are bolted, and is provided with a valve chamber or seat, *p*, for the reception of a valve, G, which is, by preference, made slightly conical, as shown. In the periphery of the valve are formed channels or passages 1, 2, 3, and 4, which extend nearly throughout the length of the valve, and are employed for supplying fluid to and reversing the motion of the engine. The angular ends 5 of the channels 1 and 4 register with the supply-pipe H, and the corresponding ends, 6, of the channels 2 and 3 register with the exhaust-pipe I. The channels 7 or 8 conduct the motor-fluid to the first or high-pressure cylinder, A, and the channels 9 or 10 exhaust it therefrom into the second cylinder, B, from which it is exhausted through the channel 11 or 12 into the cylinder C, from which it is exhausted through the channel 13 or 14 into the pipe I, and conducted to a suitable condenser.

The operation of the engine is as follows: The direction in which the engine is to run having been determined, one of the channels 5 is brought into position to register with the supply-pipe H, when the motor-fluid will be supplied to all of the cylinders in the series at its initial pressure. Should it be desired to work the motor-fluid expansively or to compound the engines, the valve is turned one-fourth ($\frac{1}{4}$) of a revolution, and one of the channels 7 or 8 brought into register with the supply-pipe, when the fluid will enter the first cylinder, A, and operate its piston, and be exhausted through the channel 9 or 10 into the second cylinder, B, and from it into the cylinder C. To reverse the engines, the valve is

turned one-half ($\frac{1}{2}$) of a revolution, whether the engines are all working under full boiler-pressure or expansively.

By the construction described a very simple and efficient compound engine is produced, in which the cylinders in their vibrations control the supply of steam or other motor-fluid to and from them, and in which the supply-valve serves to supply all of the engines in the series with a motor-fluid at its initial pressure, reverses the engines, and converts them into compound engines at the will of the attendant.

Having thus fully described my invention, what I claim is—

15 1. The combination of two or more vibrating cylinders having passages in their seated ends, a bed-plate having a valve-chamber extending throughout its length, and an adjustable valve adapted to said chamber and provided with passages communicating with each
20 of the cylinders for conducting a motor-fluid to and from said cylinders and for reversing the motion of the engines, substantially as described.

25 2. The combination of two or more vibrating cylinders having passages in their seated ends, a bed-plate having a valve-chamber extending throughout its length, and a valve provided with passages constructed to put the

cylinders in communication with each other, and with the supply and exhaust pipes, whereby a motor-fluid is conducted into the first cylinder under its initial pressure and exhausted into another and used expansively, substantially as described. 30

3. The combination of two or more vibrating cylinders, each having a passage in its seated end, a bed-plate having a valve-chamber extending throughout its length, and an adjustable valve provided with passages communicating with each of the cylinders and passages for conducting a motor-fluid into and from one cylinder into another, substantially as described. 35

4. The combination of two or more cylinders constructed to form a valve for admitting and discharging a motor-fluid and a valve provided with passages communicating with each cylinder in the series, and adapted to conduct a motor-fluid to and from each cylinder and to reverse the engines, substantially as described. 40

In testimony whereof I affix my signature in presence of two witnesses. 50

EDWARD ANDREWS.

Witnesses:

S. A. TERRY,

D. C. REINOHLE.