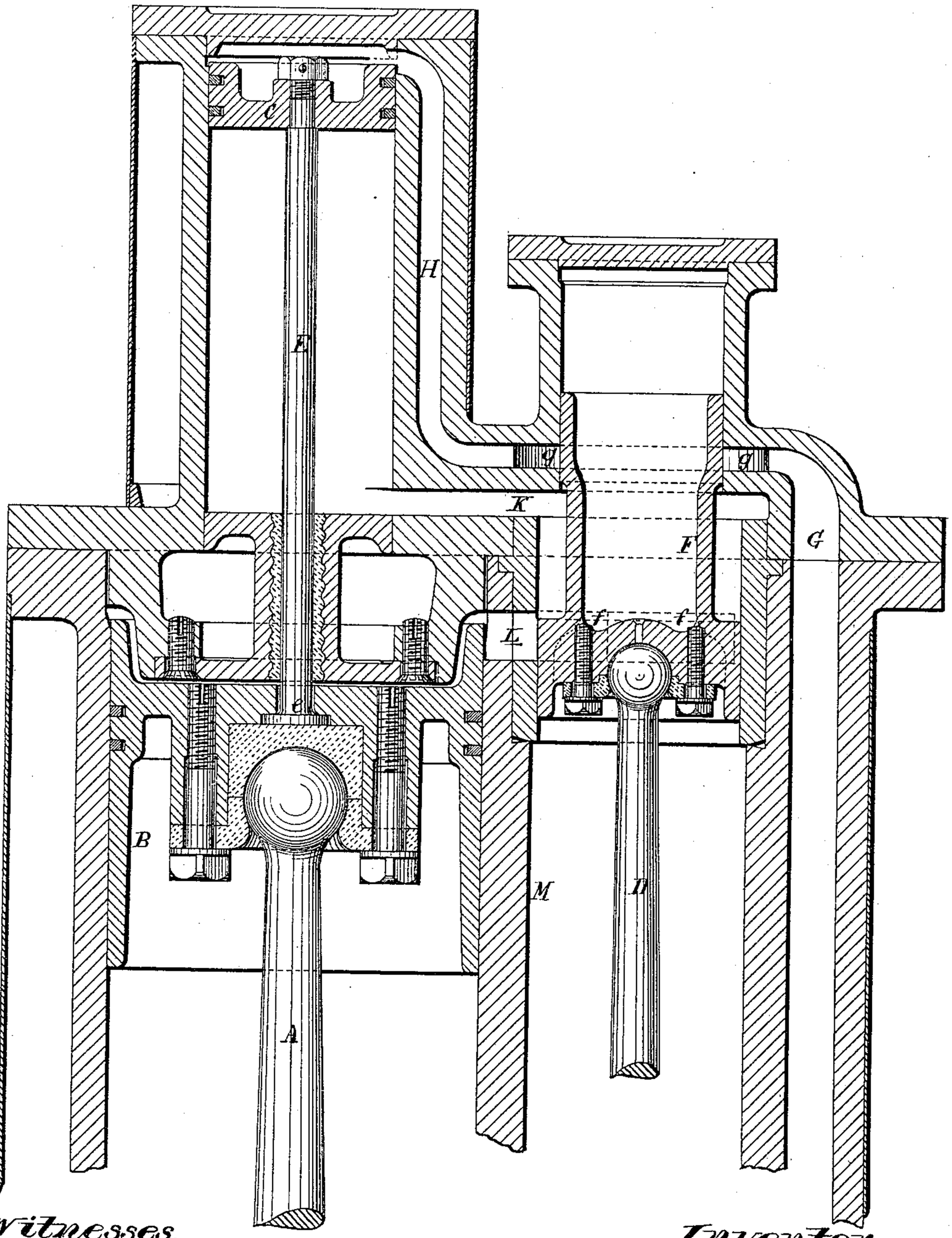
(No Model.)

P. BROTHERHOOD.

COMPOUND ENGINE.

No. 332,484. Patented Dec. 15, 1885.



Witnesses.
J. A. Rutherford
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UNITED STATES PATENT OFFICE.

PETER BROTHERHOOD, OF LAMBETH, COUNTY OF SURREY, ENGLAND.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 332,484, dated December 15, 1885.

Application filed February 12, 1885. Serial No. 155,742. (No model.) Patented in England October 17, 1884, No. 13,756.

To all whom it may concern:

Be it known that I, PETER BROTHERHOOD, a citizen of England, residing at Lambeth, in the county of Surrey, England, have invented a new and useful Improved Arrangement of Cylinders and Slide-Valve for Compound Engines, (for which I have made application for a patent in Great Britain, dated October 17, 1884, No. 13,756,) of which the following is a specification.

My invention relates to an arrangement of cylinders and slide-valve suited for the compound action of steam or other elastic fluid under pressure—that is to say, for the action of the fluid first in a small cylinder and afterward in a larger cylinder, in which it expands.

The object which I have in view is to simplify the construction and action of the slide-valve and ports and passages which it governs, to avoid waste of the working-fluid, and to maintain a strain on the connecting-rod joints always in a direction of thrust.

The accompanying drawing is a section through the slide-valve, the small or high-pressure cylinder, and part of the larger or expansion cylinder arranged according to my invention. The connecting-rod A may be spherically jointed, as shown, to the low-pressure piston B; or it might be jointed with a pin passing through an eye in the usual way, and in like manner the rod D, which works the slide-valve from an eccentric, may be jointed to slide; or, instead of connecting-rods A and D, such as are suitable for connecting directly to cranks or eccentrics, the piston and slide-valve may have rigid rods, according to the arrangement of engine to which the invention is applied. The piston C of the small cylinder has a rod, E, which may simply butt against the larger piston, B, but is preferably attached to it by a collar, as shown at *e*, with certain freedom of jointing, to allow for slight errors of eccentricity of the two cylinders. The slide-valve F is cylindrical, with passages through its end, as indicated by the dotted lines at *f*. The front end of the slide-valve is larger in area than the hinder end, so that there is always a pressure urging the slide-valve forward, and so imposing a thrust-strain on the slide-valve rod. The steam or working-fluid is supplied by the passage G to an annular cavity, *g*, surrounding the slide-valve, from which cavity it has free communication by a passage, H, to the hinder end of the small cylinder, so that there is always full pressure on the piston C, tending to force it forward. The slide-valve F governs the port K, leading to the front end of the small cylinder, and the port L, leading to the hinder end of the large cylinder. When the slide moves backward, it first closes L, then it puts K in communication with *g*, and finally it uncovers L, putting it in communication with the space M. In this condition the pressure on both sides of the piston C is equal, and the pressure behind the piston B being relieved by the escape of the exhaust through L to M, the pistons are moved back by the action of the crank to which they are connected, fluid entering the small cylinder in front of the piston C. When the slide moves forward again, it closes the communication from L to M, and from *g* to K, and puts K and L in communication, as shown in the drawing. The full pressure now acts on the back of the piston C, while the fluid in front of it loses pressure as it expands into the larger cylinder and acts on the back of the piston B. Both pistons are thus propelled, imparting power to the crank.

Although I have shown only one slide-valve with one small cylinder and part of one large single-acting cylinder, it is to be understood that two, three, or more sets of these are to be arranged in connection with one crank-shaft. Thus three or more sets might be arranged side by side, each acting on a separate crank on the shaft; or they might be arranged radially around the shaft, as in the Brotherhood engine, all the pistons acting on a single crank.

Having thus described the nature of my invention and the best means I know for carrying the same out in practice, what I claim is—

The combination of a small or high-pressure cylinder with a larger or expansion cylinder, single-acting and in line with the small cylinder, and a slide-valve and ports so arranged that while the full pressure acts constantly on the back of the smaller piston it

acts on its front during the back-stroke, the larger cylinder then discharging exhaust, and during the forward stroke the fluid that had acted in front of the smaller piston expands into the larger cylinder, acting on the larger piston, substantially as herein described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 22d day of January, A. D. 1885.

PETER BROTHERHOOD.

Witnesses:

JNO. P. M. MILLARD,

HERBERT E. DALE.