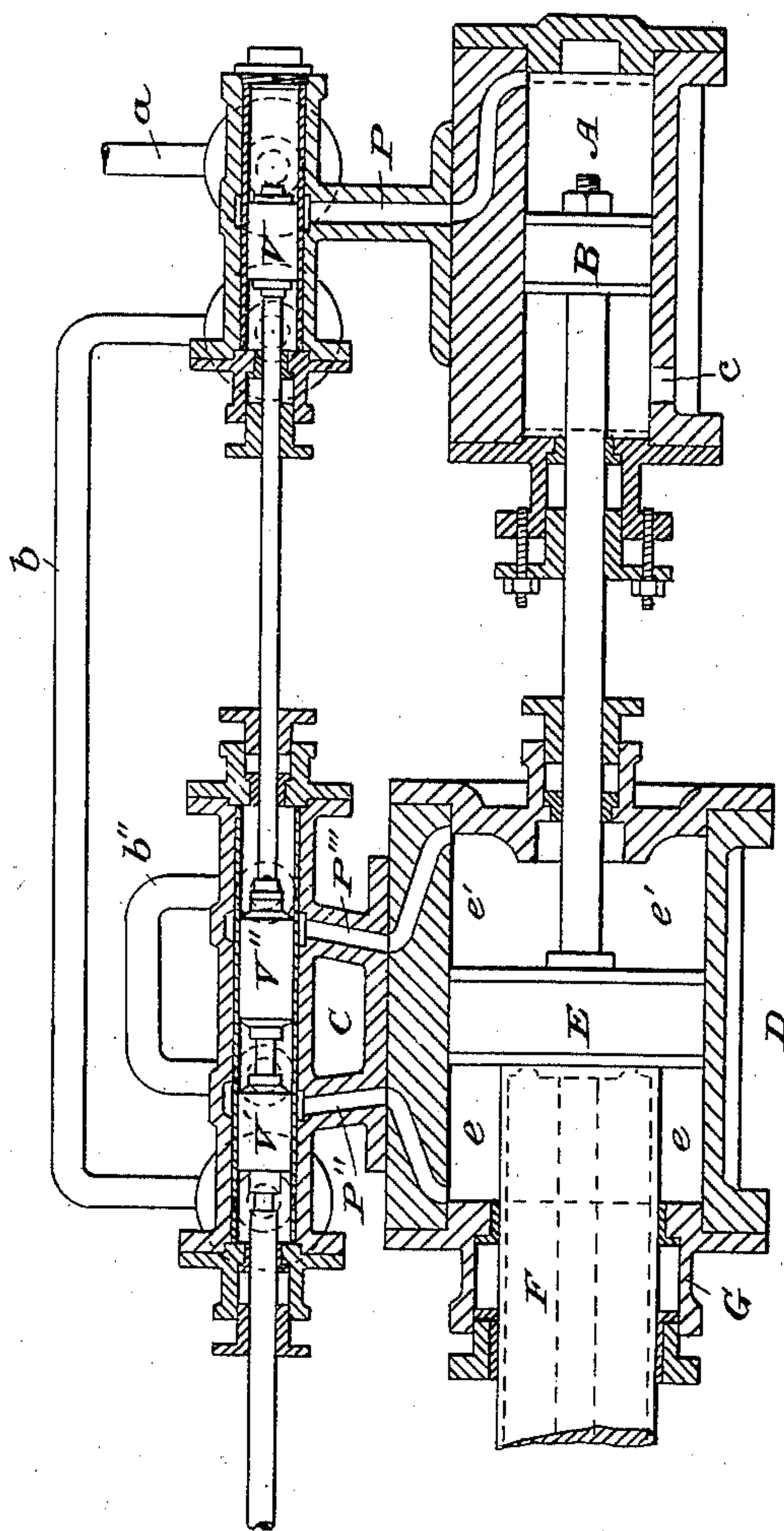


(No Model.)

E. C. URRY & G. A. FARINI.  
MULTIPLE EXPANSION STEAM ENGINE.

No. 466,855.

Patented Jan. 12, 1892.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

EDWIN CHARLES URRY AND GUILLERMO ANTONIO FARINI, OF LONDON,  
ENGLAND.

## MULTIPLE-EXPANSION STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 466,855, dated January 12, 1892.

Application filed February 13, 1891. Serial No. 381,394. (No model.)

*To all whom it may concern:*

Be it known that we, EDWIN CHARLES URRY, engineer, and GUILLERMO ANTONIO FARINI, gentleman, British subjects, residing in London, England, do hereby declare that we have invented certain new and useful Improvements in Multiple-Expansion Steam-Engines, to be fully set forth in and by the following description with reference to the appended drawings.

Our invention relates to improvements in multiple-expansion steam-engines and appliances in connection therewith, and has for its objects, primarily, the utilization as useful work of a greater percentage of the thermodynamic value of the fuel consumed than is the case with other engines in which the elasticity of steam under pressure is used as a medium of transference as hitherto constructed; secondly, we are enabled to reduce the number of parts in such engines and generally to simplify the construction thereof.

In order that our invention may be clearly understood, we have appended the accompanying sheet of drawings, representing a longitudinal section of the operative parts of an engine constructed according to our said invention.

The principle adopted by us consists in dispensing with one or more cylinders and the valve-gear appertaining thereto as ordinarily employed to produce a multiple-expansive effect, and although we do not limit the number of expansions the following description of a triple-expansive engine with reference to the appended drawings will suffice to explain the nature thereof. We employ a single-acting high-pressure cylinder A, into which the steam is admitted at *a* at the highest pressure directly from the generator. The action takes place upon one side only of the piston B, the other side being neutral throughout the cycle, by means of an opening *c*, which communicates either with the condenser or the atmosphere. In combination with the aforesaid high-pressure cylinder A we employ a double-acting cylinder D, with a piston E, preferably arranged in the manner generally known as "tandem." A series of valves V V' V'', preferably of the piston type, are arranged upon or are operated by one rod and

a cam, eccentric, crank, or other device upon the crank-shaft. The valve V regulates the admission and exhaust in the cylinder A, and in the position as shown by the drawings is cutting off the inlet at half-stroke. A continuation of the backward movement of said valve opens the port *p* on the exhaust side and the cylinder is exhausted through duct *b*, which may be a pipe or a suitable channel formed in the castings. From thence the exhaust-steam is conducted to the steam side of the valve V', which at this period uncovers the port *p''* and allows the pressure to act upon the side *e* of the piston E, which acts as an intermediate expansive effect. The continuation of the respective movements of the connected pistons and valves eventually opens the port *p''* upon the exhaust side of the valve V' and enables the exhaust from *e* to pass to *e'* by means of the pipe or channel *b''*. At this period the valve V'' has uncovered the port *p'''*, and the final expansive effect is carried out in *e'* upon the piston E. Upon the completion of this part of the stroke the valve V'', by its return movement, uncovers the port *p'''* upon the exhaust side, and the final attenuated pressure passes through a channel or pipe C to the condenser or to the atmosphere. In this manner and by these means we are enabled to procure a triple-expansive effect by the employment of two cylinders only, the first expansion taking place in A, the second in the side *e* of the cylinder D, and the third and final in *e'*.

In order to maintain the proper ratio of the areas acted upon in the double-acting cylinder D relatively to the degree of expansion, and also for the purpose of simplifying the general construction of the engine, we employ a sleeve or trunk F, attached to the piston E. Said trunk is of predetermined diameter, so as to diminish the capacity of the side *e* of the cylinder D, and may be effectively utilized as an auxiliary or primary guide, and a suitable gland and stuffing-box G is provided to enable said trunk to work freely and render it steam-tight.

It is evident from the foregoing description that we are, according to our invention, enabled to produce a triple-expansive effect in an extremely simple and effective manner,



and by extending the series, as described and shown by the drawings, so that other sets of cylinders, pistons, and valves similar thereto may be superimposed one set upon the other, 5 horizontally, vertically, or diagonally arranged, we can carry out a multiple-expansive effect to any extent within the limits of practicability. Thus we are enabled to effect the objects of our said invention, as herein 10 set forth, since the value of steam at a high initial pressure as a means for transferring and converting the energy derived from the combustion of fuel is thereby utilized to the greatest practicable extent, and the elimina- 15 tion of one cylinder in a triple-expansive effect considerably reduces the number of working parts and the space occupied relatively to the engines as hitherto constructed.

Having now described the nature of our said invention and in what manner the same 20 is to be performed, we declare that what we claim is—

In a multiple-expansive steam-engine, the combination of two cylinders A and D of unequal capacity, pistons B and E in said cylin- 25 ders, respectively, and carried by a single rod, trunk F, and valves V V' V'', all carried by a single rod, substantially as set forth.

In witness whereof we have hereunto set our hands in the presence of two witnesses.

EDWIN CHARLES URRY.

GUILLERMO ANTONIO FARINI.

Witnesses:

M. A. WALSH,

A. S. BÜSING.