

(No Model.)

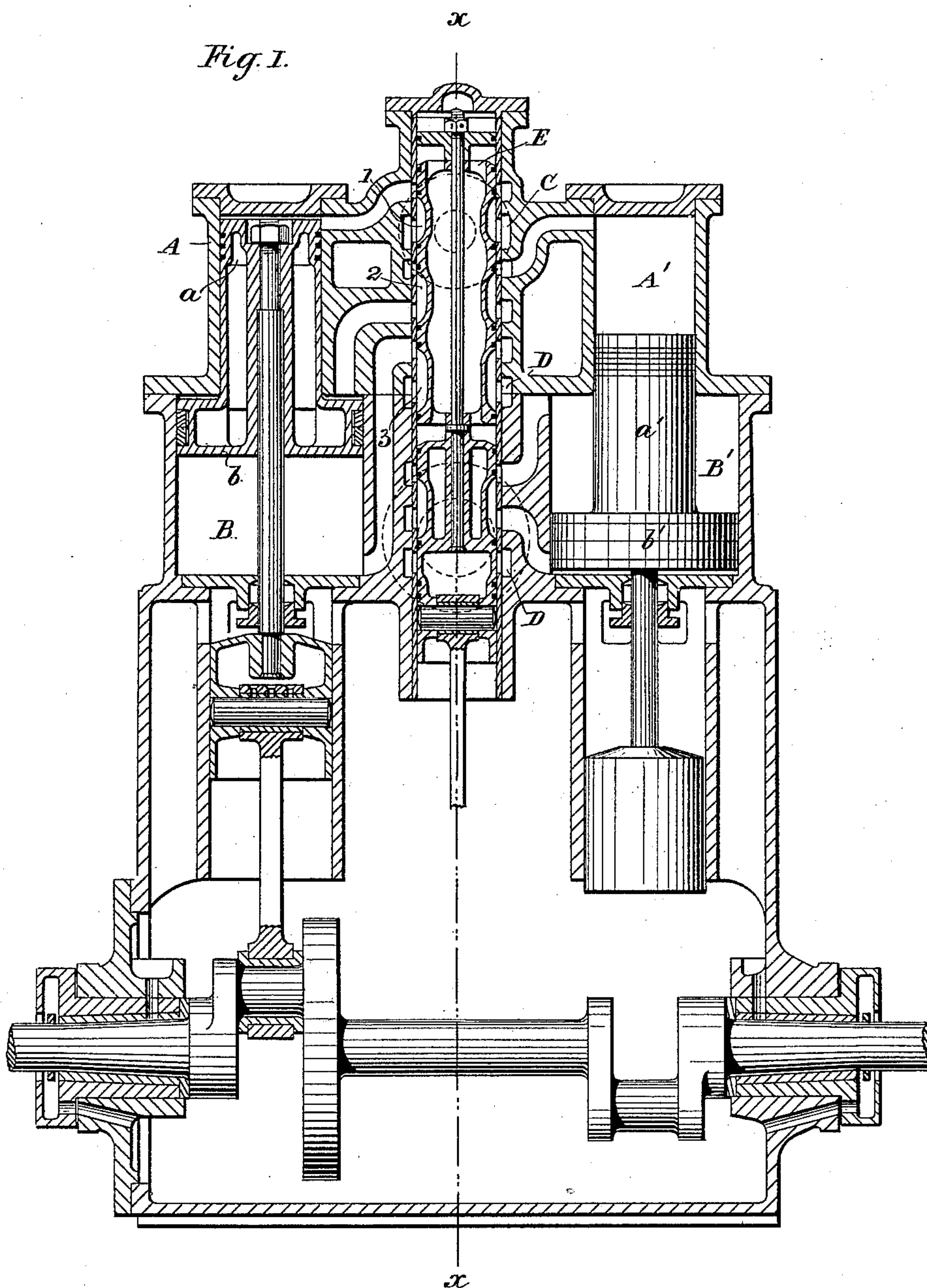
2 Sheets—Sheet 1.

A. G. BROWN.

COMPOUND OR EXPANSIVE ENGINE.

No. 391,941.

Patented Oct. 30, 1888.



Witnesses.

N. B. Knappell.
A. E. Farnsman.

Inventor.

A. G. Brown,
by Foster Freeman.
Attys.

(No Model.)

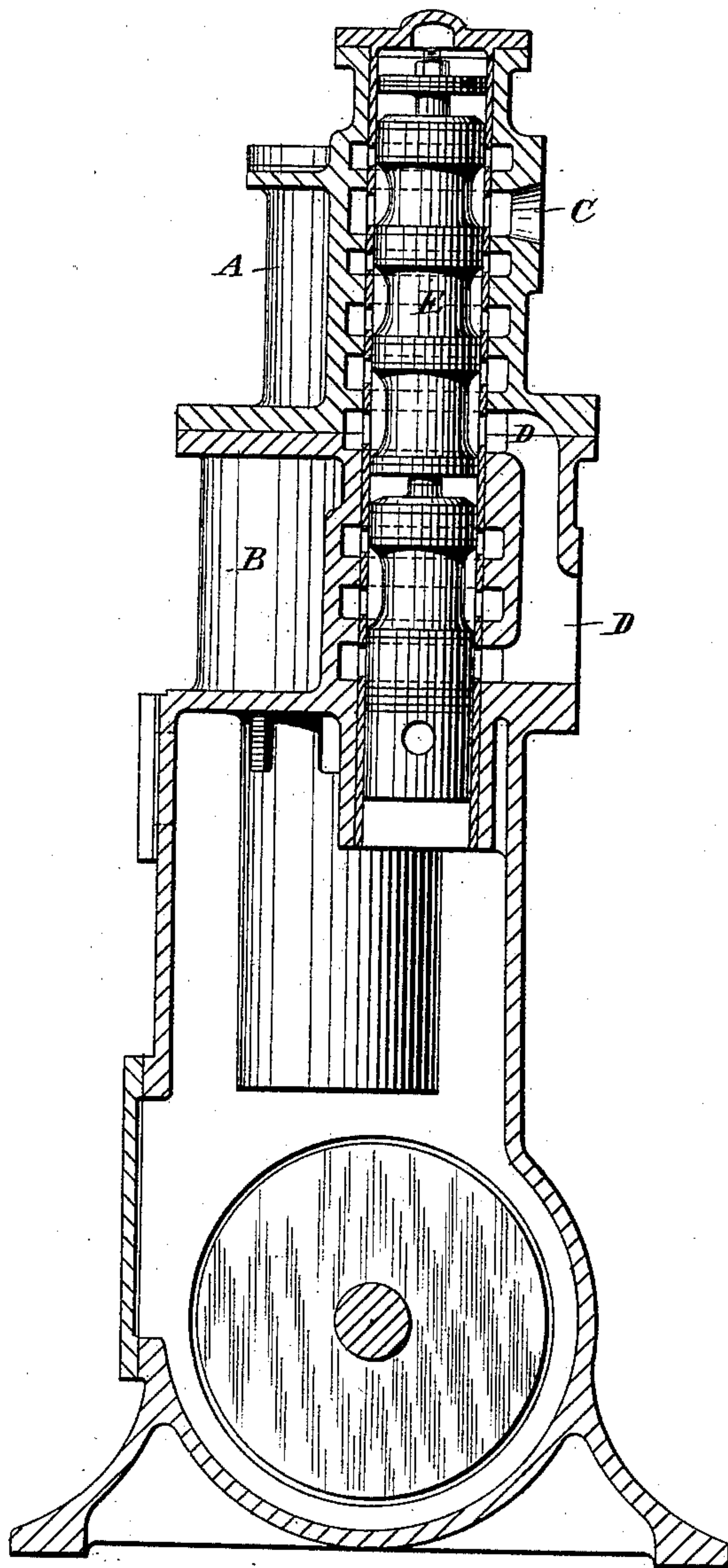
2 Sheets—Sheet 2.

A. G. BROWN.
COMPOUND OR EXPANSIVE ENGINE.

No. 391,941.

Patented Oct. 30, 1888.

Fig. 2.



Witnesses.

N. S. Campbell.
A. E. Farnham.

Inventor.

A. G. Brown.
by Foster & Freeman.
attys.

UNITED STATES PATENT OFFICE.

ARTHUR G. BROWN, OF CATHCART, SCOTLAND.

COMPOUND OR EXPANSIVE ENGINE.

SPECIFICATION forming part of Letters Patent No. 391,941, dated October 30, 1888.

Application filed March 14, 1888. Serial No. 267,141. (No model.) Patented in England April 6, 1887, No. 5,135; in France February 18, 1888, No. 188,821, and in Belgium February 20, 1888, No. 80,708.

To all whom it may concern:

Be it known that I, ARTHUR GEORGE BROWN, a citizen of the United States, residing at Cathcart, North Britain, have invented
5 a new and useful Improvement in Compound or Expansive Engines, (the same having been patented to me in British Patent No. 5,135, of April 6, 1887; Belgium, No. 80,708, of February 20, 1888, and French Patent No. 188,821,
10 of February 18, 1888,) of which the following is a specification.

This invention relates to that class of motive-power engines which have what are known as high and low pressure cylinders, the pressure,
15 after being utilized in the former, passing to the latter through a suitable valve, and being there allowed to further expand before being exhausted to a condenser or to waste.

For convenience of illustration I will describe my invention when applied in what is known as a "triple-expansion" and also in a four-cylinder engine. Such an engine is illustrated in the accompanying drawings, in which—

25 Figure 1 represents a sectional elevation through the four cylinders and the valve, and Fig. 2 an elevation on the line *x x*.

Valves substantially of a Maltese-cross section, working in cylindrical pressure-chests
30 and performing only a partial rotation, being also provided with a groove or communicating-port, which momentarily opens communication between the cylinders of the same class, may be used with these engines; and such
35 valves are fully described in an application for a patent, filed by me and of even date herewith; but I do not confine myself to the use of such valves in the construction of the engines, and therefore show a species of cylindrical
40 slide-valve, as from my said specification of even date the application of my improved valve will be clearly understood.

In the drawings, A A' are the high-pressure cylinders, which carry pistons *a a'*, while the
45 low-pressure cylinders B B' carry pistons *b b'*, pistons *a b* being carried by one piston-rod and pistons *a' b'* by a second.

C is the steam-inlet, D the exhaust, and E the hollow valve.

50 When the parts are in the position shown,

the steam entering by C passes around the space or recess 1 in the valve, and thence to top of piston *a* in cylinder A, the valve at the same time opening the exhaust from the top of piston *a'*, from whence the steam passes by
55 recess 2 to the top of piston *b* in cylinder B, and the exhaust from beneath piston *b* is opened to discharge D. As pistons *a b* travel down their respective cylinders, the valve cuts off steam from the top of piston *a* and opens
60 exhaust from above said piston through the center of the hollow valve E to the top of piston *b'*, steam at the same time being admitted to the top of piston *a'* and the exhaust
65 opened to discharge from beneath piston *b'*. In the meantime the exhaust from the top of piston *b* has been opened to the bottom of said piston through recess 3 in the valve; and if a condenser be employed I will thus secure
70 a final exhaust, pulling in the same direction and at the same time as the high and low pressure pistons on the same piston-rod are moving.

It will be understood that the complete operation alternately takes place in cylinders A
75 B' and A' B, and that the valve E is operated from the crank-shaft in the usual manner.

It will be noted on reference to the drawings that there is a considerable difference between the top and bottom area of the low-pressure
80 piston, the effect of this construction being that as communication is opened through recess 3 the pressure per square inch is practically equalized on the top and bottom of said piston and the tendency is to raise said piston, and
85 thus the wear on the crank and wrist pins, as also on the bearings, is minimized. On the downstroke of the piston the valve cuts off the final exhaust before the piston reaches its low-
90 est point, thus entrapping a portion of the steam, which forms a cushion in the cylinder and relieves the pressure on the bearings and pins.

It will be observed that a single valve situated in a position between the cylinders is employed to give direction to steam for the four
95 cylinders shown, and that the course of the steam is from the high-pressure cylinder on one side of the valve to the top of the low-pressure cylinder on the opposite side, and
100

thence to the bottom of the same low-pressure cylinder, from which it finally exhausts.

I am aware that it is not new in single-acting four-cylinder engines to exhaust from the top of the high-pressure cylinder on one side to the top of the low-pressure cylinder upon the other; but in this construction the final exhaust has always been taken from the top of the low-pressure piston, and to this construction I lay no claim; but

What I do claim, and desire to secure by Letters Patent, is—

1. In a compound steam-engine, the combination of the high-pressure cylinder and piston, the low-pressure cylinder and piston, the area of the latter being greater on one side than on the other, a steam-passage communicating between the opposite sides of the low-pressure piston, and a valve which controls said passage, whereby the steam from the side of the piston having the less area is passed to the side having the greater area, substantially as described.

2. In a four cylinder compound steam-engine, the combination of the two high-pressure cylinders and pistons, the two low-pressure cylinders and pistons, the latter being of unequal area upon their opposite sides, the steam-passages from the high-pressure cylinders to the low-pressure cylinders on the side of the

pistons having the smaller areas, the communicating steam-passages between the portions of the low-pressure cylinders on opposite sides of their pistons, and a valve which controls all of said passages, whereby the steam is first delivered to the high-pressure cylinders, then to the low-pressure cylinders on the sides of their pistons having the smaller areas, and then to the low-pressure cylinders on the opposite sides of the said pistons, substantially as described.

3. In a compound steam-engine, the combination of the two high-pressure cylinders and their pistons, and the two low-pressure cylinders and their pistons arranged below the high-pressure cylinders, a valve between the said cylinders, steam-passages from the high-pressure cylinders to the opposite low-pressure cylinders, and steam-passages connecting the opposite ends of each low-pressure cylinder, the said passages being controlled by the said valve, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

A. G. BROWN.

Witnesses:

WM. ANDREW,
J. W. FERGUSON.