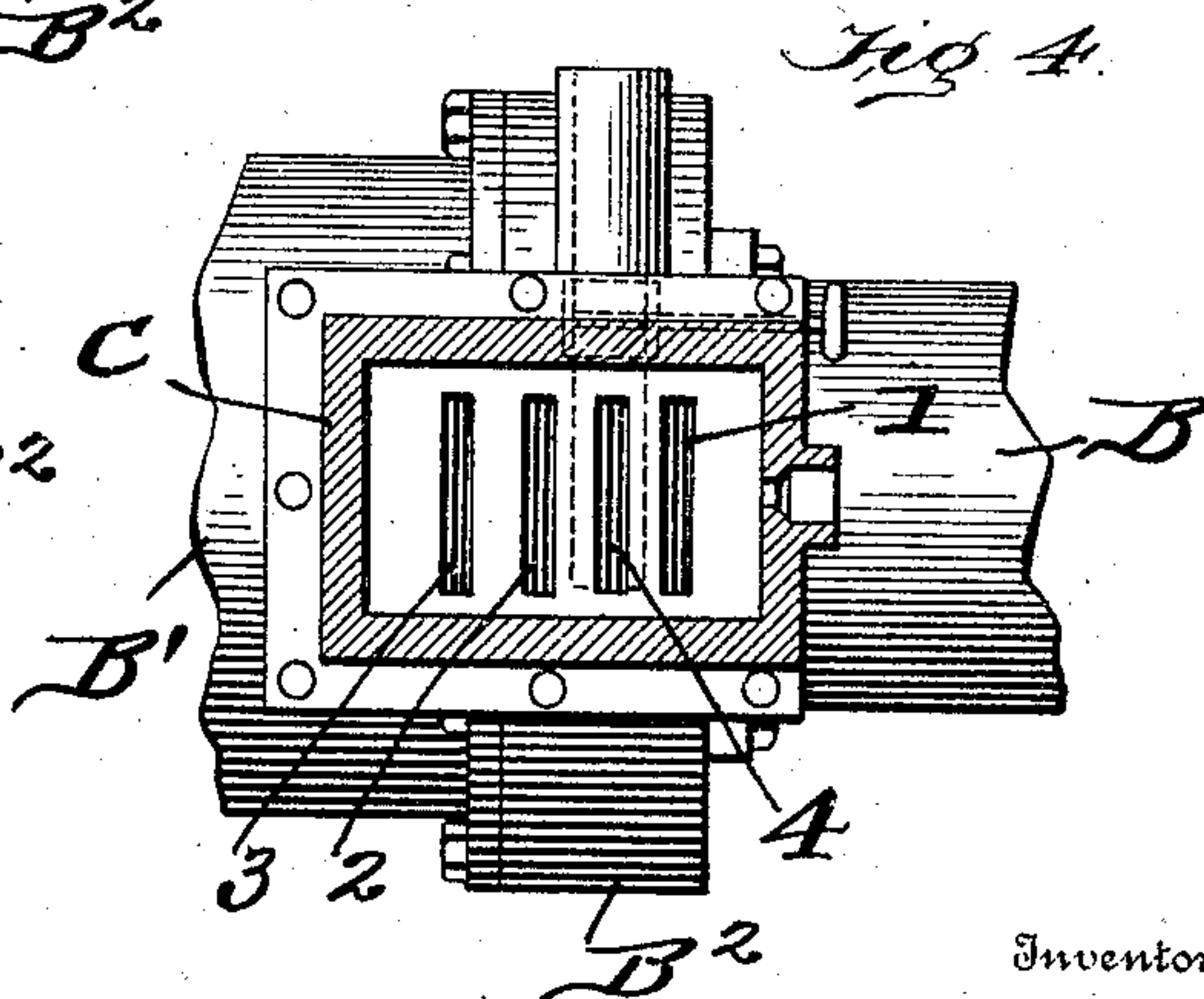
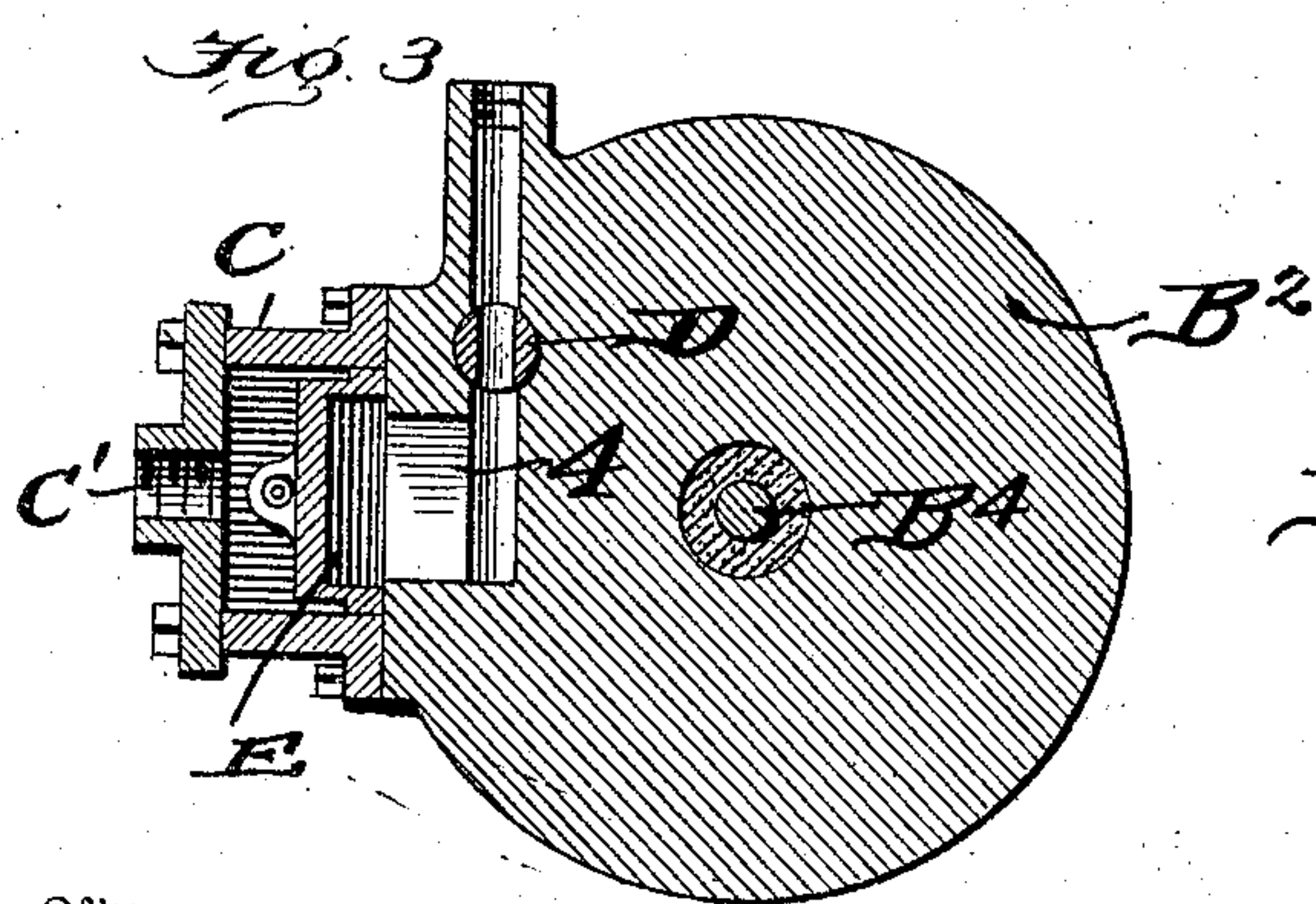
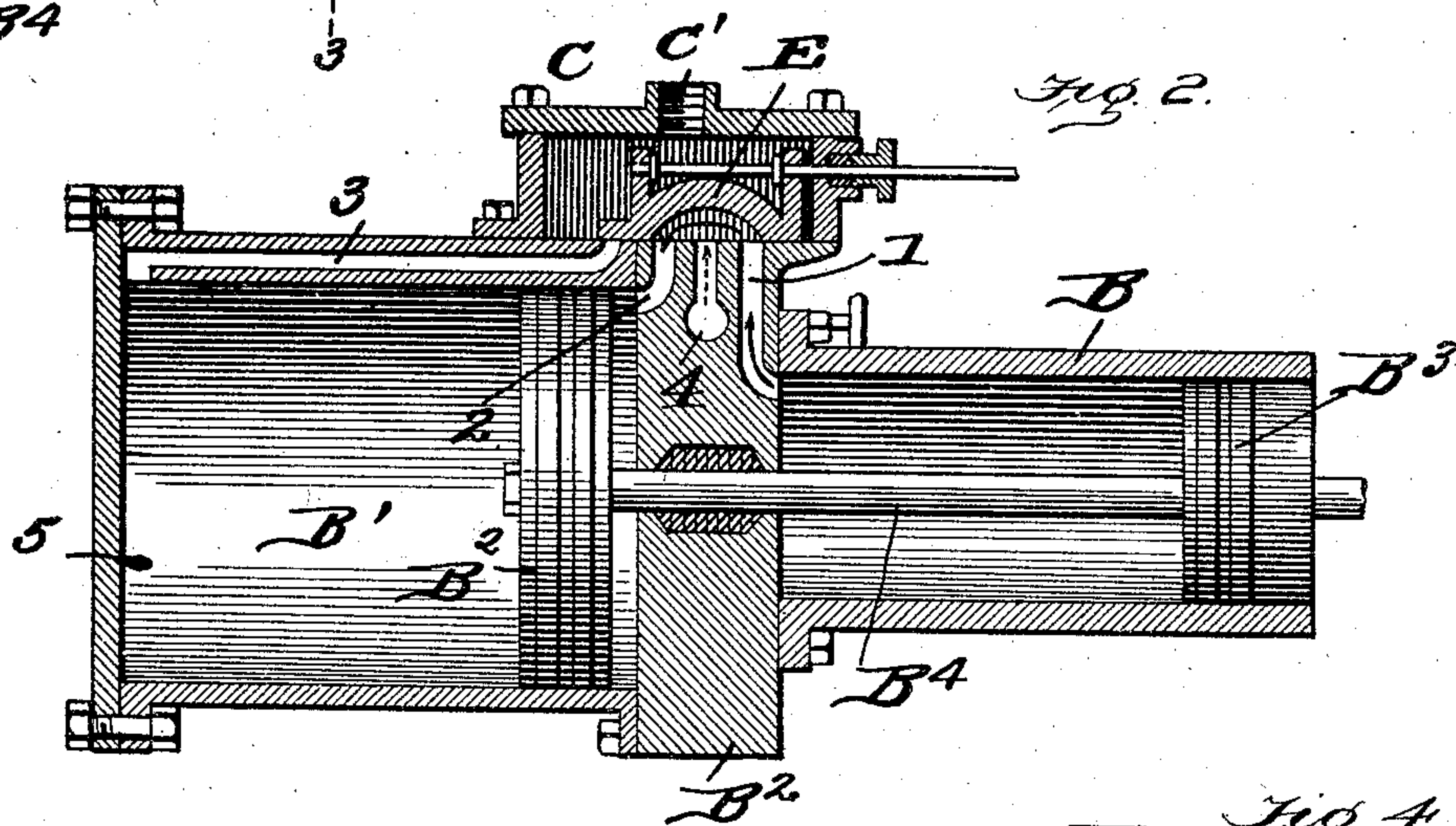
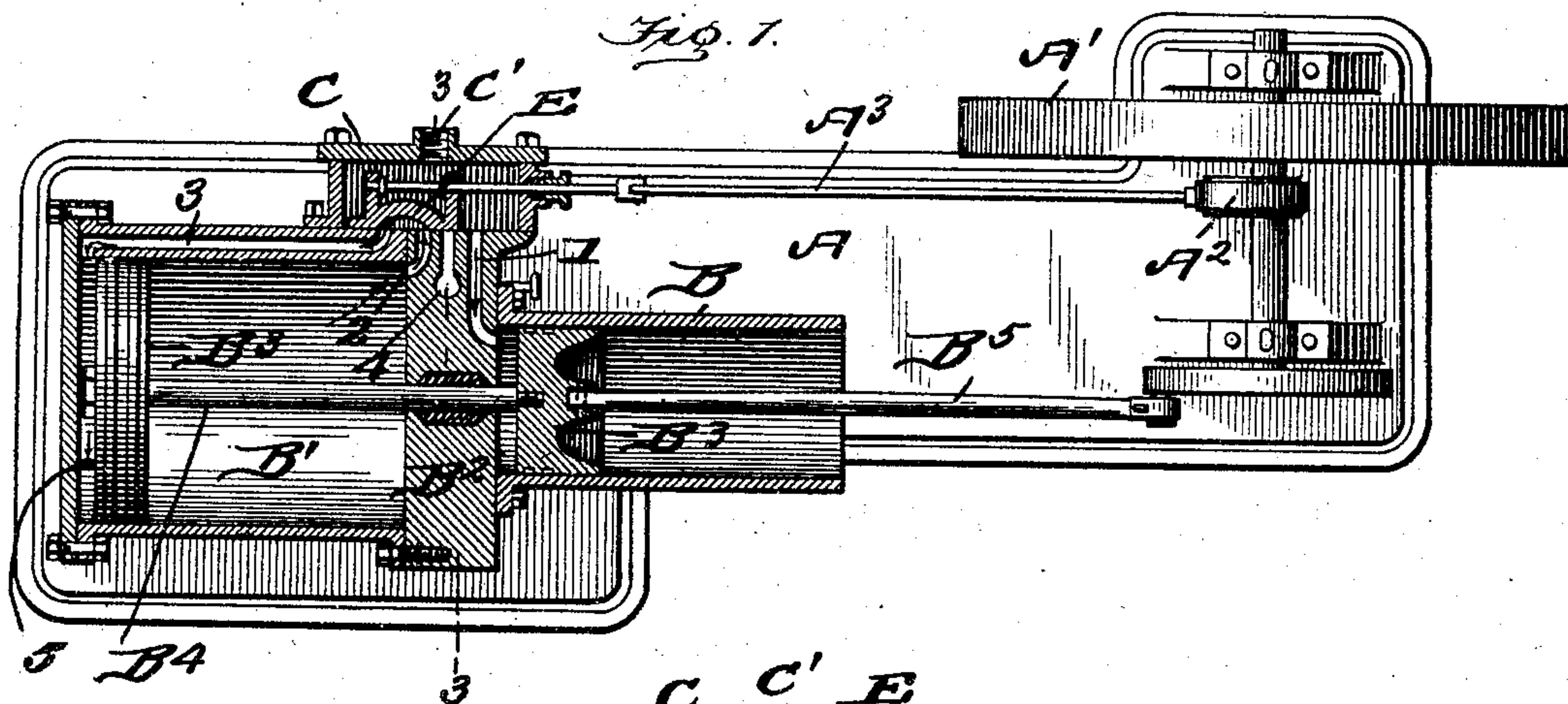


No. 785,376.

PATENTED MAR. 21, 1905.

H. H. PILCHER.
COMPOUND STEAM ENGINE.
APPLICATION FILED MAR. 24, 1904.



Witnesses

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COMPOUND STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 785,376, dated March 21, 1905.

Application filed March 24, 1904. Serial No. 199,733.

To all whom it may concern:

Be it known that I, HERBERT H. PILCHER, a citizen of the United States, residing at Memphis, in the county of Shelby and State of Tennessee, have invented a new and useful Improvement in Compound Steam-Engines, of which the following is a specification.

This invention relates to that class of compound engines having tandem-arranged high and low pressure cylinders, a piston in each, a common piston-rod, means for admitting steam into the high-pressure cylinder, and means for passing the steam from the high-pressure cylinder to the low-pressure cylinder, where a second expansion occurs.

The object of this invention is to construct an engine of this type which will be as easily understood and operated as the ordinary simple steam-engine and which can be constructed at a cost not to exceed that of the usual type of simple engine.

Compound engines as usually constructed are of such complicated design and construction that they have a high initial cost, are of such delicate adjustment as to make their maintenance expensive, and are at the same time wasteful of energy by reason of undue expansion of steam through long ports and intricate valves.

A further object of this invention is to provide an auxiliary port and valve whereby steam may be admitted directly from the boiler to the low-pressure cylinder, thereby enabling the engine to be operated as a simple engine and also to be started with the valve in any position.

The invention consists in the novel features of construction and combination of parts hereinafter described, particularly pointed out in the claims, and shown in the accompanying drawings, in which—

Figure 1 is a plan view of the engine, the cylinders, valve-casing, slide-valve, and one piston being shown in section. Fig. 2 is a longitudinal horizontal section through the high and low pressure cylinders, the pistons being shown in elevation. Fig. 3 is a section on the line 3 3 of Fig. 1. Fig. 4 is a detail

elevation, the valve-casing being shown in section.

In the drawings, A represents the bed-plate, A' a fly-wheel, A² an eccentric-strap, and A³ the eccentric-rod, actuating the slide-valve, and all of the usual construction.

On the bed-plate are mounted tandem a high-pressure cylinder B and a low-pressure cylinder B', separated by the central cylinder-head B² of more than the usual degree of thickness. The low-pressure cylinder is of greater diameter than the high-pressure cylinder B and in each are arranged pistons B³, connected by a piston-rod B⁴, passing through the cylinder-head B² and surrounded with suitable packing material. The high-pressure cylinder B is open at its forward end, and a suitable drive-rod B⁵ is connected to the piston B³ of the high-pressure cylinder.

The valve-casing C is carried by the central cylinder-head B² and the low-pressure cylinder B' and has a centrally-arranged steam-inlet C', into which an end of a steam-pipe (not shown) is threaded. Leading from this valve-casing C is a port 1, opening into the high-pressure cylinder B, and a port 2, leading from the valve-casing to the low-pressure cylinder B'. A port or passage 3 opens at one end into the valve-casing adjacent the port 2 and extends the length of the low-pressure cylinder B', opening at its opposite end into the said cylinder adjacent the rear end of the said low-pressure cylinder B'.

Arranged between the inlet-ports 1 and 2 is an auxiliary port 4, formed in the central cylinder-head B² and extending longitudinally through the head to a point below the valve-casing C between the ports 1 and 2, and the port 4 is then extended into the valve-casing C, opening into said casing between the ports 1 and 2. In the port 4 is arranged a valve D of any desired kind and adapted to be operated by hand. A steam-pipe (not shown) may be connected to the outer end of the port and admits steam from the boiler to the valve-casing C through the said port.

In the rear end portion of the low-pressure cylinder is located an exhaust-port 5. An

arched slide-valve E is arranged in the valve-casing C and is actuated by the eccentric-rod A³ in the usual manner. The arch of the valve E is of such size that it will extend 5 simultaneously over ports 1 and 2, thereby connecting the two cylinders, and the valve is of such length that when the ports 1, 2, and 4 are under the arch the valve-shoe will cover the end of the passage 3, opening into 10 the valve-casing C, as clearly shown in Fig. 2.

The operation of my engine is as follows: The parts being in the position shown in Fig. 1, steam will be admitted from the boiler through the valve-casing into the high-pressure cylinder by way of the port 1 and expanding therein will drive the pistons B³ forward, the pressure being exerted against the piston B³ in the high-pressure cylinder B only. When the pistons have reached the 20 end of their forward stroke, the valve E will be in the position in Fig. 2, admittance of steam into the high-pressure cylinder B having been cut off before the completion of the forward stroke, and in this second position 25 of the valve E the ports 1 and 2 will have communication beneath the valve-arch and the steam in the high-pressure cylinder B will pass through the said ports and expand the second time in advance of the piston B³ 30 in the low-pressure cylinder B'. It will be understood that the valve D is closed and that the exhaust-port 5 is open. When the first rearward stroke has been completed, the parts are again in the position shown in Fig. 35 1, and as steam has now been admitted to both cylinders the arrows in Fig. 1 will indicate the direction of the steam during the first part of the second and each recurring forward stroke, new live steam being admitted to the high-pressure cylinder B, and 40 the expanded steam in the low-pressure cylinder B' is forced back through the port 2, which is now cut off from communication with the port 1 and is in communication with 45 the port or passage 3, and the expanded steam is led around the piston B³ in the low-pressure cylinder and again enters said cylinder in the rear of the piston therein and is exhausted from this end of the cylinder B' 50 through the exhaust-port 5. By leading the steam through the passage 3 around the piston B³ in the low-pressure cylinder B' the back pressure on the front side of the piston is compensated for by the slight reexpansion 55 of the steam in the rear of the said piston. This not only saves waste of any remaining energy left in the steam in the low-pressure cylinder, but by equalizing the pressure on the opposite sides of the piston B³ in the low-pressure cylinder the entire energy exerted 60 by the live steam in the high-pressure cylinder B can be utilized in driving forward the piston B³ in the high-pressure cylinder B.

It will now be obvious that should the engine stop with the valve E in the position

shown in Fig. 2 instead of in the position shown in Fig. 1 live steam could not be admitted in the manner described to either of the cylinders for the purpose of starting the engine. The auxiliary valve D is therefore opened, 70 and live steam is admitted into the low-pressure cylinder B' through the port 4 and port 2 and the engine thereby started. It should also be obvious that if the valve were to stop in a position midway that shown in Figs. 1 75 and 2, covering or closing the valve-casing ends of ports 1 and 3, it would be impossible to admit steam into the cylinders through the inlet C'; but by opening the auxiliary valve D steam would be admitted to the low-pressure cylinder B', as above described. It will also be noted that, while a compound engine requires one or more revolutions before developing its normal working power, with my construction by opening the valve D more 85 than the normal working power can be developed in starting or can be used in an emergency, the live steam working directly against the piston B³ having the larger pressure area.

I do not desire to be limited to any specific 90 valve construction nor to the special arrangement of the ports and passages so long as they are grouped in such a manner as to give the desired result.

Having thus fully described my invention, 95 what I claim as new, and desire to secure by Letters Patent, is—

1. A compound engine comprising a high-pressure and a low-pressure cylinder, a common valve-casing, an arched slide-valve adapted to work in the said casing, said casing having a steam-inlet, and having ports leading therefrom and opening respectively into the high and low pressure cylinders, the said cylinders having a central cylinder-head, said 100 head having an auxiliary port formed therein and opening outwardly and also into the valve-casing, a valve in the auxiliary port, and means for admitting steam into said port direct from the boiler. 110

2. A compound engine comprising a high and a low pressure cylinder arranged tandem and having a central, common cylinder-head, a valve-casing arranged adjacent the said central cylinder-head and having a port leading 115 into the high-pressure cylinder and ports leading to each end of the low-pressure cylinder, the said low-pressure cylinder having an exhaust-port adjacent its rear end, a slide-valve adapted to work in the said casing, means for 120 admitting live steam directly into the said casing, the central cylinder-head having an auxiliary port leading to the valve-casing and opening into said casing between the ports leading to the high and low pressure cylinders respectively, and a hand-controlled valve 125 in the said auxiliary port adapted to be opened to admit live steam into the valve-casing through the auxiliary port.

3. A compound engine comprising high and 130

low pressure cylinders, a common central cylinder-head having an auxiliary port therein, a valve-casing, said casing having ports leading from the casing to the high and low pressure cylinders, respectively, means for admitting steam directly into the valve-casing, means for admitting steam from a boiler into the auxiliary port, a hand-controlled valve in the said port, and a slide-valve in the casing, said valve when in its rearmost position admitting live steam from the casing to the high-pressure cylinder and permitting passage of steam around the piston of the low-pressure cylinder, and when in its forward position permitting passage of steam from the high-pressure to the low-pressure cylinder, as and for the purpose set forth.

4. A compound engine comprising a high-pressure and a low-pressure cylinder, a valve-casing common to both cylinders, said casing having the steam-inlet C' opening therein, a port 1 leading to the high-pressure cylinder,

a port 2 leading to the low-pressure cylinder and opening into the forward end portion of said cylinder, a passage 3 leading to and opening into the rear end portion of the low-pressure cylinder, and an auxiliary port 4 opening into the casing between ports 1 and 2, a slide-valve in the casing, a valve in the auxiliary port 4, and means for admitting steam into the valve-casing through the auxiliary port 4, the said low-pressure cylinder having an exhaust-port adjacent its rear end, the said slide-valve being arched and adapted when in its forward position to span the ports 1, 2 and 4 and close the port 3, when in its rearmost position to span the ports 2 and 3, close the port 4 and clear the port 1, and in an intermediate position to span the ports 2 and 4, as and for the purposes set forth.

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Witnesses:

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