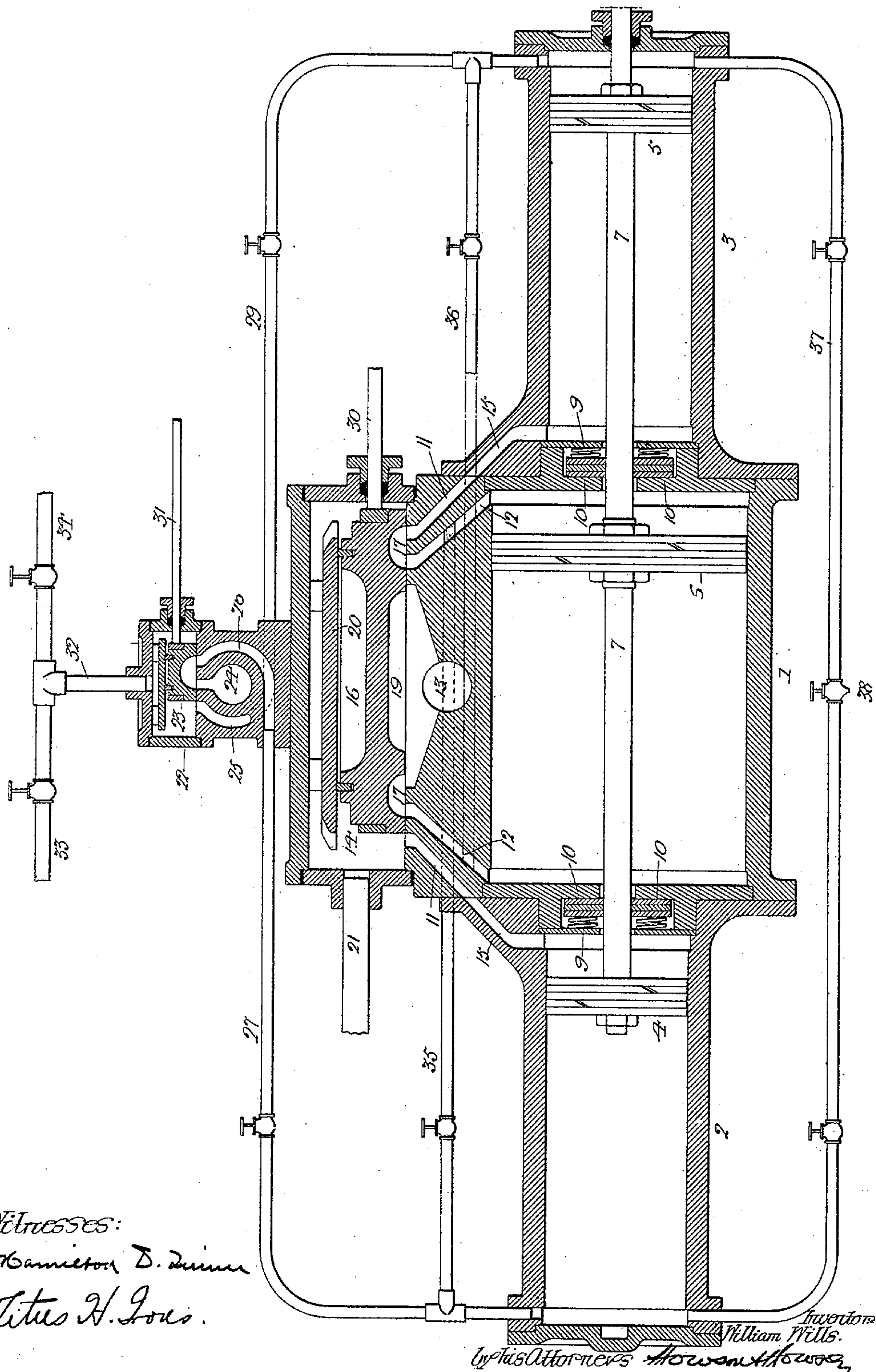


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PATENTED MAR. 27, 1906.

W. WILLS.
COMPOUND STEAM ENGINE.
APPLICATION FILED JUNE 19, 1905.



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WILLIAM WILLS, OF PHILADELPHIA, PENNSYLVANIA.

COMPOUND STEAM-ENGINE.

No. 816,411.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM WILLS, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain
5 Improvements in Compound Steam-Engines, of which the following is a specification.

My invention relates to that type of compound engine in which a single low-pressure cylinder is combined with a pair of high-pressure cylinders, the object of my invention
10 being to economically increase the power of such an engine. This object I attain in the manner hereinafter set forth, reference being had to the accompanying drawing, which
15 represents a longitudinal sectional view of a compound engine constructed in accordance with my invention.

1 represents the low-pressure cylinder of the engine, and 2 and 3 the high-pressure
20 cylinders, which in the present instance are arranged one at each end of the low-pressure cylinder; both of the high-pressure pistons 4 and 5 and also the low-pressure piston 6 being attached to a common piston-rod
25 7, which passes through a stuffing-box at the outer end of the high-pressure cylinder 3 and also passes through packing-boxes in the partitions between the low and high pressure cylinders, these packing-boxes being, by preference,
30 provided with a plurality of split rings 10, embracing the rod and maintained in steam-tight contact with the partition by means of springs 9. The low-pressure cylinder has at each end a pair of passages 11 and
35 12 and an intermediate exhaust-chamber 13, both of the passages 11 and 12 communicating with the interior of the valve-chest 14 and the passages 12 also communicating with the interior of the low-pressure cylinder, one
40 at each end of the same. The passages 11 communicate with passages 15, leading, respectively, to the inner ends of the high-pressure cylinders 2 and 3.

The valve-chest 14 contains a reciprocating
45 valve 16, having in its under face chambers 17, one near each end of the valve, and an intermediate chamber 19, the valve also having on the back a packing-ring which bears against a balancing plate 20 in the valve-
50 chest, so as to relieve the valve in great measure from the downward pressure of the steam in the chest. Live steam or other motive fluid is admitted to the valve-chest through a pipe 21 and under control of the valve 16 is
55 directed through the passages 11 and 15, first to the inner end of one high-pressure cylinder

and then to the inner end of the other high-pressure cylinder, the exhaust from the inner end of each high-pressure cylinder being directed to the adjoining end of the low-pressure cylinder through the passages 15 and 11, a chamber 17 of the valve, and a passage 12, and the exhaust from each of the low-pressure cylinders being directed to the exhaust-chamber 13 through a passage 12 and a chamber 17 of the valve, as will be readily understood from the drawing.

Usually in engines of this type the low-pressure cylinders are single-acting, although in some cases it has been proposed to connect
70 the opposite ends of the high-pressure cylinders during the inward stroke of the piston. One of the objects of my invention is to so construct an engine of this type as to admit to the outer end of each of the high-pressure
75 cylinders during the inward stroke of the piston therein a supply of steam derived either from the valve-chest 14 or from a source independent thereof, this supply of steam being in the latter case for the sake of economy
80 the exhaust from another engine operated in conjunction with the main engine—as, for instance, the engine which operates the condensing-pump employed in connection with said main engine—or being an independent
85 high-pressure supply when the maximum of additional power is required. The independent supply of steam is controlled by an independent valve-chest 22, conveniently located, this supplementary valve-chest being in the
90 present instance shown upon the back of the main valve-chest 14. This valve-chest contains an ordinary D-valve 23, balanced in the same manner as the valve 16 and operating in conjunction with an exhaust-passage 24,
95 and two induction and eduction passages 25 and 26, which are crossed in the chest, so that the right-hand passage 26 may communicate, through a valved pipe 27, with the left-hand
100 high-pressure cylinder 2 and the left-hand passage 25 may communicate, through a valved pipe 29, with the right-hand high-pressure cylinder 3. The purpose of this crossing of the passages 25 and 26 is to permit of like
105 movement of both of the valves 16 and 23, so that the rods 30 and 31 of the valves may be operated from the same moving part of the engine, it being apparent that if the passages 25 and 26 were not crossed in the manner described the direction of movement of the
110 valve 23 would have to be the reverse of the direction of movement of the valve 16.

Steam is conveyed to the chest 22 through a pipe 32 and under control of the valve 23 is admitted to the outer end of one of the high-pressure cylinders simultaneously with the exhaust from the outer end of the other high-pressure cylinder, so that the piston of each high-pressure cylinder is subjected to pressure during the inward stroke as well as during the outward stroke. The pipe 32 has two valved branches 33 and 34, one communicating with the supply of exhaust-steam and the other with a supply of live steam, so that either can be used, depending upon the amount of increased power desired.

In order to provide for the admission of steam to the outer ends of the cylinders 2 and 3 from the valve-chest 14, a valved pipe 35 leads from the outer end of the left-hand cylinder 2 to the right-hand passage 12, and a similar valved pipe 36 leads from the outer end of the right-hand cylinder 3 to the left-hand passage 12, so that when the valves in the pipes 27 and 29 are closed and those in the pipes 35 and 36 are opened the exhaust from the inner end of either high-pressure cylinder is conveyed not only to the adjoining end of the low-pressure cylinder, but also to the outer end of the opposite high-pressure cylinder. This provides for a greater expansion than usual of the steam at the beginning of the stroke of the low-pressure piston and lessens the strain upon the latter, which strain is in ordinary practice frequently so great as to cause the piston to break, this advantage more than compensating for the back pressure exerted upon the outer face of the high-pressure piston.

A valved pipe 37 with drip-valve 38 provides for the flow of steam or other motive fluid between the outer ends of the high-pressure cylinders when neither of the before-described methods of operation is resorted to. Hence with the three methods of operation thus provided the power of the engine can be very closely adapted to the work which it has to perform.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination in a compound engine, of a low-pressure cylinder, pair of high-pressure cylinders, pistons in each of said cylinders, valve mechanism for admitting motive fluid into one end of each high-pressure cylinder, exhausting it therefrom into corresponding ends of the low-pressure cylinder and exhausting it from the latter, and means for admitting to the other ends of the high-pressure cylinders, motive fluid from a source independent of that which supplies the first-mentioned ends of the high-pressure cylinders, substantially as specified.

2. The combination in a compound engine, of a low-pressure cylinder, pair of high-pressure cylinders, pistons in each of said cylinders, valve mechanism for admitting motive fluid into one end of each high-pressure cylinder, exhausting it therefrom into corresponding ends of the low-pressure cylinder and exhausting it from the latter, and independent valve mechanism controlling the admission and exhaust of a separate supply of motive fluid operating in connection with the other ends of the high-pressure cylinders, substantially as specified.

3. The combination in a compound engine of a low-pressure cylinder, pair of high-pressure cylinders, pistons in each of said cylinders, valve mechanism for admitting motive fluid into one end of each high-pressure cylinder, exhausting it therefrom into corresponding ends of the low-pressure cylinder and exhausting it from the latter, and independent valve mechanism controlling the admission and exhaust of a separate supply of motive fluid operating in connection with the other ends of the high-pressure cylinders, said supplementary valve mechanism having its passages crossed, substantially as and for the purpose set forth.

4. The combination in a compound engine, of a low-pressure cylinder, pair of high-pressure cylinders, pistons in each of said cylinders, valve mechanism for admitting motive fluid into one end of each high-pressure cylinder, exhausting it therefrom into corresponding ends of the low-pressure cylinder and exhausting it from the latter, and connections between the inner end of each high-pressure cylinder, the adjoining end of the low-pressure cylinder and the outer end of the other high-pressure cylinder, substantially as specified.

5. The combination in a compound engine, of a low-pressure cylinder, pair of high-pressure cylinders, pistons in each of said cylinders, valve mechanism for admitting motive fluid into one end of each high-pressure cylinder, exhausting it therefrom into corresponding ends of the low-pressure cylinder and exhausting it from the latter, an independent connection between the other ends of the high-pressure cylinders, and means for opening and closing communication through said connection, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM WILLS.

Witnesses:

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