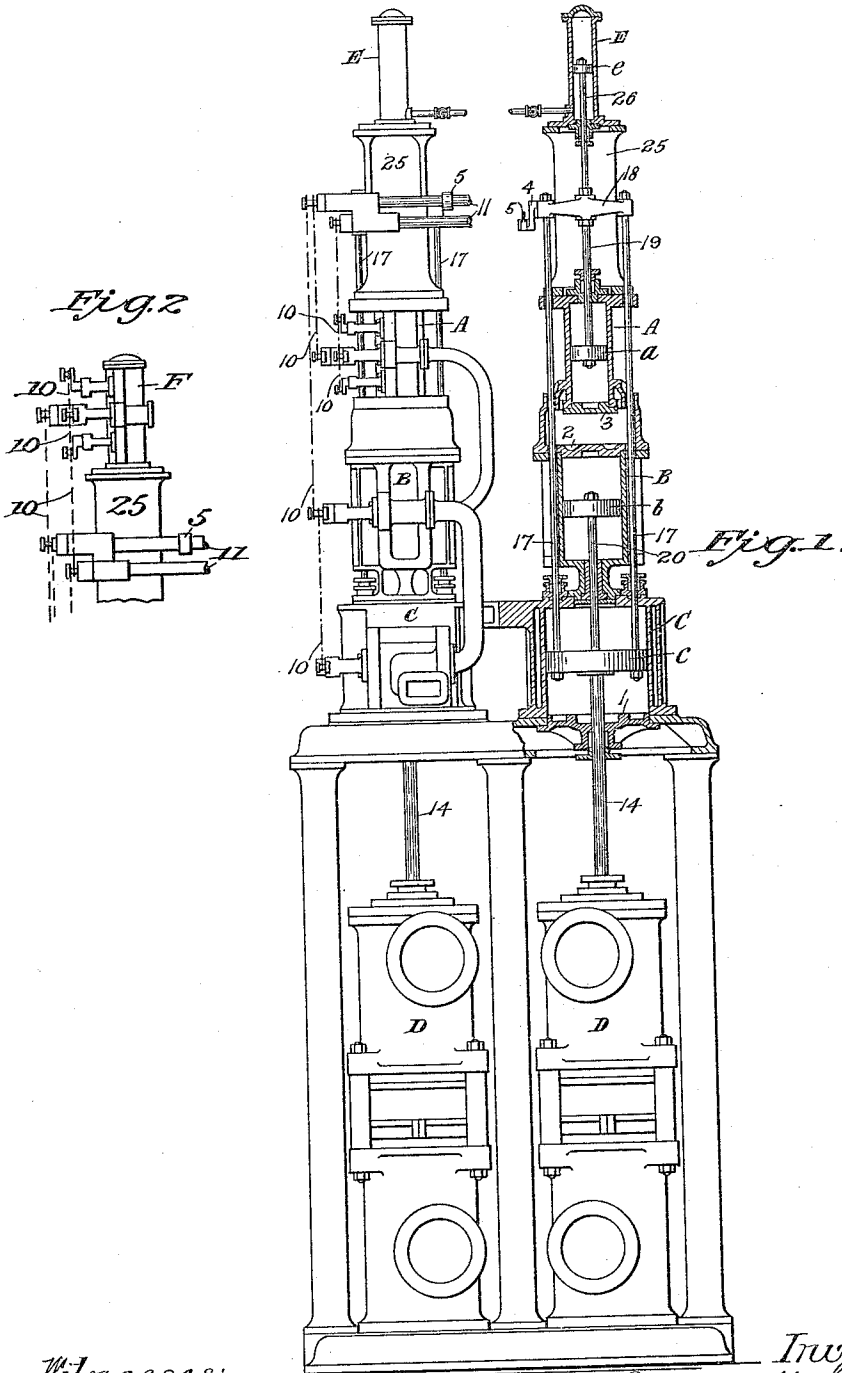


J. H. SEBALD.
 MULTIPLE EXPANSION ENGINE.
 APPLICATION FILED AUG. 4, 1909.

Patented Jan. 12, 1915.

1,124,340.



Witnesses:
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UNITED STATES PATENT OFFICE.

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MULTIPLE-EXPANSION ENGINE.

1,124,340.

Specification of Letters Patent.

Patented Jan. 12, 1915.

Application filed August 4, 1909. Serial No. 511,144.

To all whom it may concern:

Be it known that I, JOSEPH H. SEBALD, a citizen of the United States, residing at Arlington, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Multiple-Expansion Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates especially to vertical triple expansion duplex engines of that class having the cylinders on each side arranged in line, the especial object of the invention being to provide an improved arrangement of pistons, piston rods, and cross head for vertical engines of this class.

The invention includes, however, certain broad features which may be applied also in single engines or in horizontal engines.

In the accompanying drawing forming a part of this specification, there is shown for the purpose of illustration a vertical duplex pumping engine embodying all the features of the invention in a preferred form and this construction will now be described in detail and the features forming the invention specifically pointed out in the claims.

In the drawings:—Figure 1 is a sectional elevation of the engine. Fig. 2 is an elevation of the upper portion of one side of the engine showing a modification.

Referring to Fig. 1, which shows the pumping engine with one side in elevation and the other side partly in section taken centrally through the steam end, A, B, C are respectively the high pressure, intermediate pressure, and low pressure cylinders having the corresponding pistons *a*, *b*, *c*, and D the water cylinders on each side of the engine having the usual plungers to which the low pressure pistons *c* are connected by rods 14.

Any suitable construction may be used for controlling the admission and exhaust of steam, employing either separate cut off valves or combined admission and cut off valves, and cut off valves may or may not be used on the intermediate cylinders as preferred. In the construction shown, cut off valves are used only on the high pressure cylinder and separate cut off valves are employed, the construction and operating connections of the valves indicated being the same as that of United States Letters Pat-

ent to Brown No. 746,667, dated December 15, 1903, the valve cranks being connected by links 10 so as to be operated from cross over rock shafts 11, all as in said Letters Patent No. 746,667 except that the cross over rock shafts 11 are arranged above or outside the high pressure cylinder so as to be operated by the cross heads similarly placed, as described hereafter.

Referring now to the arrangement of the steam end, the low pressure piston *c* on each side is connected by side rods 17 to cross head 18 above or outside the high pressure cylinder A, to which cross head the high pressure piston *a* is connected by rod 19 passing through the outer or upper end of the high pressure cylinder A. Intermediate pressure piston *b* is connected by rod 20 passing through the inner or lower end of the cylinder B to the low pressure piston *c*, and the high pressure and intermediate pressure cylinders A, B are separated to provide space for the removal of their adjacent heads and their pistons between the cylinders.

The engine as thus far described may be used without a balancing piston, but the present invention is intended especially for vertical engines having a steam balancing cylinder, and in the construction shown these cylinders E are mounted at the top of the engine on frames 25 on the high pressure cylinders, and carry balancing pistons *e* connected to cross heads 18 by rods 26 passing through the inner or lower heads of the balancing cylinders. The cylinders A, E are separated sufficiently for the movement of the cross heads 18. The cross heads 18 actuate the cross over rock shafts 11 through arms 4 on the cross heads and the usual levers 5 on the rock shafts.

The low pressure piston *c* is accessible and removable through lower or inner head 1. the intermediate pressure piston *b* and high pressure piston *a* through their adjacent heads 2, 3 into the space between the cylinders, and the balancing piston *e* through the head at the top of the cylinder.

It will be seen that, in the construction shown, each of the pistons is easily accessible and removable, convenient means are provided for actuating the valve motion, the number of stuffing boxes is reduced to the minimum, and light piston rods may be used throughout the steam end, as there is

only the load of one piston on any single rod except the plunger rod 14 through which the engine power is transmitted and the outside rods to the cross heads carry only the high pressure piston load, except when the steam balancing cylinder is used, in which case these rods carry only the additional load of the small balancing piston with the rods under tension. The invention provides a very convenient and efficient construction of duplex engine in which the valve movement is operated without any extra rod from the low pressure piston but directly from the cross head through which power from the high pressure piston is transmitted, and in which the steam balancing cylinder may be used with all the pistons readily accessible and without substantial increase in size or weight of moving parts. The same arrangement of steam end may be used with power cylinders in place of the balancing cylinders E, as illustrated in Fig. 2, in which cylinder F is shown as a high pressure cylinder, with its admission and cut-off valves operated by links 10, from cross over rock shafts 11, as in the case of cylinder A.

It will be understood that the invention is not to be limited to the exact construction or arrangement of parts shown, but that modifications may be made within the invention as defined by the claims.

What I claim is:—

1. A multiple expansion engine having three cylinders arranged in line in the order of expansion with the low pressure cylinder placed inside and the power applied from the low pressure piston, a rod connecting the intermediate pressure piston and low pressure piston, a cross head outside the high pressure cylinder to which the high pressure piston is connected by a rod through the outer head of the high pressure cylinder, and side rods connecting the cross head with the low pressure piston, the engine being constructed to provide space between the high pressure cylinder and intermediate pressure cylinder for access to their pistons.

2. A multiple expansion engine having three cylinders arranged in line in the order of expansion with the low pressure cylinder placed inside and the power applied from the low pressure piston, a rod connecting the intermediate pressure piston and low pressure piston, a cross head outside the high pressure cylinder to which the high pressure piston is connected by a rod through the outer head of the high pressure cylinder, side rods connecting the cross head with the low pressure piston, the engine being constructed to provide a space between the high pressure cylinder and intermediate pressure cylinder for access to their pistons, and a fourth cylinder outside the cross head having its piston connected to the cross head

by a rod passing through the inner end of the cylinder.

3. In a vertical multiple expansion engine, the combination of high, intermediate and low pressure cylinders arranged in line in the order of expansion with the low pressure piston at the bottom and the power applied from the low pressure piston, a rod connecting the intermediate pressure piston and low pressure piston, a cross head above the high pressure cylinder to which the high pressure piston is connected by a rod passing through the outer head of the high pressure cylinder, side rods connecting the cross head with the low pressure piston, and a balancing cylinder above the cross head having its piston connected to the cross head by a rod passing through the lower head of the balancing cylinder, the engine being constructed to provide space between the high pressure cylinder and intermediate pressure cylinder for access to their pistons.

4. A multiple expansion duplex engine having three cylinders on each side arranged in line in the order of expansion with the low pressure cylinder placed inside and the power applied from the low pressure piston, rods connecting the intermediate pressure pistons and low pressure pistons, cross heads outside the high pressure cylinders to which the high pressure pistons are connected by rods passing through the outer heads of the high pressure cylinders, side rods connecting the cross heads with the low pressure pistons, the engine being constructed to provide space between the high pressure cylinders and intermediate pressure cylinders for access to their pistons, rock shafts extending across the engine outside the high pressure cylinders and connected to the valves for operating the valves on each side of the engine from the other side, and operating connections between the cross heads and rock shafts.

5. In a vertical multiple expansion duplex engine, the combination of high, intermediate and low pressure cylinders on each side arranged in line in the order of expansion with the low pressure piston at the bottom and the power applied from the low pressure piston, rods connecting the intermediate pressure pistons and low pressure pistons, cross heads above the high pressure cylinders to which the high pressure pistons are connected by rods passing through the outer heads of the high pressure cylinders, side rods connecting the cross heads with the low pressure pistons, balancing cylinders above the cross heads having their pistons connected to the cross heads by rods passing through the lower heads of the balancing cylinders, the engine being constructed to provide space between the high pressure cylinders and intermediate pressure

sure cylinders for access to their pistons,
rock shafts extending across the engine be-
tween the high pressure cylinders and bal-
ancing cylinders and connected with the
5 valves for operating the valves on each side
of the engine from the other side, and op-
erating connections between the cross heads
and rock shafts.

In testimony whereof, I have hereunto set
my hand, in the presence of two subscribing 10
witnesses.

JOSEPH H. SEBALD.

Witnesses:

CARL GEORGE DE LAVAL,
JOHN D. BIRD.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."