

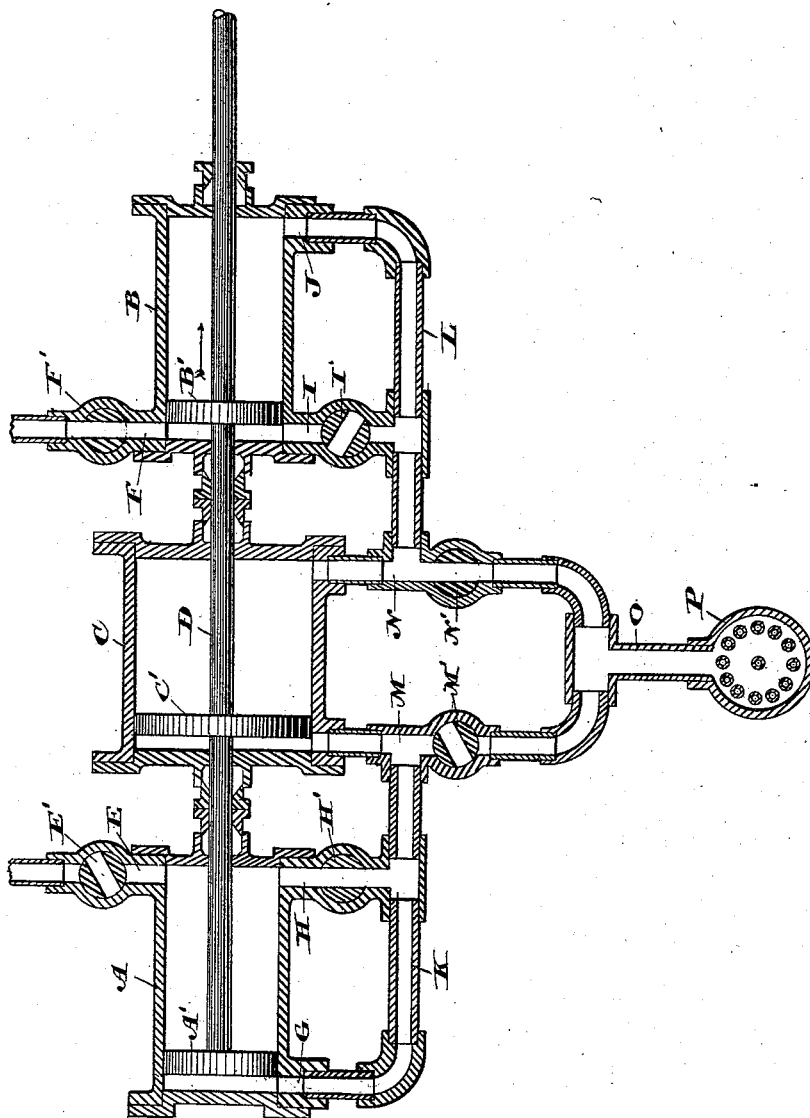
(No Model.)

J. S. PARMENTER.

COMPOUND ENGINE.

No. 494,075.

Patented Mar. 21, 1893.



Witnesses.

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# UNITED STATES PATENT OFFICE.

JAMES SPENCER PARMENTER, OF WOODSTOCK, CANADA.

## COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 494,075, dated March 21, 1893.

Application filed June 20, 1892. Serial No. 437,237. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES SPENCER PARMENTER, manufacturer, of the town of Woodstock, in the county of Oxford, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Compound Engines, of which the following is a specification.

My invention relates to improvements in compound engines and the object of the invention is to construct an engine—first—in which the back pressure will be entirely relieved from the pistons of the high pressure cylinders and—secondly—in which the area of the high and low pressure pistons will be submitted to the action of the vacuum produced by the condensing chamber and thereby in both cases minimize the amount of steam and consequent power necessary for the propulsion of the engine and it consists essentially—first—of providing two high pressure cylinders to act with the low pressure cylinder, the said high pressure cylinders being each provided with one inlet port and two outlet ports one at each end of the high pressure cylinders, one of each pair of ports being provided with a valve and each pair being connected together and to the low pressure cylinder by a common pipe and—secondly—in connecting each pair of outlet ports, which are connected to the low pressure cylinder, to the condensing chamber by pipes provided with suitable valves one pipe and valve being provided for each pair of outlet ports, the whole being arranged to co-act in the manner hereinafter more particularly explained.

The drawing represents a diagrammatic sectional view showing the arrangement of my engine.

A, and B, are the high pressure cylinders, and C, is the low pressure cylinder. A', and B', are the high pressure pistons and C', is the low pressure piston. It will be noticed that the pistons, A', B', and C', are all located on the same piston rod, D, thereby forming what is commonly known as a tandem compound engine.

E, and F, are the inlet ports of the high pressure cylinders A, and B, respectively and E', and F', are the live steam valves of the ports, E, and F.

G, and H, are the outlet ports of the high pressure cylinder, A, and I, and J, are the

outlet ports of the high pressure cylinder, B. The outlet ports, H, and I, are provided with exhaust valves, H', and I'. The ports, G, and H, are connected together by the pipe, K, and the ports, I, and J, are connected together by the pipe, L. The pipes, K, and L, extend into the pipes, M, and N, which form the ports of the low pressure cylinder and extend from it to the pipe, O, leading into the condensing chamber, P. The pipes M, and N, are provided with exhaust ports, M', and N', as shown.

Having now described the general arrangement of my engine I shall proceed to describe its action. In the drawings the position in which the pistons are placed the live steam is supposed to be entering through the port, F, into the high pressure cylinder, B, the valve, F', being now opened. When the live steam enters through the port, F, it actuates upon the piston, B', and forces it in the direction indicated by arrow until it reaches the port, J, at which period the live steam valve, E', of the port, E, leading into the cylinder, A, is thrown open and the live steam enters through the port, E, forcing the piston, A', of the cylinder, A, and the other pistons on the same rod in the opposite direction to that indicated by arrow. Simultaneously with the throwing open of the valve, E', occurs the opening of the valves, I', of the exhaust port I, and closing of the valve, N', on the pipe, N. It will now be seen that when the piston, B', is being forced in the opposite direction to that indicated by arrow the steam in the cylinder, B, will be forced through the port, I, and valve, I', pipe, L, and port, J, into the opposite end of the cylinder, B, thereby equalizing the pressure upon the piston, B'. The expansive force of the steam will cause it to enter through the pipes, L, and N, into the low pressure cylinder, C, and actuate the piston so as to further augment the action of the live steam upon the piston, A', of the high pressure cylinder, A. As soon as the piston A', reaches the port, G, the live steam is cut off by the valve, E', being closed. Simultaneously with the closing of the valve, E', the valve, H', of the port, H, is opened, the valve, M', on the pipe, M, is closed, valve, I', of the port, I, is closed and the valve, F', of the port, F, is opened. The live steam now enters through

the port, F, and forces the piston again in the direction indicated by arrow forcing the dead steam which is at the opposite end of the piston, B', in the cylinder, B, through the port, J, pipe, L, and the valve, N', now open, down through the pipe, N, and, O, into the condensing chamber, P, thereby producing a vacuum in the pipes, O, and, N, and cylinder, C, which vacuum acts upon the piston, C', drawing it in the direction in which the piston, B', is forced by the live steam and thereby augmenting the force of the steam on the piston, B', so as to force the piston rod in the direction indicated by arrow. During the period that the piston, B', and piston, C', are being forced so as to throw the rod in the direction indicated by arrow, the piston, A', which is moving also in the same direction forces the steam in the cylinder, A, through the port, H, and valve H', which is now open, through the pipe, K, back into the opposite end of the cylinder, A, thereby equalizing the pressure on the cylinder and also through the other end of the pipe, K, and pipe, M, up into the low pressure cylinder, C, against the piston, C', augmenting the action of the vacuum upon the piston, C', and forcing the piston, C', in the direction in which the piston rod is being forced by the piston, B', of the high pressure cylinder, B. When the piston, B', of the high pressure cylinder, B, has reached the port, J, the valves, F', N', and, H', are closed and the valves, E', M', and, I', are opened and as the live steam enters through the port, E, and forces the piston, A', of the cylinder, A, in the opposite direction to that indicated by arrow the steam in the cylinder, A, at the opposite end of the piston, A', is forced through the pipe, K, into the pipe, M, down through the pipes, M, and, O, to the condensing chamber, P, which condenses the steam and produces vacuum through the pipes, O, M, and cylinder, C, thereby drawing the piston, C', in the same direction as the piston, A', is forced by the live steam. During

this period the piston, B', of the cylinder, B, moving in the opposite direction to that indicated by arrow forces the steam in the cylinder, B, through the valve, I, and pipe, L, to the opposite end of the cylinder, B, thereby equalizing the pressure upon the piston, B', at the same time allowing of the expansion of the steam to operate upon the piston, C', so as to force it in the direction in which it is being thrown by the vacuum produced in the pipe, M, in the same manner as hereinbefore stated. This co-acting of the valves is repeated at each time the pistons reach the end of their stroke and consequently a reciprocating movement is imparted to the piston rod, D. It will also be understood that when the valves, F', N', and, H', are open the valves, E', M', and, I', are closed and vice versa.

Although I have shown my invention applied to a tandem compound engine it will of course be understood that it may with equal facility be applied to a cross compound engine.

What I claim as my invention is—

In a compound engine the combination with the low pressure cylinder and piston, of two high pressure cylinders and pistons arranged to coact therewith, a single inlet port leading to the inner end of each high pressure cylinder provided with a suitable valve, pipes K, and L, connecting the outer ends of the low pressure cylinders with the outer ends of the high pressure cylinders, exhaust pipes H, and I, connecting the inner ends of the high pressure cylinders with the pipes K, and L, provided with suitable cut off valves, and exhaust pipes connecting the pipes K, and L, with the condenser, with suitable cut off valves located in said exhaust pipes, substantially as described.

JAMES SPENCER PARMENTER.

Witnesses:

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EDWIN WILLIS.