(No Model.)

A. G. BROWN.

STEAM ENGINE.

No. 514,701. Patented Feb. 13, 1894.

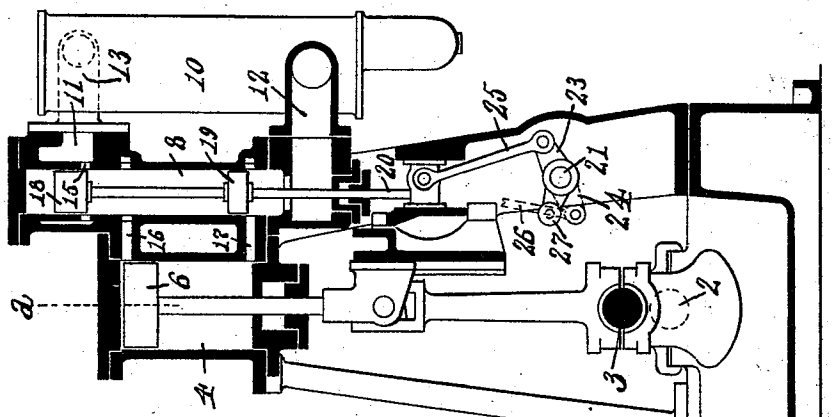

Fig. 2.

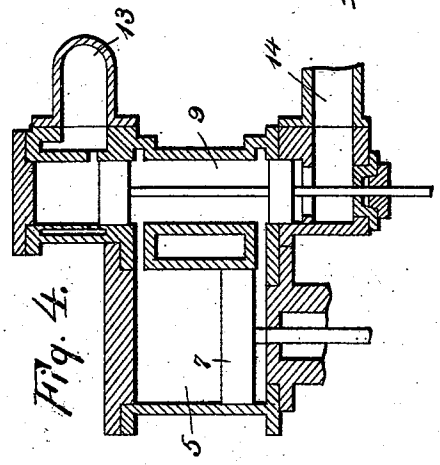

Fig. 4.

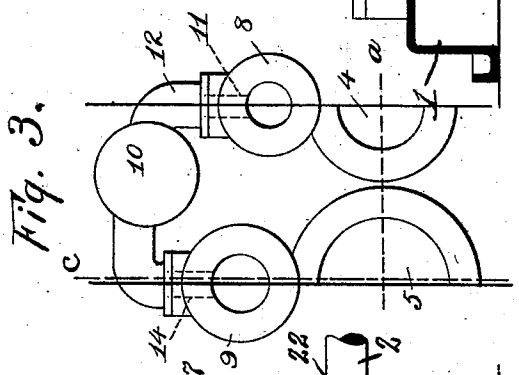

Fig. 3.

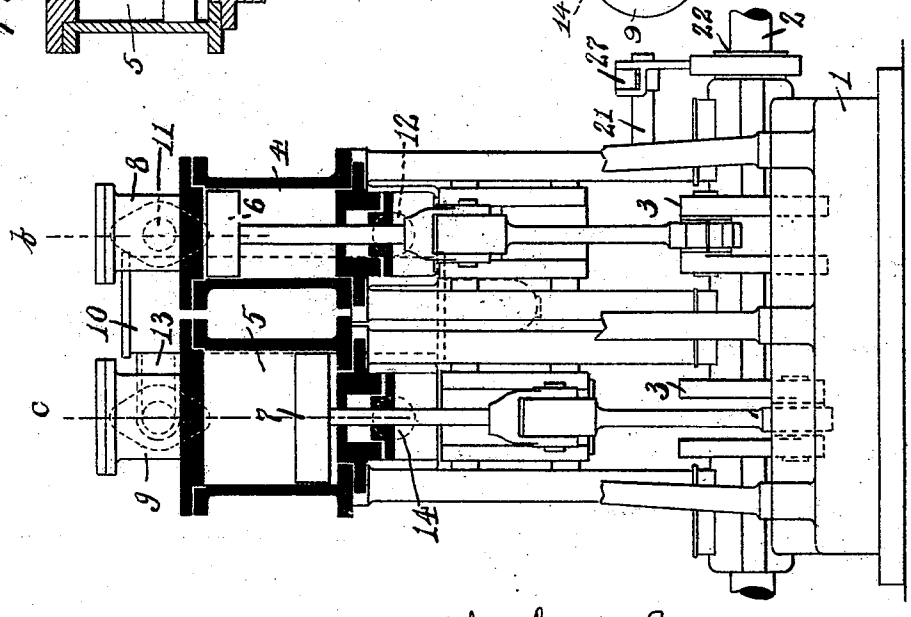

Fig. 1.

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ARTHUR GEORGE BROWN, OF BOLTON, ENGLAND.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 514,701, dated February 13, 1894.

Application filed May 15, 1893. Serial No. 474,178. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR GEORGE BROWN, a citizen of the United States, residing at Bolton, county of Lancaster, England, have invented certain new and useful Improvements in Steam-Engines, (Case C,) of which the following is a specification.

This invention relates to improvements in compound single acting steam engines and the improvements will be readily understood from the following description taken in connection with the accompanying drawings in which—

Figure 1, is a front elevation of an engine exemplifying my improvements, the cylinders appearing in vertical section in the plane of line "*a*" of the other figures of the drawings; Fig. 2, a vertical section of the same in the plane of line "*b*" of the other figures; Fig. 3, a partial plan of the cylinders, steam-chests, &c.; and Fig. 4 a vertical section of the low-pressure cylinder and valve in the plane of line "*c*" of other figures.

In this engine the high-pressure engine is complete in itself and the low-pressure engine is complete in itself and they are of the same construction and stand side by side and operate on oppositely set cranks on the same shaft. Therefore in describing details it will be sufficient to refer to one of the engines.

In the drawings:—1, indicates the bed-plate: 2, the crank-shaft: 3, the cranks, set opposite each other: 4, high-pressure cylinder: 5, low-pressure cylinder: 6, high-pressure piston: 7, low-pressure piston: 8, high-pressure steam chest: 9, low-pressure steam chest: 10, intermediate receiver: 11, live steam inlet to high-pressure steam-chest: 12, exhaust of high pressure steam chest, communicating with the intermediate receiver 10: 13, supply-connection from intermediate receiver to low-pressure steam-chest: and 14, exhaust connection of low-pressure steam chest.

Except as to the fact that the high-pressure steam chest receives live steam and exhausts to the intermediate receiver, while the low-pressure steam chest receives its supply from the intermediate receiver and exhausts to the atmosphere or condenser, being in construction merely a question of pipe connections to the inlets and outlets of the steam chests, the two steam chests and their valves are alike and the description which will be applied to the high-pressure steam-chest appearing in section in Fig. 2 would apply equally well to the low-pressure steam chest.

Proceeding now with the drawings:—15, indicates a port leading from the supply to the interior of the steam chest, supply for high-pressure steam chest being live steam inlet 11 while that for the low-pressure steam-chest is from intermediate receiver through connection 13: 16, port from steam chest to upper end of cylinder: 17, port from steam chest to the lower end of cylinder: 18, valve-piston working over port 15 and serving to close that port or to open it by passing above it: 19, valve-piston working over port 17 and moving to a position above that port or to a position below it: 20, valve stem connecting valve-pistons 18 and 19: 21, rock-shaft: 22, eccentric on the main shaft, for rocking the rock-shaft: 23, arm projecting rearwardly from the rock-shaft under the high-pressure steam chest: 24, similar arm under the low-pressure steam chest but projecting in the opposite direction so that as the rock-shaft rocks it will move one of the valves up while it moves the other down: 25, link connecting arm 23 with the valve stem which it is to operate, the high-pressure valve stem: 26, similar link for the low-pressure valve stem: and 27, arm on the rock-shaft engaged by the eccentric-rod.

The action of the high-pressure engine will first be explained in connection with Fig. 2. The piston 6 is at the top of the stroke and the valves are rising. This opens port 15 and permits live steam to go to the steam chest and then through port 16 to the top of the cylinder, thus pushing piston 6 down, steam from below that piston exhausting through port 17 and out of the steam chest into the intermediate receiver through connection 12. When the piston reaches the lower end of its stroke the valve-pistons descend, valve-piston 18 closing port 15, and valve-piston 19 passing below port 17, under which conditions the steam inlet and exhaust are both cut off from the steam chest, ports 16 and 17 at the same time being placed in free communication with each other through the steam chest. Fig. 4 shows the low-pressure piston and valve in the position which

they have when the high-pressure parts are in the position seen in Fig. 2; but Fig. 4 may also usefully serve in indicating the position of the high-pressure valve when the high-pressure piston is ready to begin its up stroke. Piston 6 then rises. Steam which was above it merely transfers to the lower end of the cylinder. On the next down stroke the action is as before, live steam going above the piston, and that below it exhausting into the intermediate receiver.

Fig. 4 shows the position of low-pressure piston and valve when the high-pressure parts are in the position seen in Fig. 2.

The action in the low-pressure cylinder is precisely the same except that it receives steam from the intermediate receiver instead of from a source of live steam supply, and exhausts to atmosphere or condenser instead of to intermediate receiver, it being understood of course that the pistons of the two engines are moving in opposite directions, one making its effective down stroke, while the other one is rising and transferring its steam to the other end of its cylinder. As the pistons rise, transferring the steam from one end of the cylinder to the other, they are in equilibrium of pressure. The cylinder and moving parts should be so proportioned that the power of the two engines is equal and the moving parts of equal weight. It will be noticed that the intermediate receiver does not perform the ordinary office of intermediate receivers in compound engines. In ordinary compound engines the receiver serves simply as a reservoir for equalizing to a certain extent, the steam pressure acting on the larger piston, and aside from such equalization, ordinary compound engines will operate as well without an intermediate receiver as with one. But in the present case the intermediate receiver is essential to the operativeness of the engine, for when the high-pressure piston is at the top of its stroke and is ready to move down under the impulse of a fresh charge of steam, the low-pressure piston is at the bottom of its stroke and is ready to move up. Therefore the steam cannot pass from the high-pressure cylinder directly into the low but must go into a receiver and stay there until the low-pressure piston is moved up to the top of its stroke and is ready to take its charge of steam from the receiver, that is, the high-pressure cylinder has discharged all its steam into the reservoir before the low-pressure steam takes a particle of it.

I claim as my invention—

In a steam engine, the combination, substantially as set forth, of a crank-shaft with two cranks set opposite each other, a high-pressure engine to operate one of said cranks, a low-pressure engine to operate the other crank, an intermediate receiver between the two engines, and valves and valve gearing and passages arranged to at one time admit live steam over the high-pressure piston and exhaust the steam from under that piston into the receiver and place both ends of the low-pressure cylinder in communication with each other while cut off from its supply and discharge, and at another time to admit steam from the receiver to above the low-pressure piston and exhaust the steam from under that piston and place both ends of the high-pressure cylinder in communication with each other while the high-pressure cylinder is cut off from supply and discharge.

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