(No Model.)

A. F. HALL.

STEAM ENGINE.

No. 347,344. Patented Aug. 17, 1886.

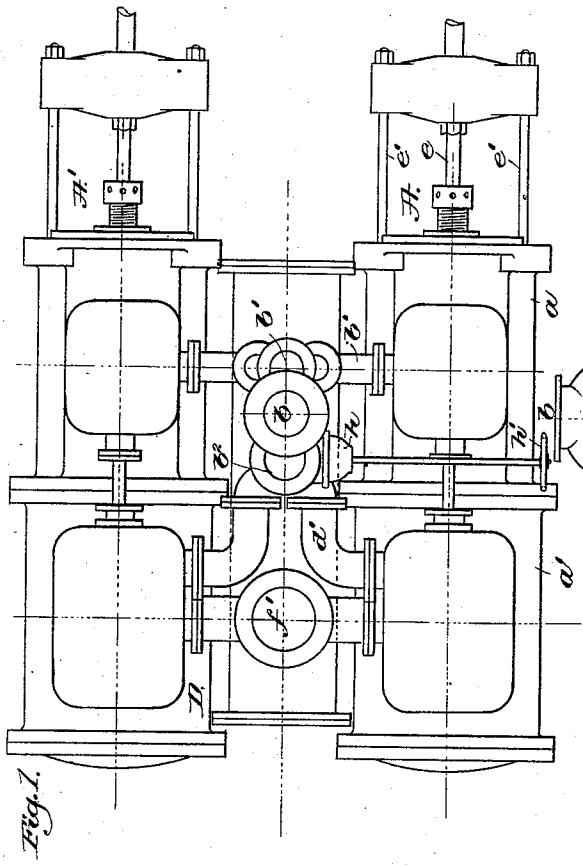

Fig. 1.

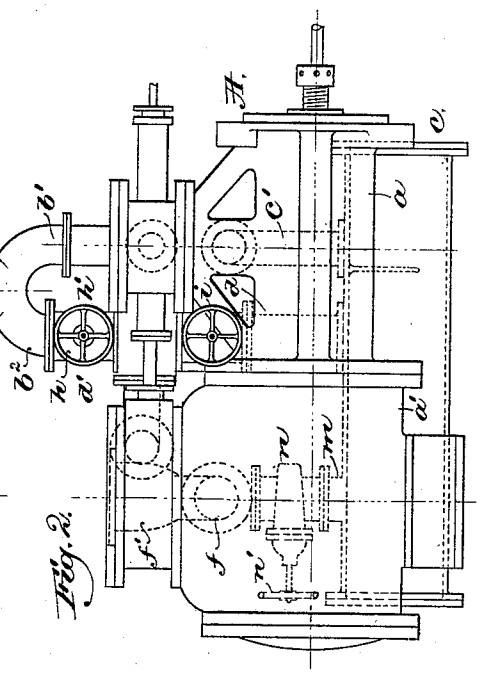

Fig. 2.

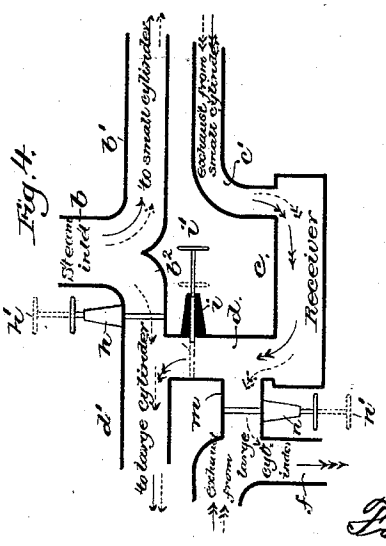

Fig. 4.

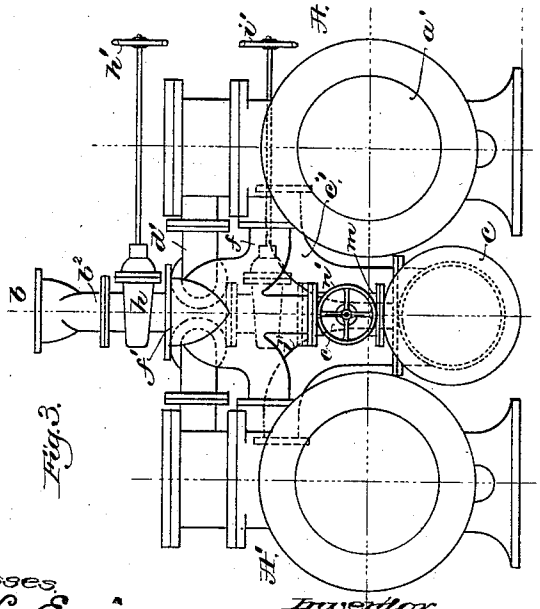

Fig. 3.

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UNITED STATES PATENT OFFICE.

ALBERT F. HALL, OF BOSTON, MASSACHUSETTS.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 347,344, dated August 17, 1886.

Application filed December 14, 1885. Serial No. 185,600. (No model.)

To all whom it may concern:

Be it known that I, ALBERT F. HALL, of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Steam-Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention, relating to steam-engines, is especially applicable to a duplex compound direct-acting pumping-engine. Such engines, as usually constructed, have two pairs of co-operating cylinders, each pair consisting of a high and low pressure cylinder in line with one another, one of larger diameter than the other, and the smaller or high-pressure cylinders receive the steam or other actuating-fluid directly from the boiler or generator or reservoir of actuating-fluid, and the fluid, after having done its work in the smaller or high-pressure cylinders, is exhausted into the larger or low-pressure cylinders, either passing directly thereto, or passing into an intermediate chamber or receiver and then to the larger cylinders, from which it is finally exhausted into the atmosphere or a consumer.

The object of the present invention is to provide means by which the power of a duplex engine may be increased, if necessary; and the invention consists, essentially, in providing an exhaust-passage for the smaller or high-pressure cylinders, independent of the inlet-passage for the low-pressure cylinder, the said independent exhaust-passage leading to the atmosphere or condenser, and also providing an independent passage for the actuating-fluid, which will, for convenience, be called "live steam," to enter the larger or low-pressure cylinders with its initial pressure, together with a suitable valve or valves for controlling the said passages. When the duplex pumping-engine is to operate as a compound engine, the live-steam or induction passage from the boiler to the larger cylinders is closed, the independent exhaust-passage from the smaller cylinders is also closed, and the passage from the receiver or exhaust of the smaller cylinders to the inlet of the larger cylinders is open; but when it is desired to increase the power of the engine the passage from the receiver or exhaust of the smaller cylinders to the inlet of the larger cylinders is closed, and the independent exhaust for the said smaller cylinders is opened and the inlet for live steam to the larger cylinders is opened, so that the two pairs of cylinders practically constitute two pairs of independent simple engines, each cylinder of each pair receiving steam or other fluid at full pressure and exhausting it in the usual manner.

Figure 1 is a plan view of a duplex compound pumping-engine embodying this invention; Fig. 2, a side elevation thereof; Fig. 3, an end elevation thereof, and Fig. 4 a diagram indicating the relations of the different passages and valves therein to the different cylinders of the engine.

The engines A A′ may be of any suitable or usual construction—for instance, substantially the same as shown in Letters Patent No. 270,575, dated January 16, 1883, the piston of one engine controlling the valves of the other by mechanism not shown, as it forms no part of the present invention.

Each engine comprises two cylinders, *a a*′, the former of smaller diameter than the latter, the said cylinders being intended to normally co-operate together as a compound engine, the smaller or high-pressure cylinder *a* taking steam through the main steam-inlet *b* *b*′ from the boiler at one side of the piston, and exhausting the steam which has previously done its work at the other side of the piston, through a pipe, *c*′, (see Figs. 2 and 3,) into a receiver, *c*, from which it is taken by pipe *d* *d*′ to the larger or low-pressure cylinder *a*′, in which it operates on the piston in the same direction that the live steam operates in the smaller cylinder, *a*, the piston-rods *e* *e*′ from the two cylinders (see Fig. 1) being connected with a single cross-head, so that the steam in both the cylinders *a a*′ works in unison in overcoming the load of the engine. The steam that has done its work in the two cylinders successively, as described, is exhausted from the larger cylinder through the exhaust-pipe, *f f*′, and the parts thus far described, operating in the manner set forth, are the same as usually found in compound engines, and are the same in both of the engines A A′, which work together on the duplex plan, and consequently need be described in connection with but one of the said engines, as the operation and the application of the present invention

would be exactly the same whether one or two engines were used.

In order to enable the engine to exert greater power than it can in its normal operation as a compound engine, it is, in accordance with the present invention, provided with a branch pipe, b^2, (see Figs. 2 and 3,) from the main steam-supply pipe b, leading to the inlet-pipe d of the larger cylinder, through which the steam normally taken from the receiver c, or exhausting from the smaller cylinder, passes to the larger cylinder, the said pipe b^2 containing a stop-valve, h, having a handle, h', said valve normally, when the engine is acting as a compound engine, being closed. The pipe d, leading from the receiver c to the inlet-pipe d' of the large cylinder, is also provided with a stop-valve, i, having a handle, i', and when increased power is desired the said valve i is closed and the valve h opened, so that the steam admitted to the large cylinder a' comes directly from the pipe b at the full initial pressure, instead of being taken from the receiver c after having exhausted from the smaller cylinder, a, and thus having expanded and had its pressure reduced. As the exhaust from the small cylinder a no longer passes to the large cylinder under the conditions last named, means must be provided for removing the exhaust-steam from the said small cylinder, and for this purpose the receiver c, or other exhaust passage or receptacle through which the steam passes from the small cylinder, is connected by pipe m with the main exhaust-passage f' from the larger cylinder, the said pipe m containing a stop-valve, n, having a handle, n', which valve is normally closed when the cylinders are operating as a compound engine, but which is opened to permit the exhaust from the smaller cylinder to escape when the larger cylinder is taking its supply of steam from the boiler or prime source, instead of from the receiver.

The diagram, Fig. 4, shows the valves in full lines in the position occupied when the engine is operating as a compound engine, and the full-line arrows show the direction of the flow of steam under these conditions, the double-headed arrows representing exhaust steam or fluid from the smaller cylinder, and the triple-headed arrow representing steam that has been used in the two cylinders successively.

The dotted-line position of the valves and the dotted arrows indicate the condition when the two cylinders work independently, each as a simple engine taking live steam, the double-pointed arrows also representing the exhaust-steam, and there being no steam which has expanded when the engine is worked in this manner.

I am aware that prior to my invention compound direct-acting engines have been made having a high and a low pressure cylinder arranged tandemwise, or in line with each other, the low-pressure cylinder being fed with steam through the exhaust-passage of the high-pressure cylinder, the said exhaust-passage normally forming the inlet-passage for the low-pressure cylinder, the low-pressure cylinder being also fed through an independent inlet-passage communicating directly with the boiler, such as shown in United States Patents Nos. 186,539 and 176,938; but the high-pressure cylinder in such engines does not have an exhaust-passage independent of the inlet-passage to the low-pressure cylinder.

I claim—

A duplex compound direct-acting pumping-engine composed of two pairs of high and low pressure cylinders arranged tandemwise, or in line with each other, a main inlet and a main exhaust-passage for the said engine, an exhaust for each high-pressure cylinder, connected to and forming the inlet for its co-operating low-pressure cylinder, an independent inlet for each low-pressure cylinder, and an exhaust-passage for each high-pressure cylinder independent of the inlet-passage to the low-pressure cylinder, combined with valves located in said independent passages, and in the exhaust-passage for the high-pressure cylinders, whereby the exhaust from each high-pressure cylinder may be cut off from its co-operating low-pressure cylinder and conveyed away, and the actuating-fluid at initial pressure be admitted to the low-pressure cylinder, substantially as described.

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

ALBERT F. HALL.

Witnesses:
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B. J. NOYES.