

J. DAVIDSON.
CONDENSING STEAM ENGINE.
APPLICATION FILED JUNE 12, 1911.

1,018,300.

Patented Feb. 20, 1912.

Fig. 1.

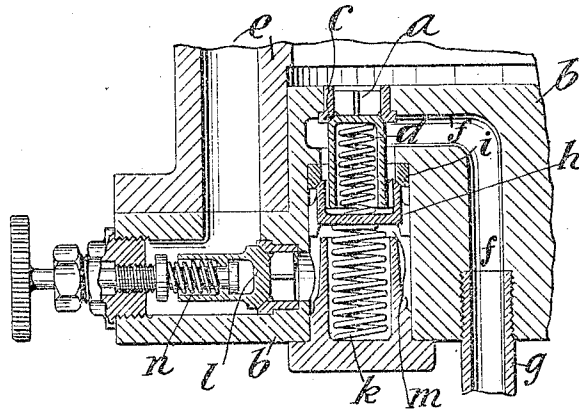
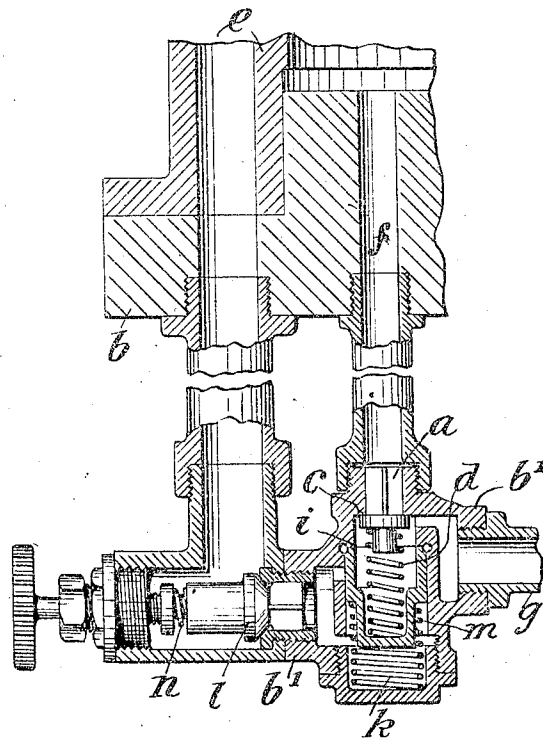


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

JOHN DAVIDSON, OF PENDLETON, ENGLAND.

CONDENSING STEAM-ENGINE.

1,018,300.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOHN DAVIDSON, a subject of the King of Great Britain, residing at Pendleton, in the county of Lancaster, Kingdom of Great Britain, have invented certain new and useful Improvements in and Connected with Condensing Steam-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to improvements in and connected with condensing steam engines and has for its object to provide such engines with a valve which will not only drain the water in the cylinder in the ordinary way but also relieves excessive pressure in the cylinder due to compression should the vacuum fail and the engine have to run non-condensing.

In practice it has been found that in the case of engines working with a high degree of compression, that is to say, engines in which the exhaust valve closes some considerable time before the piston reaches the end of the stroke and particularly in the case of engines where the exhaust takes place through the ports which are uncovered by the piston near the end of its stroke and consequently closed very early on its return stroke, very high compression pressures are reached should the condenser fail and the engine have to exhaust into the atmosphere unless relief valves of ample size are fitted.

The valve constructed in accordance with my invention works as an ordinary pressure relief valve so long as the vacuum is maintained but immediately it fails and the compression pressure in the cylinder slightly exceeds the initial steam pressure it will open wide.

It also dispenses with the ordinary arrangement of drain valves, as it will open freely with a few pounds pressure when starting the engine.

I attain these objects by the means illustrated in annexed drawing, Figure 1 showing the same employed in, and Fig. 2 attached to the cylinder end casting of a condensing steam engine, both figures being vertical sections.

Similar letters refer to similar parts throughout the several views.

In carrying out my invention and referring to the figures generally, I employ a valve *a* in the cylinder end casting *b*, Fig. 1, or in a casting *b*¹ Fig. 2, suitably connected

with the cylinder end casting *b* and the exhaust pipe or condenser (not shown), which valve by itself acts as an ordinary drain, relief or safety valve and is held onto its seat *c* by a spring *d* of a pressure somewhat in excess of the boiler pressure. When this valve opens the condensed water can pass from the cylinder *e* through a port *f* and pipe *g* to the exhaust pipe or condenser of the engine.

In alinement with the drain valve *a* I employ a second valve *h* bearing against the drain valve spring *d* and held to its seat *i* by a spring *k* much weaker than the drain valve spring *d*, say only strong enough to close its valve with a pressure of say 3 or 4 pounds per square inch. Under working conditions, the outer side of the second valve *h* is open to the steam chest or steam inlet pipe of the engine and consequently being of considerably larger diameter than the drain valve *a*, it will be held to its seat *i* with a greater pressure than that required and exerted by the drain valve spring *d* and hence the steam pressure will keep both valves *a* and *h* to their seats.

At a right angle with the two valves *a* and *h* I employ an ordinary screw down valve *l* for starting purposes. When this valve is shut, steam from the steam chest is cut off from the chamber *m* of the second valve *h* and the latter will only be pressed toward its seat by its spring *k* which will be easily overcome by the drain water spring *d* and moving outward will relieve the drain valve of a great amount of pressure and allow it to open freely to permit the condensed water or the like to pass out thus acting as an efficient drain valve of large area.

On the pipe *g* connected with the exhaust pipe or condenser (not shown) and the port *f* leading to the drain valve *a*, I employ in close proximity to the cylinder *e* a valve (not shown) which closes automatically with the automatic atmospheric exhaust valve and opens immediately the vacuum is made, or a hand operated valve may be used in lieu thereof.

As soon as the compression pressure overcomes the pressure of the drain valve spring *d*, the drain valve *a* will open and permit the port *f* in connection therewith to fill with steam at high pressure which then acts upon the interior of the second valve *h* and brings the same almost in equilibrium. Any fur-

ther pressure in the cylinder will then easily open the drain valve *a* and with it the second valve *h* and permit the compressed steam to return into the steam chest through the screw-down valve *l*, which under ordinary conditions may be open. However, to prevent any possibility of an accident due to the screw-down valve *l* being left closed, it is only held to its seat by a small spring *n* so that it will open freely immediately the pressure behind it slightly exceeds the pressure in the steam chest or steam pipe.

When the condenser is started again the valve on the pipe *g* is again opened by the closing of the said automatic atmospheric exhaust valve or by other suitable means and the interior of the second valve *h* being relieved from pressure, it will be held firmly to its seat by the outside pressure and the drain valve *a* will act again as an ordinary drain valve.

I claim:

1. In a condensing steam engine, a cylinder end having an outlet port communicating with the exhaust pipe, two spring influenced valves of varying diameter in alinement with each other and the said port, the smaller of the said valves being adapted to establish and cut off communication between the cylinder and the exhaust pipe and the larger valve between the cylinder and the steam chest of the engine and normally held to its seat by the pressure of live steam from the steam chest and by its spring when the live steam is cut off and the smaller valve opens to drain the cylinder, all combined substantially as and for the purpose specified.

2. In a condensing steam engine, a cylinder end having an outlet port communicating with the exhaust pipe, two valves of varying diameter in alinement with each

other and the said port, a chamber in connection with the larger of the said valves communicating with the steam chest and springs pressing the said valves to their seats, the smaller of the said valves being adapted to establish and cut off communication between the cylinder and the exhaust pipe and the larger valve between the cylinder and steam chest and normally held to its seat by the pressure of live steam passing from the steam chest into the said chamber and by its spring when the live steam is cut off and the smaller valve opens to drain the cylinder, all combined substantially as and for the purpose specified.

3. In a condensing steam engine, a cylinder end having an outlet port communicating with the engine exhaust pipe, two spring influenced valves of varying diameters in alinement with each other and the said port, the smaller of the said valves being adapted to establish and cut off communication between the cylinder and the exhaust pipe and the larger valve between the cylinder and steam chest, a chamber in connection with the larger of the said valves communicating with the steam chest, the said larger valve being normally held to its seat by the pressure of live steam passing from the steam chest into the said chamber and by its spring when the live steam is cut off and the smaller valve opens to drain the cylinder, and a screw-down valve between the said chamber and the steam chest, all combined substantially as and for the purpose set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN DAVIDSON.

Witnesses:

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STANLEY E. BRAMALL.