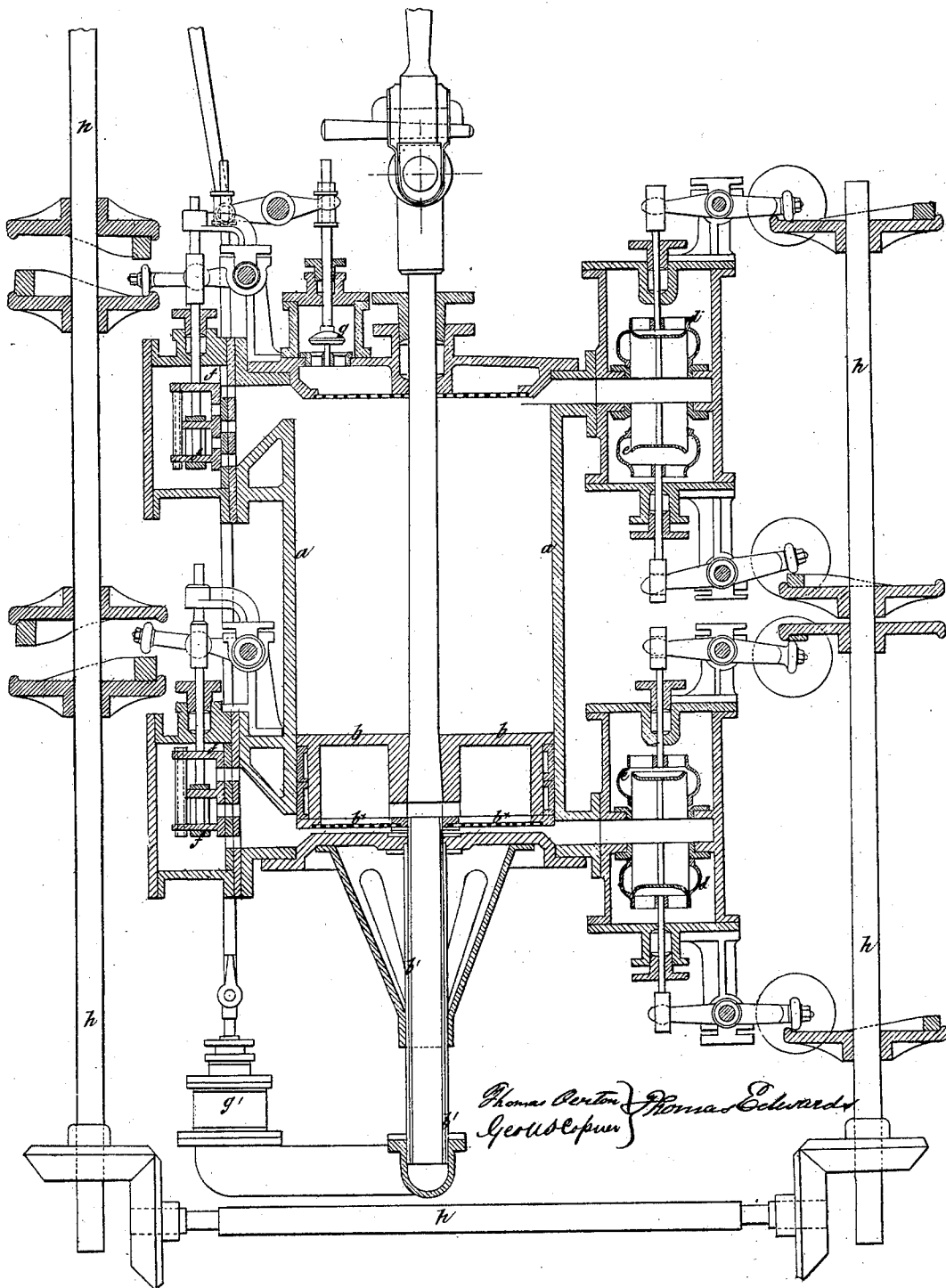


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CONDENSING STEAM ENGINE.

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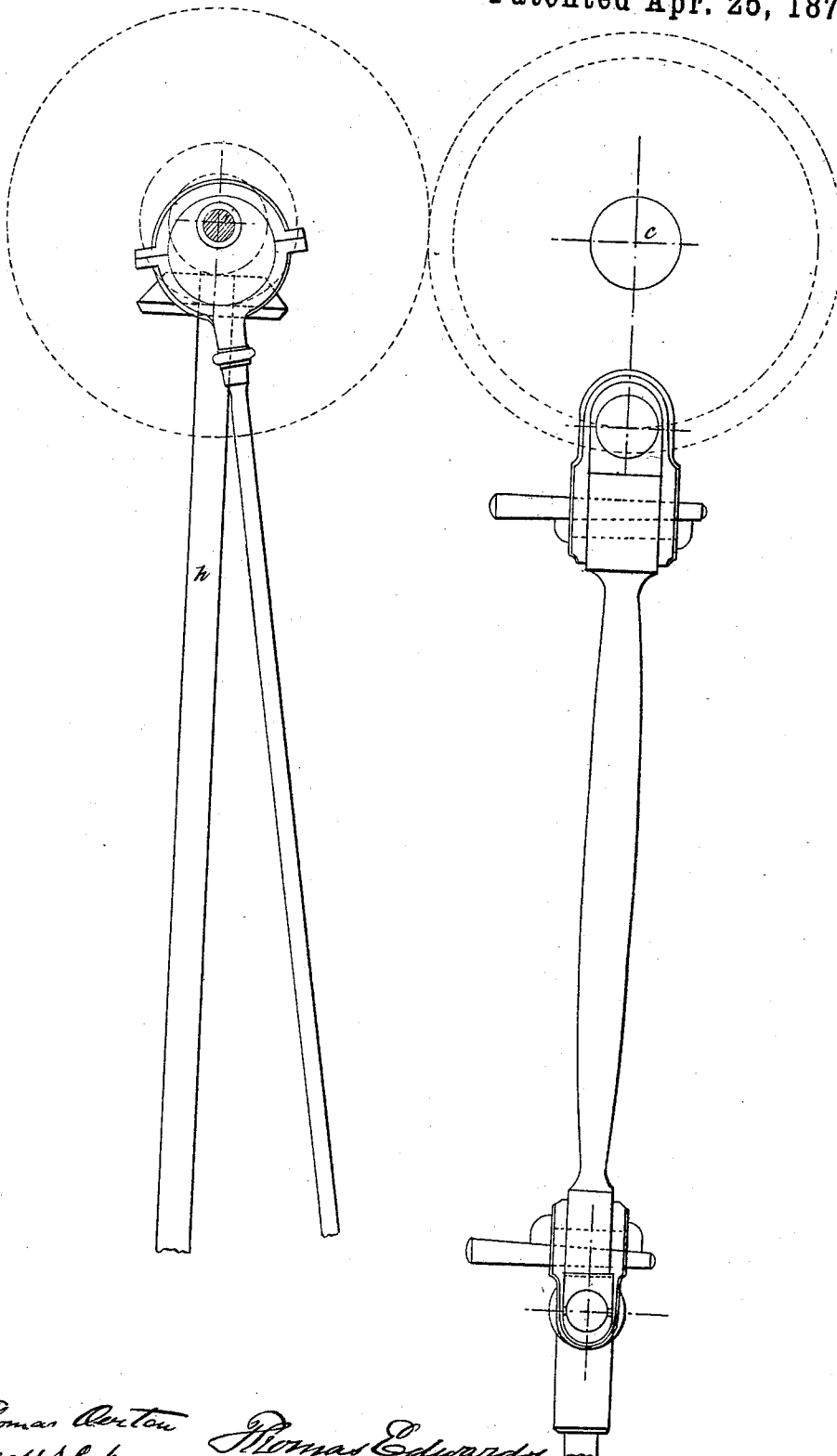
Patented Apr. 25, 1871.



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Geoffrey
1871

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United States Patent Office.

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Letters Patent No. 113,989, dated April 25, 1871.

IMPROVEMENT IN CONDENSING STEAM-ENGINES.

The Schedule referred to in these Letters Patent and making part of the same.

To all to whom it may concern :

Be it known that I, THOMAS EDWARDS, of Ladywood Birmingham, in the county of Warwick, England, engineer, a subject of the Queen of Great Britain, have invented or discovered new and useful "Improvements in Condensing Steam-Engines;" and I, the said THOMAS EDWARDS, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof; that is to say—

This invention has for its object improvements in condensing steam-engines.

At the present time, in condensing steam-engines the steam from the steam-cylinder is passed into a close vessel called the condenser, which is kept cool by means of cold water, and in which a partial vacuum is maintained by an air-pump provided for the purpose.

According to my invention I employ no separate air-pump, but I maintain a sufficient vacuum in the condensing-vessel by a piston working within it. I also supply steam over and under this piston in quantity sufficient to give the required motion to the piston, and also to aid the engine.

The arrangement I employ is as follows:

The condenser is a cylinder with a piston working within it suitably coupled with the main shaft of the engine and working in unison with the main steam-piston. The piston of the condenser being, say, at the top of the stroke, steam is admitted over it to cause its return. The steam is soon cut off, and when the piston has arrived nearly at the bottom of the cylinder a shower of cold water is thrown into the space over the piston to condense the highly-attenuated steam which this space then contains. When the piston is at the bottom of the condenser-cylinder the steam from the steam-cylinder, and which is required to be condensed, is admitted to the space over the piston which remains open to it during the next up-stroke of the piston, and so, during the up-stroke, a partial vacuum is maintained over the piston. When nearly at the top of the stroke the valve admitting steam from the engine closes, and the piston forces out of the condenser-cylinder the condensation and condensed water, and this water is led away in any convenient manner. Meanwhile, beneath the piston, as it gets to the bottom of the stroke, steam is admitted beneath it just as previously on its upper side. Its first action is to sweep out any remaining air and water from beneath the piston, and then, the escape-passage closing, it acts to force up the piston, and as it ascends the steam from the steam-cylinder is condensed in the space above it, as before stated.

The action on the one side of the piston is in all respects similar to that on the other side, and so at every stroke of the engine the work goes on.

The steam which is used for giving motion to the piston in the condenser-cylinder and for sweeping out the remaining air and water from the condenser may be boiler-steam, or it may be exhausted steam from the steam-cylinder.

The condensing arrangements above described may be used as a power-engine without being combined with a steam-cylinder or cylinders as above stated.

In order that my said invention may be most fully understood and readily carried into effect, I will proceed to describe the drawing hereunto annexed.

Description of the Drawing.

The drawing represents condensing apparatus adapted to receive and condense steam after it has worked in a steam-engine cylinder.

a a is the condenser-cylinder. Its cubic contents should be about one thousand cubic inches per horsepower indicated.

b is a piston within it, coupled by a piston-rod and connecting-rod with the main shaft *c* of the engine, or, in place of coupling the condenser-piston with the engine-shaft, it may be coupled with an axis driven at equal speed from the main shaft. The main crank and the condenser-crank should be parallel, or nearly parallel, the one to the other.

d d are equilibrium or double-seated valves, serving as the exhaust-valves of the steam-engine.

e e are similar valves to admit steam (by preference boiler steam) for a short time at the beginning of each stroke to blow the water out of the condenser-cylinder and destroy the vacuum acting against the piston.

f f are slide-valves, opening to allow of the expulsion of the water from the condenser-cylinder and then immediately closing.

g g' are valves opening to admit cold water into the condenser-cylinder to condense the steam.

The valves *d d*, *e e*, and *f f* are controlled by cams on the axes *h h*, which are so geared as to rotate at the same speed as the main shaft of the engine.

The axis *i* is also rotated at the same speed, and, by an eccentric, opens the injection-valves *g* and *g'*.

The valve *g* admits the water over a perforated plate at the top of the cylinder, and the valve *g'* up a sliding pipe, *b'*, into the piston *b* and over the perforated plate *b''* which forms the bottom of the piston.

The drawing represents the condenser-piston at the bottom of its stroke, and the piston in the steam-cylinder will be in a similar position. At this time, as will be seen, the exhaust-valve *d* from the upper part

of the steam-cylinder is wide open, to allow the exhaust steam to enter the condenser over its piston. This valve remains open until the upward stroke is nearly completed.

The lower steam-valve *e* is also shown in the drawing to be open, as is also the corresponding water-escape valve *f*, and the steam is in the act of blowing the water and air out of the space beneath the piston.

As soon as the stroke commences the valve *f* closes suddenly, but the steam-valve *e* remains open a short time longer.

During the earlier part of the up-stroke the upper injection-valve *g* remains open and a shower of water is discharged by it into the upper part of the cylinder, condensing the steam, which is at the same time entering from the steam-cylinder, and after the valve closes the shower will continue for an instant, until the cavity over the perforated plate is empty.

When the piston in the condenser-cylinder has made the greater part of its upward stroke the lower injection-valve *g'* opens and prepares a vacuum under the piston ready to receive the steam from the lower part of the steam-cylinder as soon as the lower exhaust-valve *d* opens, which it does as the piston in the condenser approaches the top of the stroke.

The upper escape-valve *f* opens just before the piston reaches the top of the cylinder; and if the quantity of water in the condenser-cylinder is such that a pressure comes upon the valve before it opens it is able to leave its seat and permit the water to pass.

At the return of the condenser-piston the course of the stroke is similar, as already stated.

In place of admitting boiler-steam to the condenser-cylinder it is, in the case of compound engines, advan-

tageous to use the steam issuing from the high-pressure cylinder.

In place of admitting a shower of condensing water into the condenser-cylinder this cylinder may be coupled with a surface condensing-chamber, the arrangements of which are similar to those of a common surface-condenser. Passages with valves in them connect this chamber with the two ends of the condenser-cylinder. The valves in these passages are similar to the valves *d d*, and they each open and close at the same time as the valve *d* at the same end of the condenser-cylinder. The air and water pass back from the condensing-chamber into the condensing-cylinder, and are ejected in the manner already described.

Having thus described the nature of my said invention and the manner of performing the same,

I would have it understood that what I claim is—

1. The condensing apparatus, composed of the condenser-cylinder, the piston thereof, the water-entry valves, the water-escape valves, and the steam-entry valves for the entrance of exhaust steam from the steam-cylinder, all combined substantially as before set forth.

2. The combination of the condenser-cylinder, the piston thereof, the water-entry valves, the water-escape valves, the steam-entry valves for the admission of exhaust steam, and the steam-entry valves for the admission of steam to displace the air, substantially as before set forth.

3. The general arrangement of the apparatus, substantially as described.

Witnesses:

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