

W. WEIR.
PUMPING CONDENSED STEAM WATER TO ELEVATED FEED HEATERS.
APPLICATION FILED JAN. 2, 1913.

1,065,194.

Patented June 17, 1913.

3 SHEETS—SHEET 1.

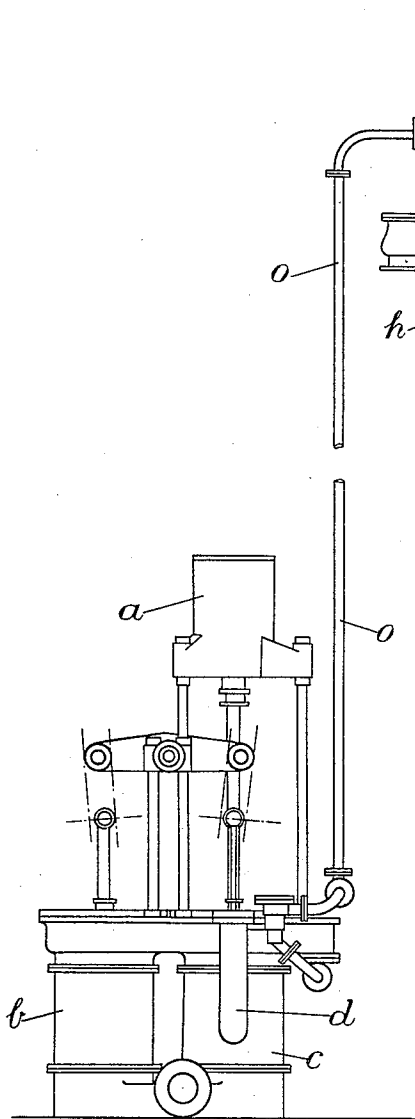


Fig. 1.

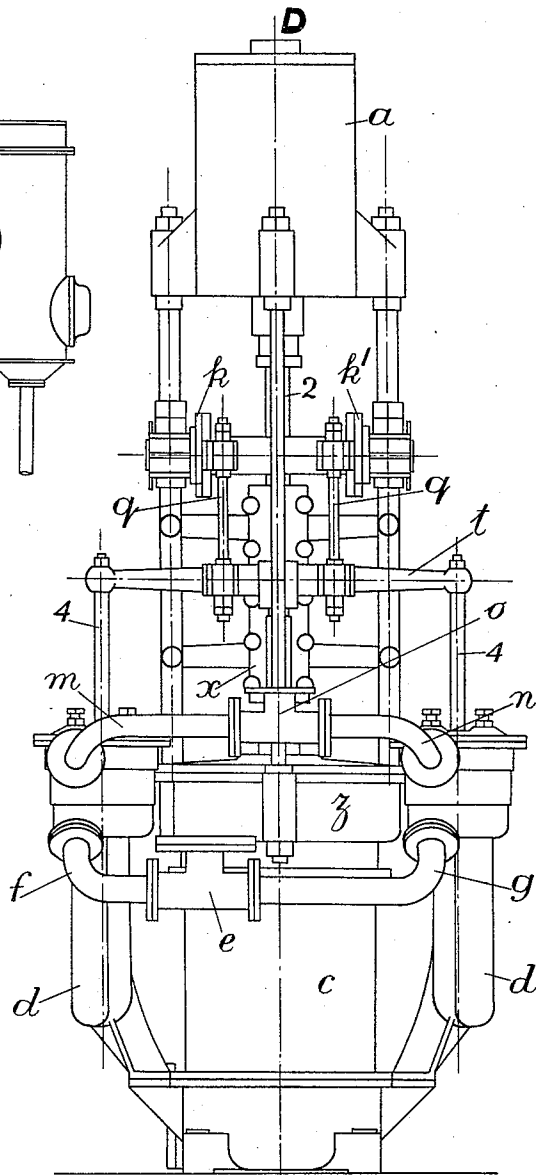


Fig. 3.

Witnesses:
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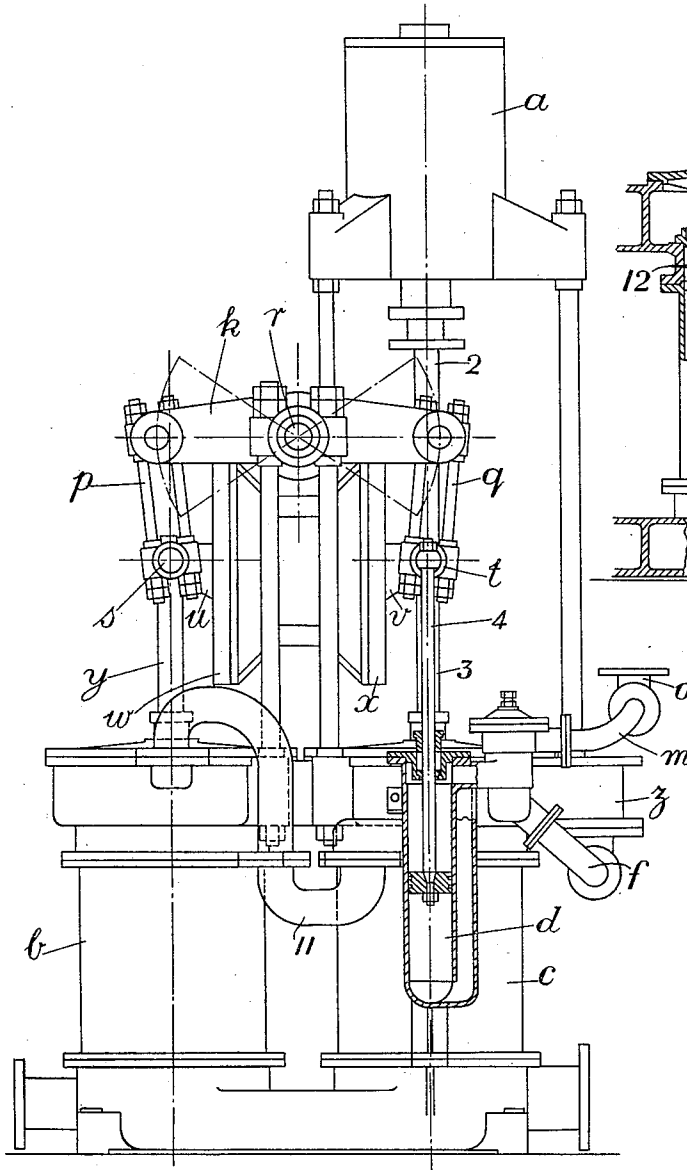


Fig: 2.

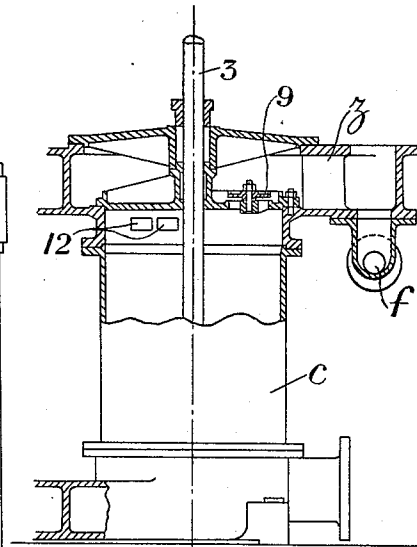


Fig: 4.

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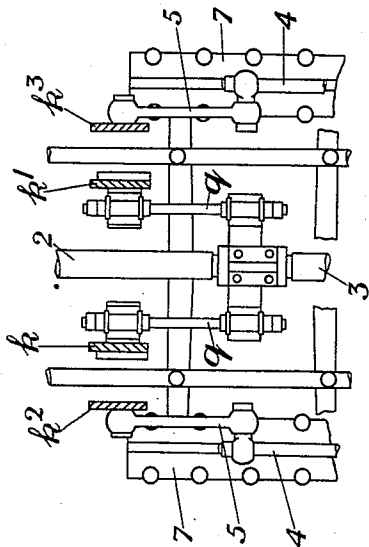


Fig. 6.

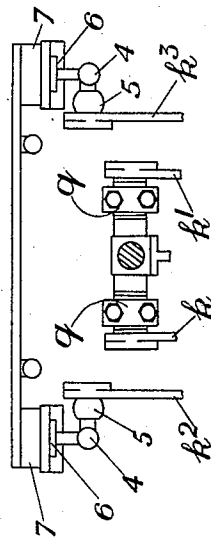


Fig. 7.

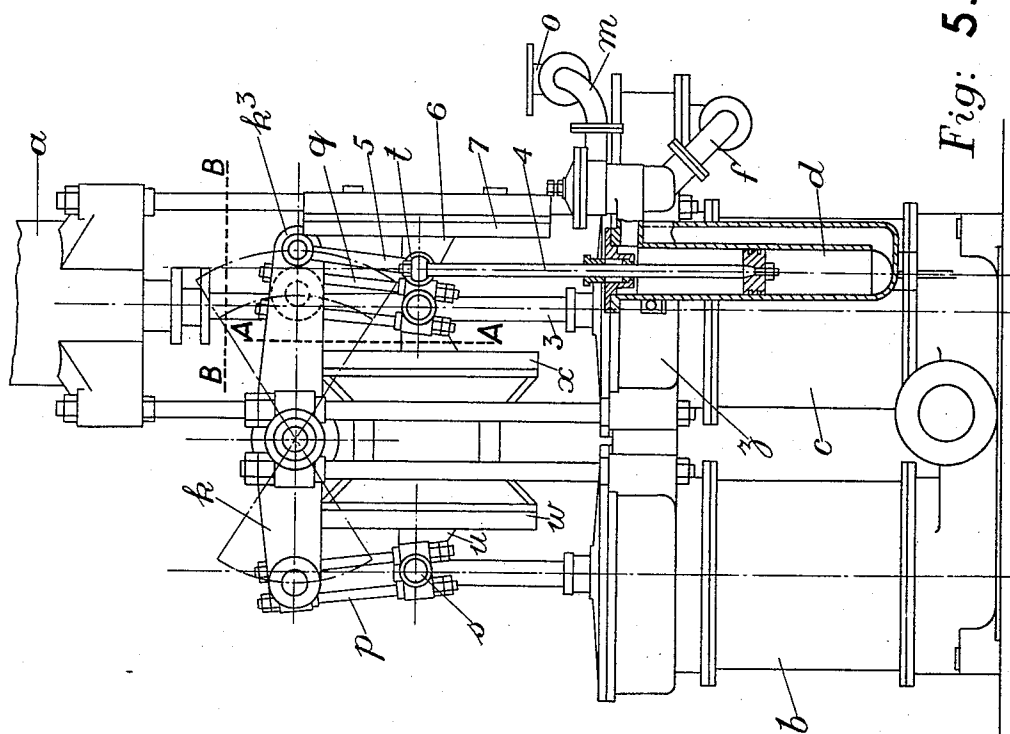


Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM WEIR, OF CATHCART, GLASGOW, SCOTLAND.

PUMPING CONDENSED-STEAM WATER TO ELEVATED FEED-HEATERS.

1,065,194.

Specification of Letters Patent.

Patented June 17, 1913.

Application filed January 2, 1913. Serial No. 739,596.

To all whom it may concern:

Be it known that I, WILLIAM WEIR, a subject of the King of Great Britain and Ireland, residing at Cathcart, Glasgow, Scotland, have invented certain new and useful Improvements Relating to the Pumping of Condensed-Steam Water to Elevated Feed-Heaters in Steamships; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to the pumping of condensed-steam water to elevated feed heaters in steamships.

The advantages of employing independent steam-driven air pumps on ships propelled by reciprocating steam engines are now generally recognized; and on vessels propelled by steam turbines independent air pumps are a practical necessity; but, where elevated direct-contact feed heaters are employed, as is now considered good practice, a difficulty arises in delivering the hot-well water to these heaters when the air pumps are of the independent type. These elevated heaters are usually situated about 20 to 35 feet above the engine room floor and, to cause the air pumps to deliver the condensed-steam water into these heaters would involve discharging the air and water from the air pumps at a pressure of about 10 to 17 pounds per square inch above atmosphere, which would seriously affect the smooth working of the pumps besides causing undue wear and tear of their mechanism.

The difficulty has heretofore been overcome in a limited number of cases by connecting the suction of one of the boiler feed pumps to the hot well into which the air pump delivers the condensed-steam water and employing this feed pump to deliver the hot-well water to the heater. This arrangement, however, involves the employment of a pump, designed for a high delivery pressure, to pump against a comparatively small head; and it is not a practice to be generally recommended. On the other hand, the installation for this duty of a special independently-driven hot-well pump, with its steam and exhaust connec-

tions, involves an increase in the complication of the engine room.

My invention consists in a novel disposition and combination of machinery and the like which will be described in the following specification and more particularly defined in the annexed claims.

Referring to the accompanying drawings:—Figure 1 shows the general arrangement of pumps, elevated heater and pipe connections according to my invention. Figs. 2, 3 and 4 show one convenient construction of pump unit according to my invention, Fig. 2 being a front elevation, partly in section, Fig. 3 a side elevation, and Fig. 4 a partial vertical section on the line D—D of Fig. 3. Figs. 5, 6 and 7 illustrate an alternative construction of pump unit, Fig. 5 being a front elevation, partly in section, Fig. 6 a vertical section on the line A—A of Fig. 5, and Fig. 7 a horizontal section on the line B—B of Fig. 5.

Referring in the first place to Fig. 1, *a* is the steam cylinder of the pump unit, *b* and *c* are air pump cylinders, *d* is a hot-well pump arranged in front of the air pump cylinder *c*, a similar hot-well pump being similarly arranged at the back of the cylinder *c*. The condensed steam is delivered by the air pumps to the hot-well pumps which discharge it to the elevated feed heater *h* by way of the pipe *o*.

Referring now to Figs. 2, 3 and 4, the beam *k*, *k'* fulcrumed at *r* is pivoted at its two ends to the upper ends of connecting rods *p* and *q* respectively, the lower ends of these rods being pivotally connected by the crosshead pins *s*, *t* to the slippers or guide blocks *u*, *v* which work in the fixed guides *w*, *x*. The slipper *u* is secured on the end of the rod *y* of the air pump *b* while the slipper *v* is secured to the rods 2 and 3 which are respectively the steam cylinder piston rod and the rod of the air pump *c*. The hot well pump rods 4, 4 are directly connected one to each end of the crosshead pin *t*. The beam is shown on the drawing as being constructed of two members *k* and *k'*, and the connecting rods *p* and *q* are shown as in duplicate. This construction has mechanical advantages, but the beam and connecting rods may be otherwise constructed if desired. The air pumps withdraw the air, vapor and water of condensation from the condenser. The water is delivered by the

pumps into the hot well or tank *z* from which it is withdrawn by the hot-well pumps by way of the pipes *e*, *f*, *g*. The hot-well pumps discharge the water to the elevated heater by way of the pipes *m*, *n*, *o*.

An alternative arrangement for driving the hot-well pumps is shown in Figs. 5, 6 and 7. The beam in this case comprises two additional members viz., k^2 and k^3 but all the members act as one. The hot-well pump rods 4, 4 are driven from the beam by being coupled by connecting rods 5, 5 with the ends of the members k^2 , k^3 . The rods are moreover provided with slippers 6, 6 which work in guides 7, 7.

With either arrangement of hot-well pump drive, a second steam cylinder could, if desired, be employed and arranged to drive on to the other end of the beam.

My invention is particularly advantageous when applied to an air pump of the type in which a single steam cylinder is employed with two air pump cylinders and a beam, and in which the pump cylinder which is in alinement with the steam cylinder is a wet pump, while the other pump cylinder is a dry pump. The unit illustrated in Figs. 2, 3 and 4 is of this type. The wet pump withdraws the water of condensation from the condenser and discharges it through the head valves 9 into the hot well *z*. The dry air pump *b* withdraws the air with vapor from the condenser, compresses the air to about 4 pounds per square inch absolute (more or less) and delivers it, by way of the pipe 11 and ports 12, to the wet pump *c* below the head valves 9, the air being further compressed in the wet pump and discharged through the head valves with the water. When my invention is applied to a pump of this type the hot-well pumps are arranged on opposite sides of the wet air pump cylinder.

The combination, with a two-cylinder air pump of the beam type, of a pair of hot-well pumps driven as hereinbefore described, serves to steady the unit by producing a more uniform load on the steam piston. This is especially the case when the air pump is of the wet-and-dry type above described. The hot-well pumps are preferably of the double-acting type.

It is to be noted that the hot-well pumps must be of relatively large capacity, as they are required to be equal to dealing with the whole of the feed, even when the air pump is running at a speed under its normal.

By means of my invention, the condensed-steam water is withdrawn from the condenser and delivered to the elevated feed heater by a single independent pump unit which also serves to withdraw the air from the condenser, the arrangement being simple and convenient and allowing the advantages of an independent air pump to be ob-

tained and the levers on the main engines to be entirely dispensed with, and also enabling the advantage of an elevated direct-contact feed heater to be obtained, and all without objectionable complications.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In combination, a steam cylinder, an air pump cylinder situated below and in axial alinement with and adapted to be directly driven by the said steam cylinder, a hot well adapted to receive the water discharged by said air pump cylinder, a pair of hot-well pumps situated on opposite sides of said air pump cylinder and adapted to be driven by said steam cylinder, and a feed heater situated a considerable height above said hot-well pumps, the said hot-well pumps being adapted to withdraw the whole of the water from the said hot-well and discharge it against gravity into the said feed heater.

2. In combination, a steam cylinder, a beam adapted to oscillate about a fixed fulcrum and to be actuated by said steam cylinder, an air pump cylinder situated below and in axial alinement with and adapted to be directly driven by the said steam cylinder, a second air pump cylinder adapted to be driven by said steam cylinder through the agency of said beam, a hot well adapted to receive the water discharged by said first-mentioned air pump cylinder, an elevated feed heater, and a pair of hot-well pumps situated on opposite sides of the first-mentioned air pump cylinder and adapted to be driven by said steam cylinder and adapted to withdraw the whole of the water from said hot well and discharge it into said elevated feed heater.

3. In combination, a steam cylinder, a beam adapted to oscillate about a fixed fulcrum and to be actuated by said steam cylinder, an air pump cylinder situated below and in axial alinement with and adapted to be directly driven by the said steam cylinder, a second air pump cylinder adapted to be driven by said steam cylinder through the agency of said beam, a hot well adapted to receive the water discharged by said first-mentioned air pump cylinder, a pair of hot-well pumps situated on opposite sides of the first-mentioned air pump cylinder and adapted to be driven by said steam cylinder, and a feed heater situated a considerable height above the said hot-well pumps, the said hot-well pumps being adapted to withdraw the whole of the water from said hot-well and discharge it against gravity into said feed heater.

4. In combination, a steam cylinder, a beam adapted to oscillate about a fixed fulcrum and to be actuated by said steam cylinder, a hot-well, an air pump cylinder pro-

vided with head valves and situated below and in axial alinement with and adapted to be driven by said steam cylinder, and adapted to suck water and to discharge it through
 5 said head valves into said hot-well, a second air pump cylinder adapted to be driven by said steam cylinder through the agency of said beam and adapted to suck air with water-vapor, and to discharge the air into
 10 said first-mentioned air pump cylinder below the head valves of the same, an elevated feed heater, and a pair of hot-well pumps situated on opposite sides of the first-mentioned air pump cylinder and adapted to be
 15 driven by said steam cylinder and adapted to withdraw the whole of the water from said hot-well and discharge it into said elevated feed heater.

5. In combination, a steam cylinder, an
 20 air pump cylinder situated below and in alinement with said steam cylinder, a piston rod for said steam cylinder, a pump rod for said air pump cylinder in alinement with said piston rod, a crosshead pin carried by
 25 said piston rod and said pump rod, a pair of hot-well pumps situated on opposite sides of said air pump cylinder, rods for said hot-well pumps pivoted to and adapted to be driven from said crosshead pin, a hot well
 30 adapted to receive the water discharged by said air pump cylinder, and a feed heater situated a considerable height above said hot-well pumps, the said hot-well pumps being adapted to withdraw the whole of the
 35 water from the said hot well and discharge it against gravity into said feed heater.

6. In combination, a steam cylinder, a

beam adapted to oscillate about a fixed fulcrum and to be actuated by said steam cylinder, a hot well, an air pump cylinder provided with head valves and situated below
 40 and in axial alinement with and adapted to be driven by said steam cylinder and adapted to suck water and to discharge it through said head valves into said hot well, a second
 45 air pump cylinder adapted to be driven by said steam cylinder through the agency of said beam and adapted to suck air with water-vapor and to discharge the air into said first-mentioned air pump cylinder below the head valves of the same, a piston rod
 50 for said steam cylinder, a pump rod for said first-mentioned air pump cylinder in alinement with said piston rod, a crosshead pin carried by said piston rod and said pump
 55 rod, a pair of hot-well pumps situated on opposite sides of said first-mentioned air pump cylinder, rods for said hot-well pumps pivoted to and adapted to be driven from said crosshead pin, a hot well adapted to
 60 receive the water discharged by said air pump cylinders, and a feed heater situated a considerable height above said hot-well pumps, the said hot-well pumps being adapted to withdraw the whole of the water from
 65 the said hot well and discharge it against gravity into said feed heater.

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

WILLIAM WEIR.

Witnesses:

JAMES DAYTON IRVINE,
 ALEXANDER DOBBIE CLARK.