

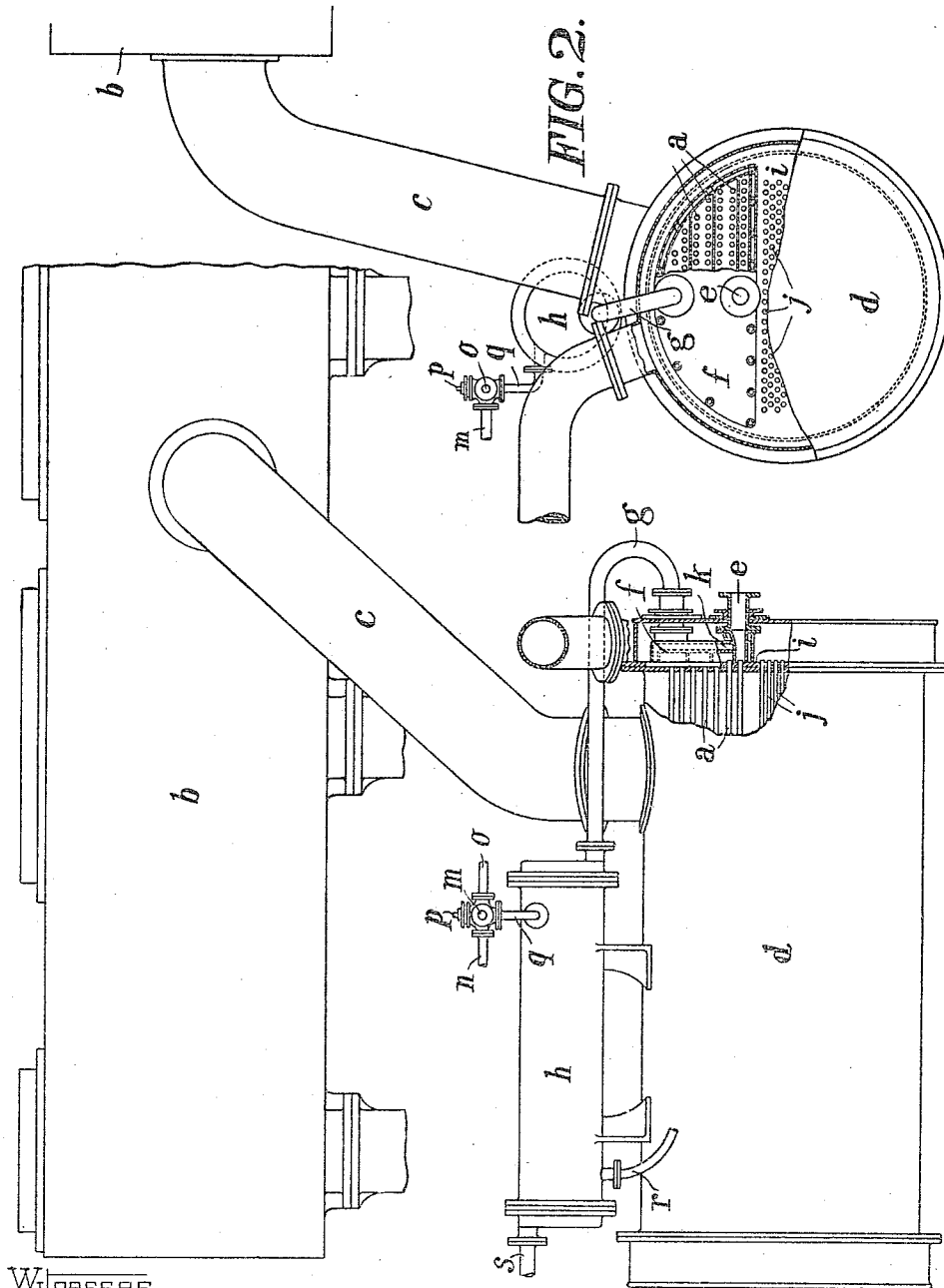
J. KERFOOT.

APPARATUS FOR HEATING FEED WATER BY EXHAUST STEAM FROM STEAM ENGINES.

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957,688.

Patented May 10, 1910.



Witnesses

W. O. Kennedy
L. E. Morrison

FIG. 1.

Inventor

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UNITED STATES PATENT OFFICE.

JAMES KERFOOT, OF ANTWERP, BELGIUM.

APPARATUS FOR HEATING FEED-WATER BY EXHAUST-STEAM FROM STEAM-ENGINES.

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Specification of Letters Patent.

Patented May 10, 1910.

Application filed February 7, 1908. Serial No. 414,667.

To all whom it may concern:

Be it known that I, JAMES KERFOOT, a subject of the King of Great Britain, residing at Antwerp, in the Kingdom of Belgium, engineer, have invented certain new and useful Improvements in Apparatus for Heating Feed-Water by Exhaust-Steam from Steam-Engines, for which application has been made in Great Britain, No. 16,070, dated July 12, 1907.

This invention relates to apparatus for heating feed water, and has for its object to provide an improved apparatus in which the heat of the exhaust steam is utilized to effect a preliminary heating of the feed water, which is then further heated by means of steam at a higher temperature, for instance steam taken direct from the boiler or from the higher pressure stages of a multiple expansion engine.

A further object of the invention is to provide an improved construction of heating apparatus combined with a condenser for the exhaust steam.

In describing the invention, reference will be had to the accompanying drawings, which show one form of the apparatus as applied to a triple expansion engine, the preliminary heater being combined with a condenser for the exhaust steam.

Of these drawings:—Figure 1 is a side elevation, and Fig. 2 an end elevation, parts of each view being in section.

b represents diagrammatically the cylinders and valve casing of a triple expansion engine; *c* is a pipe leading the exhaust steam from the low pressure cylinder to the condenser *d* (shown as a surface condenser). In this condenser *d* are arranged the ordinary tubes *j* for the condenser water, and in addition a set of tubes *a* located in the upper part of the condenser near the inlet for the exhaust steam. All these tubes are supported in tube plates *i* of ordinary form. These tubes *a* serve for the passage of the feed water, and as these are the tubes against which the exhaust steam first impinges, they receive the greater part of the heat of the exhaust steam. The feed water enters by way of the inlet pipe *e*, passes through the tubes *a*, being directed in a circuitous path by means of the division box *f*. This box is mounted on the tube plate *i*, a similar division box being provided at the other end of the condenser. These division boxes are on the outside in contact with the condensing

water which would tend to abstract the heat from the feed water inside the boxes. By the present invention however this cooling effect is avoided by providing the division boxes with steam jackets, indicated at *h*, which are interposed between the feed water and the condensing water. From the preliminary heater tubes *a* the feed water passes by way of the pipe *g* to the second heater *h*. This latter is supplied with steam at a higher temperature than is the preliminary heater, for instance live steam direct from the boiler may be admitted through the pipe *m*, exhaust steam from the high pressure stage of the engine through the pipe *n* and from the intermediate stage through the pipe *o*, the three inlet pipes being controlled by the cock *p*, which connects either one or the other to the pipe *q* leading direct into the heater *h*. The outflow for the heating fluid is by way of the pipe *r* which is preferably connected with the steam trap.

The construction of the second heater *h* is similar to the preliminary heater, except of course that the condensing tubes are omitted. The outlet for the feed water is by way of the pipe *s*.

It is obviously not necessary that the preliminary heater should be combined in one apparatus with the condenser so long as it is adapted to utilize the exhaust steam, for instance instead of a surface condenser a jet condenser can be used and a separate apparatus for heating the feed water interposed in the way of the exhaust steam before it reaches the condenser. In the case of a non-condensing engine the apparatus is naturally arranged in the path of the steam before it reaches the atmosphere.

The feed water is driven through the heating apparatus by force pumps, preferably single-acting, and passes from thence to the boilers, the single-acting pumps giving the water an intermittent progression. The feed water is admitted into the heating apparatus through a change cock, so that it can be temporarily diverted from the heating apparatus and sent direct from the pumps to the boiler to enable the heating of the device to be repaired or cleaned.

I declare that what I claim is:—

1. Apparatus for heating feed water comprising a chamber, means for leading steam into the upper part of said chamber, a tube plate extending completely across said cham-

ber near each end thereof, two separate sets of tubes extending between said plates, one set being located in the upper part of said chamber and the other in the lower part, a
 5 cover box located on each tube plate and between it and the adjacent end of the chamber and extending over and inclosing the ends of the tubes of the upper set, division
 10 pieces in said boxes separating the tubes into rows, a steam jacket on each of said boxes, means for admitting feed water to the lowest
 15 division of one of said boxes, means for carrying off feed water from the top division of one of said boxes, and means for supplying
 20 condensing water to the spaces between the tube plates and the ends of the chamber outside the cover boxes so as to feed the
 25 lower set of tubes therewith.

2. Apparatus for heating feed water, comprising a chamber, means for leading steam
 20 into the upper part of said chamber, a tube plate extending completely across said chamber near each end thereof, a set of tubes extending
 25 between said tube plates in the upper part of the chamber, a cover box located on each tube plate and between it and the adjacent end of the chamber and extending
 30 over and inclosing the ends of said tubes, division pieces in said boxes separating the tubes into rows, a steam jacket on each of said boxes, means for admitting feed
 35 water to the lowest division of one of said boxes, means for carrying off water from the top division of one of said boxes, condensing
 means located in the lower part of the cham-

ber, and means for supplying water to the spaces between the tube plates and the ends of the chamber outside the cover boxes so as to feed said condensing means therewith.

3. Apparatus for heating feed water, comprising a chamber, means for leading steam
 40 into the upper part of said chamber, a tube plate near each end of said chamber, tubes extending between said plates in the upper
 45 part of the chamber, means for conducting feed water into the lowest of said tubes, means for causing the feed water to pass in a zig-zag path through said set of tubes,
 50 means for carrying off feed water from the top tubes of said set, said three last mentioned means being located between the tube plates and the ends of the chamber, means
 55 located in the lower part of said chamber for condensing the steam, means for supplying water to the spaces between the tube plates and the ends of the chamber outside the feed
 60 water guiding means located in these spaces so as to feed said condensing means therewith, and a steam jacket separating the feed water guiding means from the cooling influence of the condensing water.

In witness whereof, I have hereunto signed my name this 23rd day of January 1908, in the presence of two subscribing witnesses.

JAMES KERFOOT.

Witnesses:

B. VERWILT,
 G. DE LERSY.