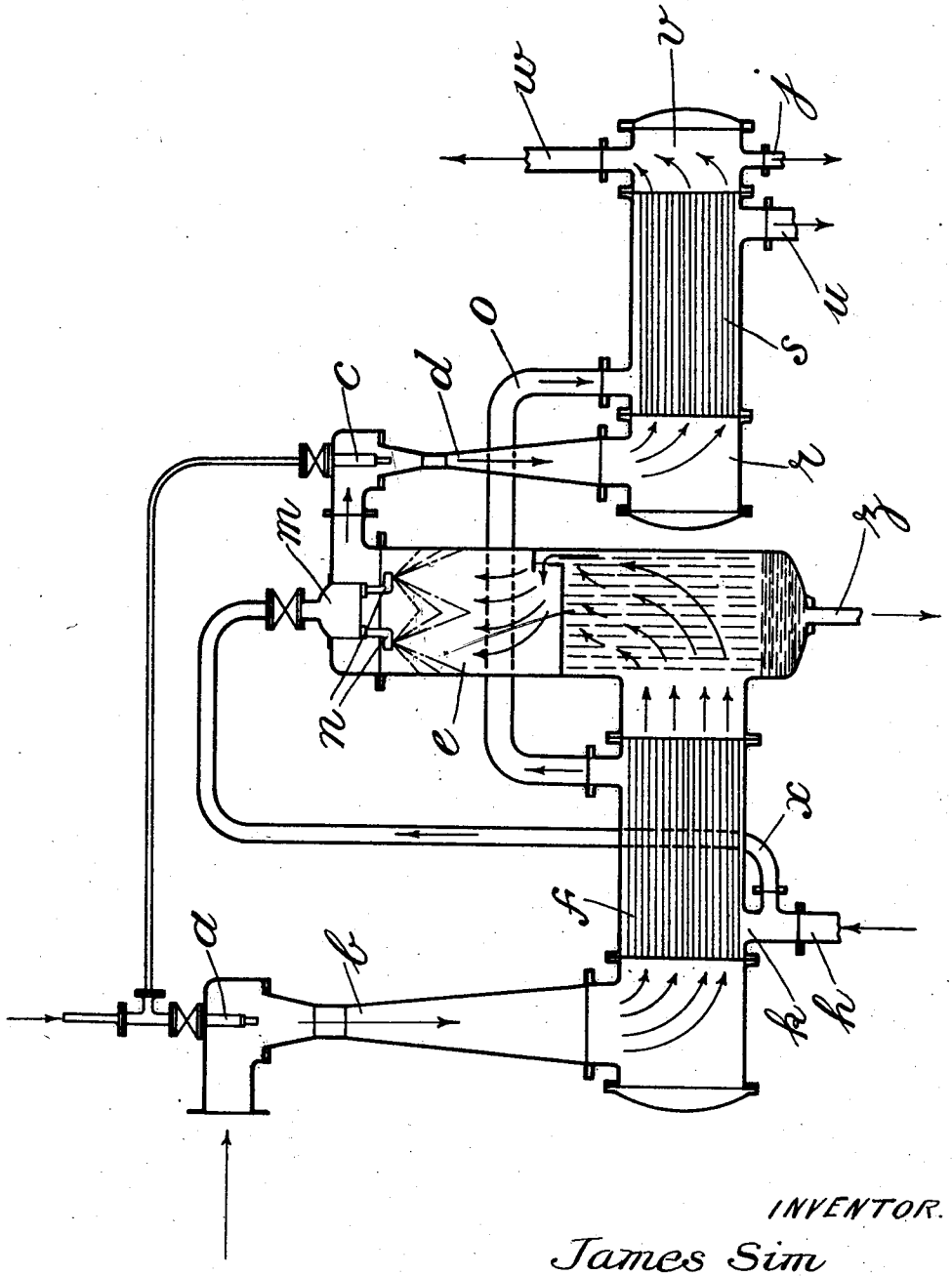
June 16, 1931. J. SIM 1,810,873

MULTISTAGE STEAM JET EJECTOR

Filed April 12, 1930



INVENTOR.

James Sim

By William C. Linton

Attorney.

Patented June 16, 1931 1,810,873

UNITED STATES PATENT OFFICE

JAMES SIM, OF GLASGOW, SCOTLAND, ASSIGNOR TO G. & J. WEIR, LIMITED, OF GLASGOW, SCOTLAND

MULTISTAGE STEAM-JET EJECTOR

Application filed April 12, 1930, Serial No. 443,837, and in Great Britain May 16, 1929.

The present invention relates to multi-stage steam-jet ejectors, for example, to the ejectors used to discharge the air from the main condensers in steam power plants.

When, in a steam-power plant, a two-stage steam-jet ejector employed for discharging the air from the main condenser is provided with an inter-condenser of the surface type in which the cooling or condensing water is condensate from the main condenser, the heat in the operating steam of the first stage is conserved.

By replacing the surface condenser (i. e. the inter-condenser) by a condenser of the direct-contact type, the air-handling capacity of the (two-stage) ejector is substantially increased, but the heat in the operating steam of the first stage is lost.

The object of the present invention is to reduce this heat loss while retaining the air-handling advantage.

This object is attained by the present invention. The invention will be defined in the annexed claims but it may here be said to consist generally in employing for inter-condensing a surface condenser and a direct-contact condenser, the two being arranged in series with the surface condenser nearest to the first-stage steam-jet, and the cooling or condensing water used in the surface-inter-condenser being thereafter delivered into the feed system, the heat transferred in this condenser being thus conserved.

Actual tests carried out by me show that a two-stage ejector furnished in this manner will give a performance equal to that obtained by the same ejector with a direct-contact inter-condenser only which takes the same steam-jet steam as the combined surface and direct-contact condenser, while the combination condenser arrangement avoids the excessive heat loss associated with the use of a direct-contact condenser only.

The accompanying drawing—which is diagrammatic—illustrates the carrying of the invention into effect in one convenient manner as applied to a two-stage ejector employed to discharge the air from the main condenser in a steam power plant.

a is the steam-jet nozzle and *b* the combining nozzle and diffuser of the first stage. *c* is the steam nozzle and *d* the combining nozzle and diffuser of the second stage. The discharge from the first stage is passed through the surface condenser *f*. The steam and uncondensed vapour therefrom pass into the chamber *e* of the direct-contact condenser. This chamber is of considerable height with respect to its lateral dimensions.

h is a water pipe bringing condensate from the main condenser. This pipe is branched. The one branch *k* takes the water to the surface condenser *f* where it is employed as the cooling or condensing water, while the other branch *x* leads the water to the water-receiving and delivery chamber *m* of the direct-contact condenser. The water is discharged into the main chamber of the direct-contact condenser through the nozzles *n*.

The second stage ejector draws the air from the top end of the chamber *e* and discharges it into the end chamber *r* of the surface condenser *s*.

The cooling or condensing water for the condenser *s* is the same water as has been employed for the same purpose in the condenser *f*, the water being conducted from the one condenser to the other by way of the pipe *o*. This cooling water, on discharge from the condenser *s* (by the pipe *u*), is delivered into the feed system.

The condensate collecting in the bottom of the chamber *e* is arranged to flow back, through the pipe *z*, and either through a trap or through a loop or U pipe, to the main condenser. As regards the condensate deposited in the delivery chamber *v* of the condenser *s*, this condensate may (the chamber *v* being at atmospheric pressure) be discharged, by way of the pipe *j*, to the feed tank, or it may be passed back through a trap to the main condenser. The air delivered into the chamber *v* is discharged through the pipe *w* to the atmosphere.

In the case of a three-stage ejector, the combination inter-condenser arrangement (according to the present invention) may be employed with respect either to one, or both,

of the inter-condensers, and, in the event of a multi-stage ejector with more than three stages, the combination inter-condenser arrangement could be employed with one, or more, or all, of the inter-condensers.

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

1. A multi-stage steam-jet ejector arrangement for use in a steam power plant, involving a surface-inter-condenser and a direct-contact-inter-condenser, these two inter-condensers being in series with the surface-inter-condenser nearest to the first-stage steam jet, the arrangement being such that the cooling water used in the said surface-inter-condenser is thereafter delivered into the feed system of the plant.

2. A multi-stage steam-jet ejector arrangement for use in a steam power plant, involving a surface-inter-condenser and a direct-contact-inter-condenser, these two inter-condensers being in series with the surface-inter-condenser nearest to the first-stage steam-jet, the arrangement being such that the cooling water used in the said surface-inter-condenser is thereafter delivered into the feed system of the plant, and the arrangement being such that the cooling water employed in the said direct-contact-inter-condenser is condensate from the main condenser of the plant.

3. A multi-stage steam-jet ejector arrangement for use in a steam power plant, involving a surface-inter-condenser and a direct-contact-inter-condenser, these two inter-condensers being in series with the surface-inter-condenser nearest to the first-stage steam jet, the arrangement being such that the cooling water used in the said surface-inter-condenser is thereafter delivered into the feed system of the plant, and the arrangement being such that the cooling water employed in the said direct-contact-inter-condenser and the said surface-inter-condenser is condensate from the main condenser of the plant which is supplied to the two said inter-condensers in parallel.

4. A multi-stage steam-jet ejector arrangement for use in a steam power plant, involving a surface-inter-condenser and a direct-contact-inter-condenser, these two inter-condensers being in series with the surface-inter-condenser nearest to the first-stage steam jet, and a surface condenser for dealing with the steam from the last stage, the arrangement being such that the cooling water employed in the said surface-inter-condenser is thereafter employed as cooling water in the said surface condenser for dealing with the steam from the last stage and is then delivered into the feed system of the plant.

5. A multi-stage steam-jet ejector arrangement for use in a steam power plant, involving a surface-inter-condenser and a direct-contact-inter-condenser, these two inter-condensers being in series with the surface-inter-condenser nearest to the first-stage steam jet, and a surface condenser for dealing with the steam from the last stage, the arrangement being such that the cooling water employed in the said surface-inter-condenser is thereafter employed as cooling water in the said surface condenser for dealing with the steam from the last stage and is then delivered into the feed system of the plant, and the arrangement being such that the cooling water employed in the said direct-contact-inter-condenser is condensate from the main condenser of the plant.

6. A multi-stage steam-jet ejector arrangement for use in a steam power plant, involving a surface-inter-condenser and a direct-contact-inter-condenser, these two inter-condensers being in series with the surface-inter-condenser nearest to the first-stage steam jet, and a surface condenser for dealing with the steam from the last stage, the arrangement being such that the cooling water employed in the said surface-inter-condenser is thereafter employed as cooling water in the said surface condenser for dealing with the steam from the last stage and is then delivered into the feed system of the plant, and the arrangement being such that the cooling water employed in the said direct-contact-inter-condenser and the said surface-inter-condenser is condensate from the main condenser of the plant which is supplied to the two said inter-condensers in parallel.

I hereby sign my name to this specification.

JAMES SIM.