Nov. 17, 1931. J. KIRGAN 1,832,637

CONDENSER

Filed Aug. 15, 1930 2 Sheets-Sheet 1

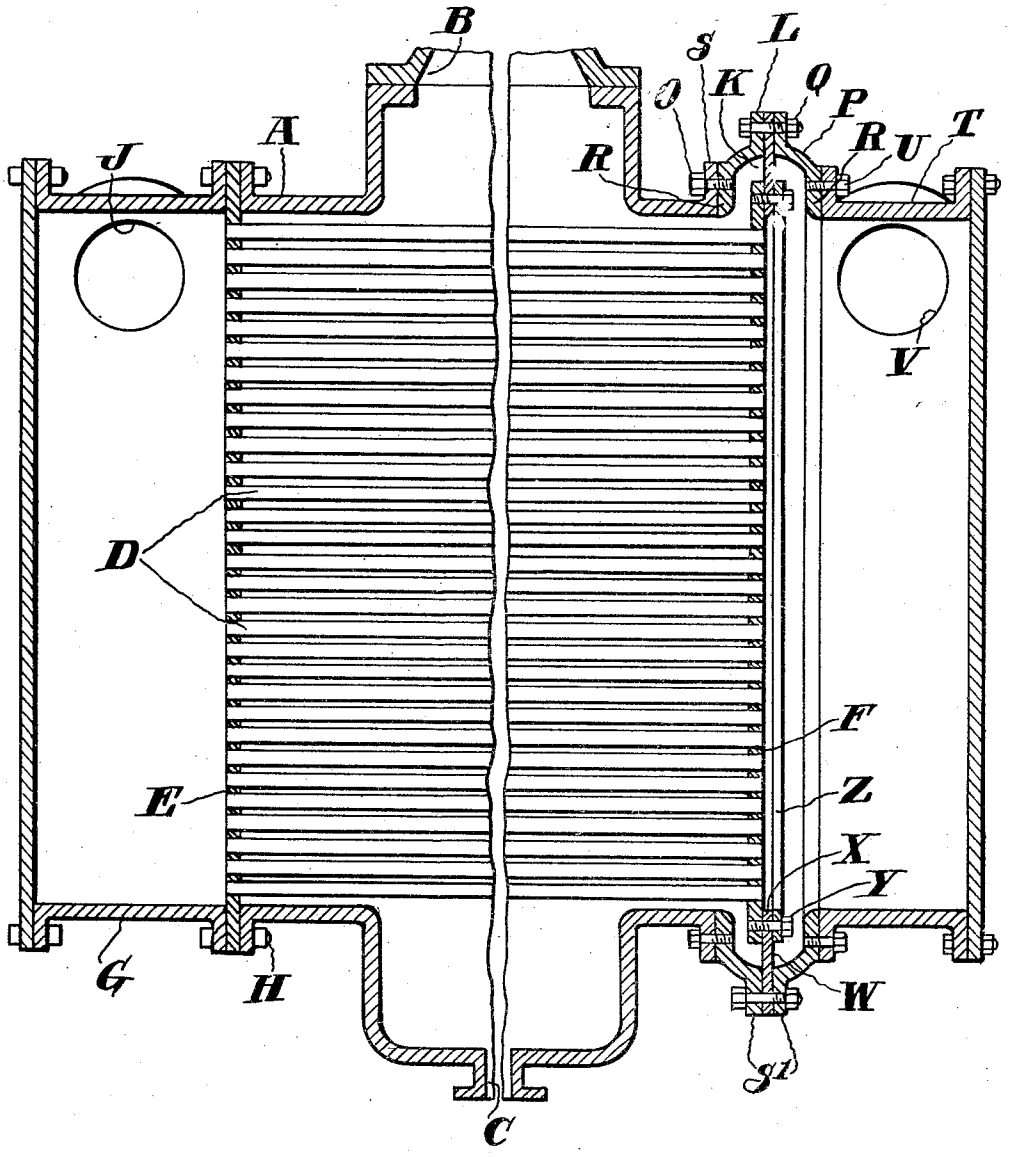


FIG.-1.

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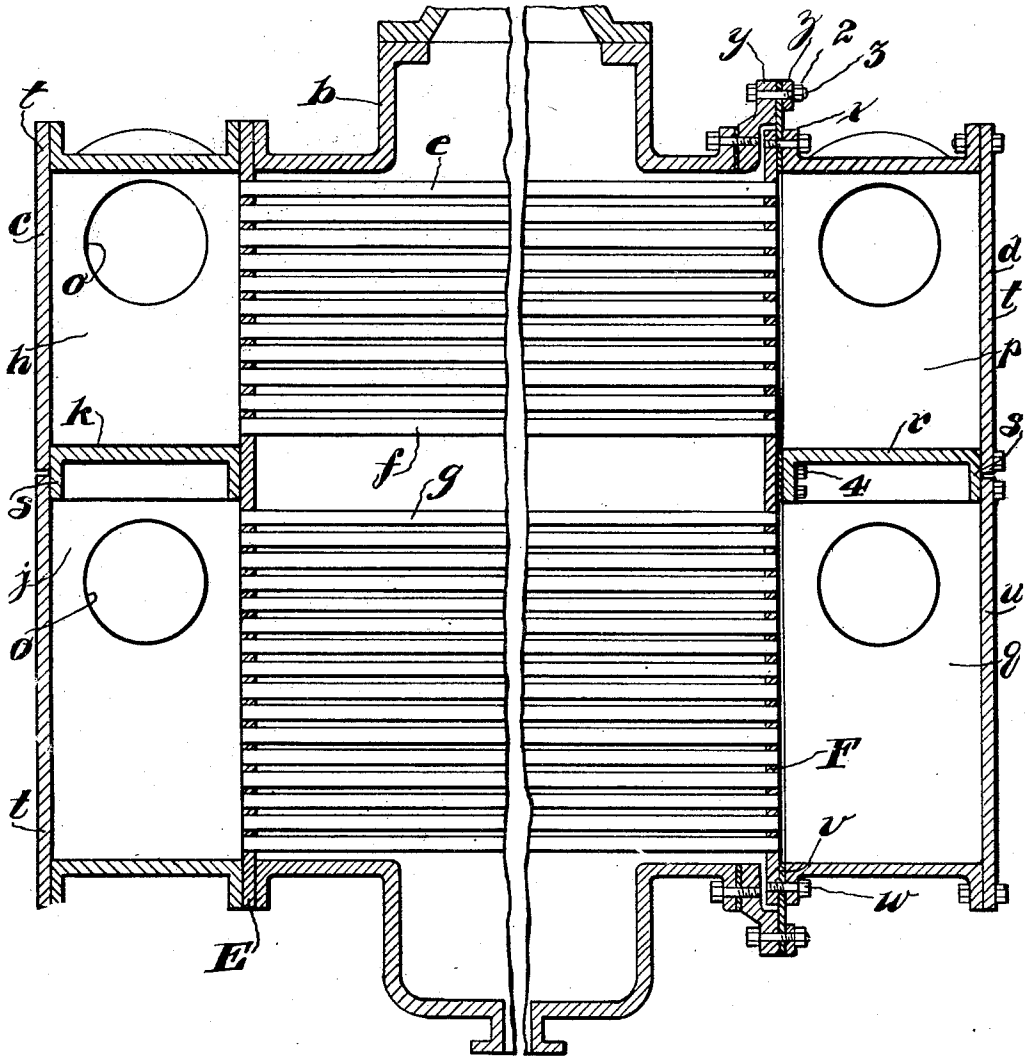


FIG.-2.

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UNITED STATES PATENT OFFICE

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CONDENSER

Application filed August 15, 1930. Serial No. 475,571.

This invention relates to condensers, but more particularly to a flexible joint for condensers of the surface type employing tube sheets in which the ends of the cooling tubes are embedded and wherewith they cooperate to form seals for preventing the inter-mixture of condensate and the cooling medium, such as raw water.

One object of the invention is to prevent the occurrence of leaks between the cooperating surfaces of the cooling tubes and the tube sheets whereby the cooling tubes are supported.

Another object is to permit of relative contractile and expansive movement of the condenser casing and the cooling tubes.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying the specification and forming a part thereof,

Figure 1 is a longitudinal sectional elevation of a surface condenser having the invention applied thereto, and

Figure 2 is a similar view showing a modified form of the invention.

Referring to the drawings and at first more particularly to Figure 1, A designates a condenser casing having an inlet B through which steam may enter the casing A and at a point in the bottom of the casing an outlet C through which condensate may be withdrawn by suitable pump means (not shown).

The condenser A may, as indicated, be of the single pass type and is accordingly provided with a nest of tubes D which extend longitudinally of the casing A and therefore transversely of the direction of steam flow through the casing.

The ends of the tubes D may be fixedly secured in any well known manner to the tube sheets E and F located adjacent the ends of the casing A. The tube sheet E in this instance lies between one end of the casing A and a water box G secured to the casing as by means of bolts H which also serve to clamp the tube sheet E firmly between these elements. The water box G may be provided with a suitable inlet opening J preferably located near the upper portion of the water box and through which opening raw cooling water may be supplied to the cooling tubes D.

In accordance with the practice of the invention the tube sheet F which may be of somewhat smaller dimensions than the tube sheet E is located entirely within the casing A so that a space K exists between the tube sheet F and the wall of the casing A or, as illustrated, a clamping ring L which is secured to the casing A by means of bolts O.

Arranged in face to face relationship with the clamping ring L is a second clamping ring P which may be in all essential respects similar to the clamping ring L to which it is secured by bolts Q. Both clamping rings L and P have introverted flanges R, that of the ring L being seated against an outer lateral flange S of the casing A to cooperate therewith for forming a seal between these elements and it is in the flange S and the flange R of the ring L that the bolts O are arranged.

Seated against the outer surface of the flange R of the ring P is a water box T which is secured to the ring P by bolts U. The water box T has a discharge opening V through which the cooling fluid flowing from the tubes D into the water box T may flow from the condenser.

As is well known, in apparatus of the character to which the present invention pertains, the various elements thereof are exposed to mediums of different degrees of temperature. For example, during the normal operation of the condenser the casing A and the outer surfaces of the tubes D are constantly exposed to the direct contact of the steam intended to be condensed while the interior surfaces of the tubes are exposed to cooling water of comparatively low temperature. Obviously, when operating under these conditions there will be unequal degrees of relative expansion and contraction in the casing A and the tubes D.

In structures of this type employing fixed tube sheets and where the ends of the cooling tubes are secured to the tube sheets by expanding the ends of the tubes it is extremely difficult to maintain fluid tight joints between the tubes and the tube sheets whereby they are

supported. The present invention contemplates the provision of means to enable relative expansive and contractile movement of the tubes and the casing. To this end the tube sheet F is provided with an expansion plate or joint W having an opening X therein to permit free communication between the water box T and the tubes D.

The plate W is of such cross sectional area that it may flex readily whenever unequal expansion between the casing A and the tubes D takes place and is secured to the tube sheet F at points near the edge thereof by bolts Y which serve to clamp the plate W and the tube sheet F in fluid tight relationship. Preferably a supporting ring Z is seated on the side of the plate W facing the water box T and said supporting ring is also clamped in position by the bolts Y.

The outer portion of the plate W in this instance lies between the lateral flanges S′ of the rings L and P and is clamped therebetween by the bolts Q to form fluid tight joints at this point. The plate W thus not only serves as an expansion joint between the tube nest and the casing A but also supports the tube sheet and its proportionate share of the tube nest.

In the modification shown in Figure 2 the casing designated by *b* is provided at one end with an inlet water box *c* and at its other end with a discharge water box *d*. The condenser shown in this modification may also be of the single pass type, although in this instance the cooling tubes *e* are arranged in two groups *f* and *g* and the inlet water box *c* is divided into upper and lower compartments *h* and *j* respectively by a plate *k*. Each compartment has an inlet opening *o* through which water from the same source of supply may enter the compartments.

Similarly the water box *d* is divided into upper and lower compartments *p* and *q* respectively by a plate *r*. The plates *k* and *r* are preferably provided with flanges *s* against which upper and lower cover plates *t* and *u* may be bolted to form closures for the outer ends of the water boxes *c* and *d*.

This arrangement affords a convenient means for inspecting the tubes *e* or for making repairs thereto since, as will be readily appreciated, it enables either one of the groups of tubes to be rendered inactive while such repairs are being made and at the same time allows the unaffected group of tubes to remain active for condensing steam during its passage through the casing *b*.

Between the water box *c* and the casing *b* is arranged a tube sheet E to support the ends of the tubes *e* adjacent the water box *c*. The opposite ends of the tubes *e* are, as in the preferred modification, supported by a tube sheet F between which and the water box *d* is clamped the inner portion of an apertured flexible plate or joint *v*, bolts *w* being used for this purpose and said bolts extend through a flange *x* on the water box *d* and through the plate *v* and the tube sheet F.

The outer portion of the plate *v* is clamped into fluid tight relationship with a clamping ring *y* bolted to the end of the casing *b*, and a supporting ring *z* is seated against the outer surface of the plate *v* to form a seat for nuts 2 of bolts 3 whereby the rings *y* and *z* and the plate *v* are securely clamped together.

In the present instance the inner end or flange of the plate *r* is secured to an intermediate portion of the tube sheet F by means of bolts 4. The entire arrangement is such that the plate *v* supports not only a portion of the tubes *e* and the tube sheet F but also the water box *d*.

In practice, the present invention has been found to function in an unusually efficient manner. Due to the arrangement described the seal between the ends of the tubes of the condenser and the tube sheets whereby they are supported will at all times remain unimpaired and, owing to the flexibility of the plate whereby the tube sheet F is supported, the tubes and the casing of the condenser may expand and contract freely without imposing destructive strains upon any portion of the device.

I claim:

1. A surface condenser, comprising a casing, water boxes for the ends of the casing, tube sheets, cooling tubes in the casing connected at their ends to the tube sheets, flexible means forming a support for one tube sheet to permit of relative contractile and expansive movement of the tubes and the casing, and means interposed between one water box and the casing to support said flexible means.

2. A surface condenser, comprising a casing, water boxes for the ends of the casing, tube sheets, cooling tubes in the casing connected at their ends to the tube sheets, flexible means forming a support for one tube sheet and cooperating therewith to form a seal between the casing and one of the water boxes, and means interposed between one water box and the casing to support said flexible means.

3. A surface condenser, comprising a casing, water boxes for the ends of the casing, tube sheets, cooling tubes in the casing connected at their ends to the tube sheets, a flexible plate interposed between the casing and a water box and being connected to one tube sheet to support said tube sheet and to permit of relative contractile and expansive movement of the tubes and the casing, and means secured to the casing and said water box and interposed therebetween to support said flexible plate.

4. A surface condenser, comprising a casing, water boxes for the ends of the casing, tube sheets, cooling tubes connected at their

ends to the tube sheets, clamping rings interposed between the casing and one water box, a flexible plate clamped between said rings and supported independently of the casing and said water box, and means for connecting one tube sheet to the plate for supporting the said tube sheet and to permit of relative expansion and contraction of the casing and the tubes.

In testimony whereof I have signed this specification.

JOHN KIRGAN.