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1,605,157

P. A. BANCEL

SURFACE CONDENSER

Filed March 26, 1925 2 Sheets-Sheet 1

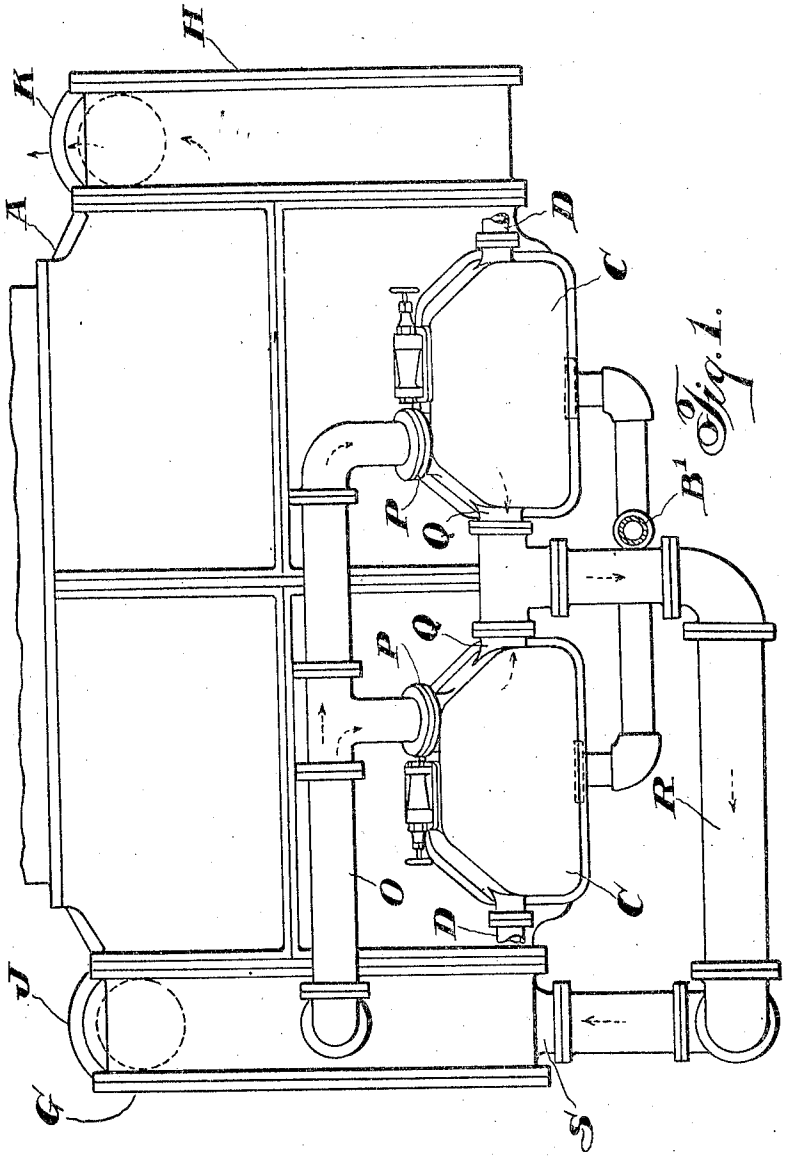


Fig. 1.

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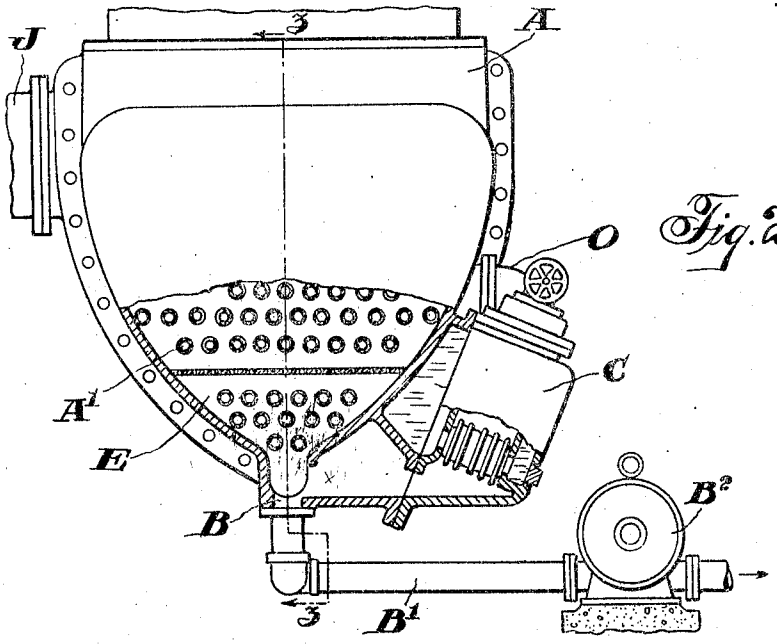


Fig. 2.

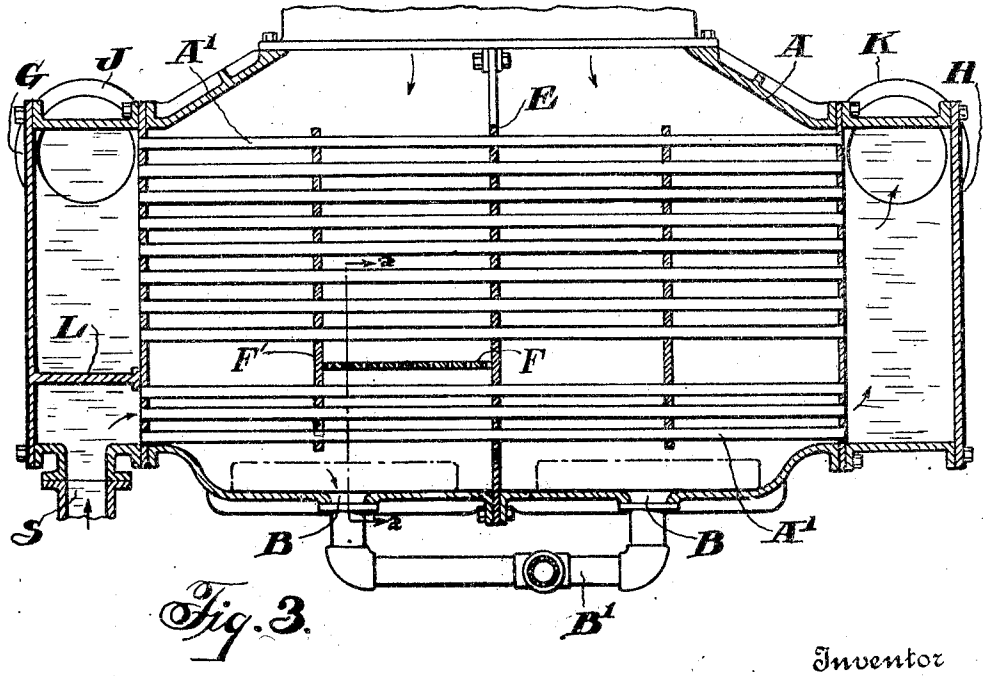


Fig. 3.

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Patented Nov. 2, 1926. 1,605,157

UNITED STATES PATENT OFFICE.

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SURFACE CONDENSER.

Application filed March 26, 1925. Serial No. 18,378.

This invention relates particularly to surface condensers, but may apply to other surface cooling or heating devices, in which steam or other gas or vapor is condensed or in which air or gas is cooled or heated.

The object of the invention is to cause as complete a flow of the steam or vapor as possible through the condensing unit, for instance, and by producing substantially complete flow, more steam will be condensed. In a cooler or heater as distinguished from a condenser, the object is also to cause this substantially complete flow of the gas or vapor through the cooler or heater.

In an ordinary surface condenser as, for instance, a single pass condenser, the penetration of flow of vapor or gas is not uniform throughout the length of the condenser, due to the fact that the temperature decreases from the water inlet end to the water discharge end of the condenser. This causes varying amounts of steam to be condensed per unit of tube area in different portions of the condenser, and the penetration of vapor is less at the water inlet end than at the water outlet end.

It is an object of this invention to apportion the steam in the various parts of the condenser so as to produce substantially the same depth of penetration throughout and to utilize the entire available cooling surface of the condenser.

In accordance with my invention, I divide the condenser into sections or compartments by a partition or partitions extending transversely across the longitudinal water tubes or cooling surfaces of the condenser. By this means, the pressure in the bottom of each compartment may be lowered enough to cause complete penetration of the steam.

Without the sections or compartments. the air is drawn out of the entire condenser by the vacuum pump or other evacuating apparatus, and if the fall of pressure is sufficient to produce complete penetration of the vapor in the inlet end, steam will be drawn from the discharge end of the condenser, which is highly undesirable. If the pressure drop is no more than sufficient to cause complete penetration of the vapor at the outlet end, a certain amount of inactive cooling surfaces is left at the inlet water end. By dividing the condenser into a plurality of compartments, the vacuum in each compartment may be different, and the amount of inactive cooling surfaces in each compartment is decreased, thus increasing the total amount of active cooling surfaces in the whole condenser.

The invention is illustrated in one of its preferred forms in the accompanying drawings, in which—

Figure 1 is a side elevation of a condenser,

Figure 2 is an end elevation partly in transverse section, and

Figure 3 is a longitudinal sectional elevation of a condenser.

Referring to the drawings, the condenser A is preferably a surface condenser, provided with the water tubes A′, and the condenser shell may be of wedge shaped form, as shown, in which the mixture of condensable vapor and gas, as steam and air, is admitted in the top and after passing downwardly over the condensing surfaces, the condensate passes out of the bottom, in this instance through the outlets B, there being a plurality of outlets, connected by suitable piping B′ to the condensate removal pump B^2.

Although coolers need not be used in connection with this invention, they are shown in the drawings for purposes of illustration, and in this instance a plurality of coolers C are arranged against the lower portion of one or both sides of the condenser, preferably at an angle to the vertical axis of the condenser. These coolers comprise that portion of the condensing apparatus in which the latter part of the total heat abstraction takes place, and they are preferably shown of wedge shaped or pyramidal form, although not necessarily of this form. The mixture of air and vapor coming from the condenser A after the major portion of the steam has been condensed, in this case, passes upwardly through the coolers, which are provided with multiple cooling elements, sprays or surfaces. Suitable evacuators, as for instance vacuum pumps, (not shown) are adapted to be connected to the coolers at the outlets D. The function of the coolers, as is well understood, is to complete the condensation of the vapors as the mixture flows from the surface condenser, and a separate vacuum pump is preferably used for each cooler.

It is apparent from the drawings that suitable piping and connections, to be described, are provided for the circulation of

cooling water both through the water tubes of the condenser and the cooling elements of the coolers, although as stated, the coolers may be omitted if desired, as the invention is applicable to a condenser without coolers.

In accordance with this invention, one or more transverse partitions E divide the casing of the condenser into a plurality of compartments, in this instance one partition E being shown for purposes of illustration. This partition or a plurality of partitions may be mounted in the condenser in any suitable manner and care should be taken that the partition forms a substantially tight joint with the bottom portions, at least, of the walls of the condenser casing and throughout a height sufficient to prevent short circuiting of the gases between the outlets or vacuum pump connections. Caulking will preferably be used between the partition and the walls of the casing around the lower portion of the casing in the joint between the partition and the casing. The tubes passing tightly through the partition, form sufficiently tight joints without other securing means.

Since the partition E as shown in Figure 3 divides the steam inlet opening at the top of the condenser casing, the condensable mixture entering the condenser is caused to divide and flow through both compartments. In accordance with this construction, the pressure drop is greatest at the water inlet end and the said drop in each compartment is progressively smaller from the injection water end of the condenser to the discharge water end. By forming a substantially tight joint around the lower portion of the partition E between the partition and the condenser casing and between the tubes and the partition E, the pressure in the bottom of each compartment may be lowered enough to cause complete penetration of the steam from the top to the bottom of each compartment, when both coolers and their vacuum pumps assumed to be connected thereto are in operation. The vacuum in each compartment may be different, so that the pressure drop in the compartments progressively decreases and the amount of inactive cooling surfaces in each compartment is decreased. The total amount of active cooling surfaces in the whole condenser is by this means increased. As an example, let it be assumed that a certain vacuum is drawn at the top of the condenser in each compartment. In such cases the vacuums drawn at the bottoms of the compartments will be higher than said given vacuum, but will progressively decrease towards the water discharge end of the condenser.

The partition E not only forms a dividing partition in the condenser, but forms a support sheet for the tubes. Due to the position of the inlet with respect to the tubes A′, the tendency of the steam entering it at high velocity is to pass straight down instead of under the overhanging portion of the casing A adjacent the inlet water head G. Steam is directed into these spaces by obstructing its path adjacent the partition E as by means of a baffle F extending from the partition E to an intermediate tube sheet F′.

Suitable means are provided, as stated, for circulating water through the condenser and the coolers, and as shown, the condenser is provided with the inlet water head G and the discharge water head H, and water enters the head G at the water inlet J and passes through the upper rows of tubes A′ and out the discharge outlet K. A deck L is formed in the inlet water head G and water passes from the inlet water head G through the pipe O to the water inlets P of the coolers C and from the discharge outlets Q of the coolers through the common pipe R to the inlet S of the inlet water head G beneath the deck L and thence through the lower rows of tubes A′ to the discharge water head H.

I claim:

1. A surface condenser comprising a casing having longitudinally extending water tubes, an inlet for a condensable mixture of vapor and gas at the top of the casing, at least one transverse partition dividing the casing into a plurality of compartments, and outlets for condensate and non-condensable vapors at the bottom of each compartment, said non-condensable vapor outlets being adapted to be connected to evacuating apparatus, whereby the pressure drop in each compartment may be progressively smaller from the injection water end of the condenser to the discharge water end.

2. A surface condenser comprising a casing having longitudinally extending water tubes, an inlet for condensable mixture of vapor and gas at the top of the casing, at least one transverse partition dividing the casing into a plurality of compartments, said partition forming a substantially tight joint with the bottom portions of the walls of the casing, and outlets for condensate and non-condensable vapor at the bottom of each compartment, said non-condensable vapor outlets being adapted to be connected to evacuating apparatus, whereby the pressure drop in each compartment may be progressively smaller from the injection water end of the condenser to the discharge water end.

3. A surface condenser comprising a casing having longitudinally extending water tubes, an inlet for a condensable mixture of vapor and gas at the top of the casing, at least one transverse partition dividing the casing into a plurality of compartments, said partition forming a substantially tight joint with the bottom portions of the walls

of the casing, and outlets for condensate and non-condensable vapors at the bottom of each compartment, said non-condensable vapor outlets being adapted to be connected to evacuating apparatus, whereby the pressure drop in each compartment may be progressively smaller from the injection water end of the condenser to the discharge water end.

4. A surface condenser comprising a casing having longitudinally extending water tubes, an inlet for a condensable mixture of vapor and gas at the top of the casing, at least one transverse partition dividing the casing into a plurality of compartments for steam, said partition forming a substantially tight joint with the bottom portions of the walls of the casing, outlets for condensate and non-condensable vapors at the bottom of each compartment, and devaporizers connected to said non-condensable vapor outlets, said devaporizers being adapted to be connected to evacuating apparatus, whereby the pressure drop in each compartment may be progressively smaller from the injection water end of the condenser to the discharge water end.

5. A surface condenser comprising a casing having longitudinally extending water tubes, an inlet for a condensable mixture of vapor and gas at the top of the casing, at least one partition dividing the casing into a plurality of compartments, and outlets for condensate and non-condensable vapors at the bottom of each compartment, said partition forming a substantially tight joint with the bottom portion of the walls of the casing and with the tubes throughout a height sufficient to prevent short-circuiting of gases between said outlets for each compartment, said non-condensable vapor outlets being adapted to be connected to evacuating apparatus, whereby the pressure drop in each compartment may be progressively smaller from the injection water end of the condenser to the discharge water end.

In testimony whereof I have signed this specification.

PAUL A. BANCEL