

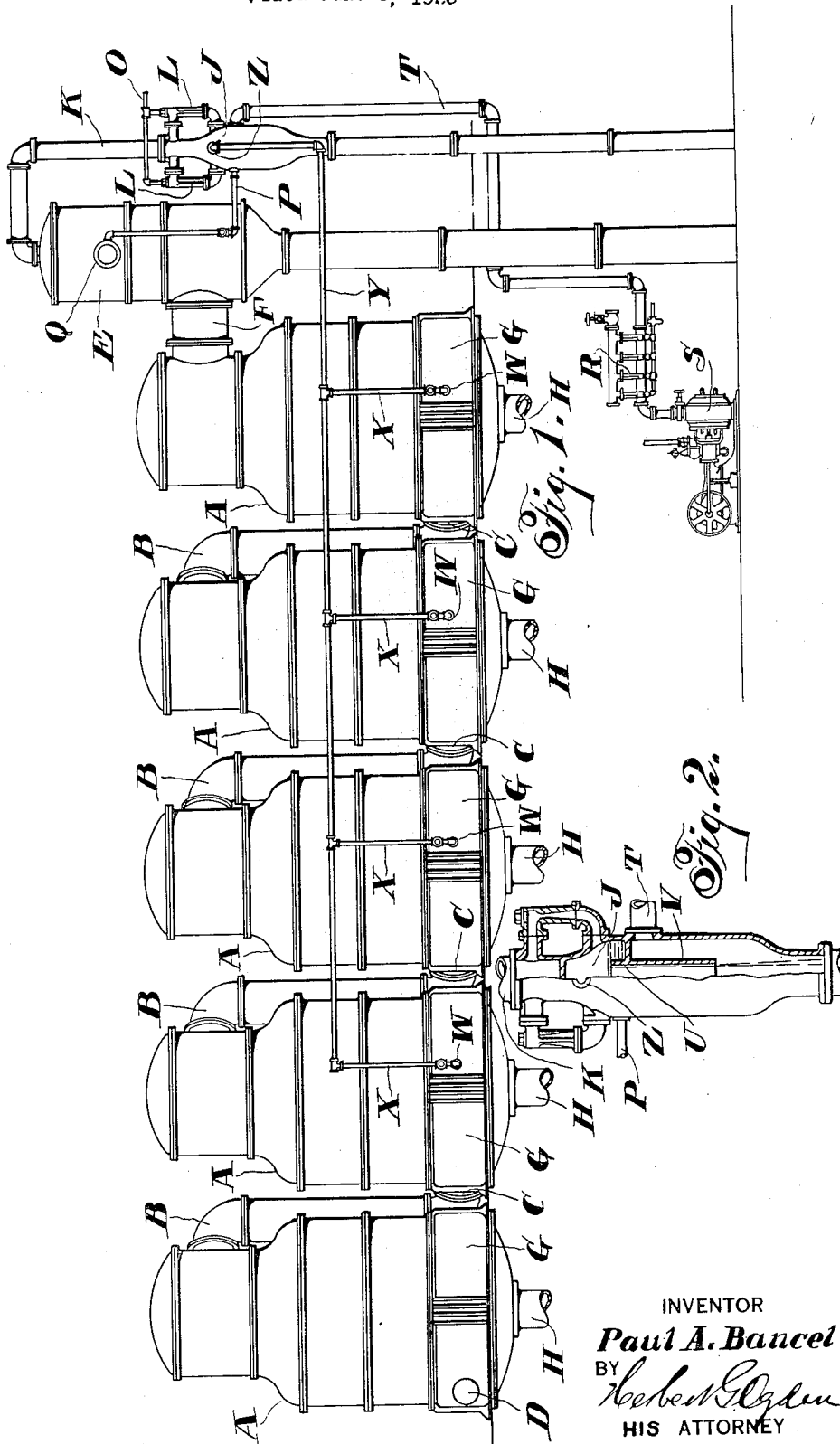
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P. A. BANCEL

MULTIPLE EFFECT EVAPORATING APPARATUS

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UNITED STATES PATENT OFFICE.

PAUL A. BANCEL, OF NUTLEY, NEW JERSEY, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MULTIPLE-EFFECT EVAPORATING APPARATUS.

Application filed June 8, 1923. Serial No. 644,130.

To all whom it may concern:

Be it known that I, PAUL A. BANCEL, a citizen of the United States, a resident of Nutley, county of Essex, and State of New Jersey, have invented a certain Multiple-Effect Evaporating Apparatus, of which the following is a specification, accompanied by drawings:

This invention relates to evaporating apparatus, but more particularly to multiple effect apparatus, suitable for use in the sugar industry in evaporating sugar syrup, but also applicable to the evaporation of other liquids as desired.

The object of the invention is to enable multiple effect evaporating apparatus to be more economically used with a main condenser and intercooler or intercondenser, and with an evacuator connected to the intercooler, capable of producing a vacuum appreciably higher than the steam pressure in the last or final effect of the series, in order to cause flow of air and non-condensable gases or vapors from the said final effect to the intercooler.

By venting the steam box of the last or final effect of the evaporating apparatus to the intercooler, instead of to the main condenser, the primary steam jets and the main condenser itself are relieved of this air and vapor leakage, so that a smaller vacuum pump may be used for evacuation.

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

Figure 1 is a diagrammatic side elevation of multiple effect evaporating apparatus embodying the invention, and

Figure 2 is an enlarged detail vertical sectional view taken through the intercooler.

Referring to the drawings, a plurality of steam heated evaporators A are connected in series with each other, by connecting the steam and vapor outlet pipe B of each evaporator or effect to the steam inlet C of the steam box G of the next adjacent evaporator or effect. Steam for heating purposes is supplied at the steam inlet D of the first steam box G, from any suitable source, (not shown), and a main condenser, in this instance a barometric condenser E is connected to the outlet pipe F from the evaporating chamber of the last effect. The evaporators A may be of any suitable or standard construction in which the evaporating chamber

may be divided by the heating chamber into the usual upper and lower liquid containing chambers connected by circulating tubes which pass through the heating chamber but this internal well known construction is not shown for the sake of simplicity. The syrup is heated in the lower liquid containing compartments or chambers, and the sugar is withdrawn from these chambers at the bottom outlets H. The main discharge outlets from the steam boxes G may be connected in any suitable or usual manner (not shown) to evacuating apparatus.

The barometric condenser E may be of standard construction. An intercooler J which may be like that disclosed in my Patent No. 1,526,040, February 10, 1925, for steam jet condenser pump, is connected to the main condenser by the pipe K and primary augmentor jets L supplied with steam from the supply pipe O, compress air and gases from the main condenser and discharge into the intercooler at low vacuum. The intercooler is supplied with water by the pipe P connected to the water supply pipe Q of the main condenser. Secondary jets R or a vacuum pump S or both connected to the intercooler by the pipe T, form the second stage of the evacuating apparatus. The water in the intercooler flows over the wier U and the pipe or apron V protects the vacuum pump connection from the entrance of water.

In accordance with this invention, auxiliary steam box vents W from the steam boxes G are connected to the intercooler J for the purpose of venting non-condensable gases, thus relieving the main condenser E and primary steam jets L of this air leakage. In the present instance, the vents W are located at the lower portions of the evaporators A, in the steam belts or boxes G forming the heating chambers or compartments, and the pipes X from each auxiliary vent are conveniently connected to the common vent pipe Y which is connected to the intercooler at Z. Air and non-condensable gases and vapors from the steam boxes or belts pass off through the auxiliary vent pipes X and Y to the intercooler J. The evacuating apparatus comprising the primary jets L and the secondary jets R and vacuum pump S should be capable of producing a vacuum appreciably higher than the vacuum in the last or final evaporator or effect A

nearest to the main condenser E in the series, in order to cause flow of the air and non-condensable gases or vapors from the steam box of the said last effect to the intercooler.

5 I claim:

1. Multiple effect evaporating apparatus, comprising a plurality of steam heated evaporators connected in series and having steam boxes, in combination with a main condenser connected next in series with the evaporating chamber of the final evaporator or effect, an intercooler connected next in series to the main condenser and means for venting non-condensable gases from the steam box of the said last effect directly into the said intercooler, thereby causing a flow of air and non-condensable gases or vapors from the steam box of the said last effect into the intercooler, and an evacuator connected to the intercooler.

2. Multiple effect evaporating apparatus, comprising a plurality of steam heated evaporators connected in series and having steam boxes, in combination with a main condenser for said apparatus connected next in series with the evaporating chamber of the final evaporator or effect and having an intercooler connected next in series thereto and an evacuator connected next in series after the intercooler capable of producing a vacuum appreciably higher than the steam pressure in the final effect of the series, and means for venting non-condensable gases from the steam box of the said last effect directly into the intercooler, thereby causing a flow of air and non-condensable gases or vapors from the steam box of the said last effect into the intercooler.

3. Multiple effect evaporating apparatus, comprising a plurality of steam heated evaporators connected in series and having steam boxes, in combination with a main condenser for said apparatus connected next in series with the evaporating chamber of the final evaporator or effect and having an intercooler connected next in series thereto and an evacuator connected next in series after the intercooler capable of producing a vacuum appreciably higher than the steam pressure in the final effect of the series, and a pipe for venting non-condensable gases connecting the steam box of the said last effect directly with the intercooler, thereby causing the flow of air and non-condensable gases or vapors from the steam box of the said last effect into the intercooler.

4. Multiple effect evaporating apparatus, comprising a plurality of steam heated evaporators connected in series and having steam boxes, in combination with a main condenser for said apparatus connected next in series with the evaporating chamber of the final evaporator or effect and having an intercooler connected next in series thereto and an evacuator connected next in series after the intercooler capable of producing a vacuum appreciably higher than the steam pressure in the final effect of the series, vent pipes for venting non-condensable gases from the steam boxes of the effects connected to a common vent pipe, and means connecting the said common vent pipe directly to the said intercooler.

In testimony whereof I have signed this specification.

PAUL A. BANCEL.