Sept. 25, 1923. 1,468,679

T. M. SKINNER, JR

CONCENTRATING EVAPORATOR

Filed April 15, 1920 2 Sheets-Sheet 1

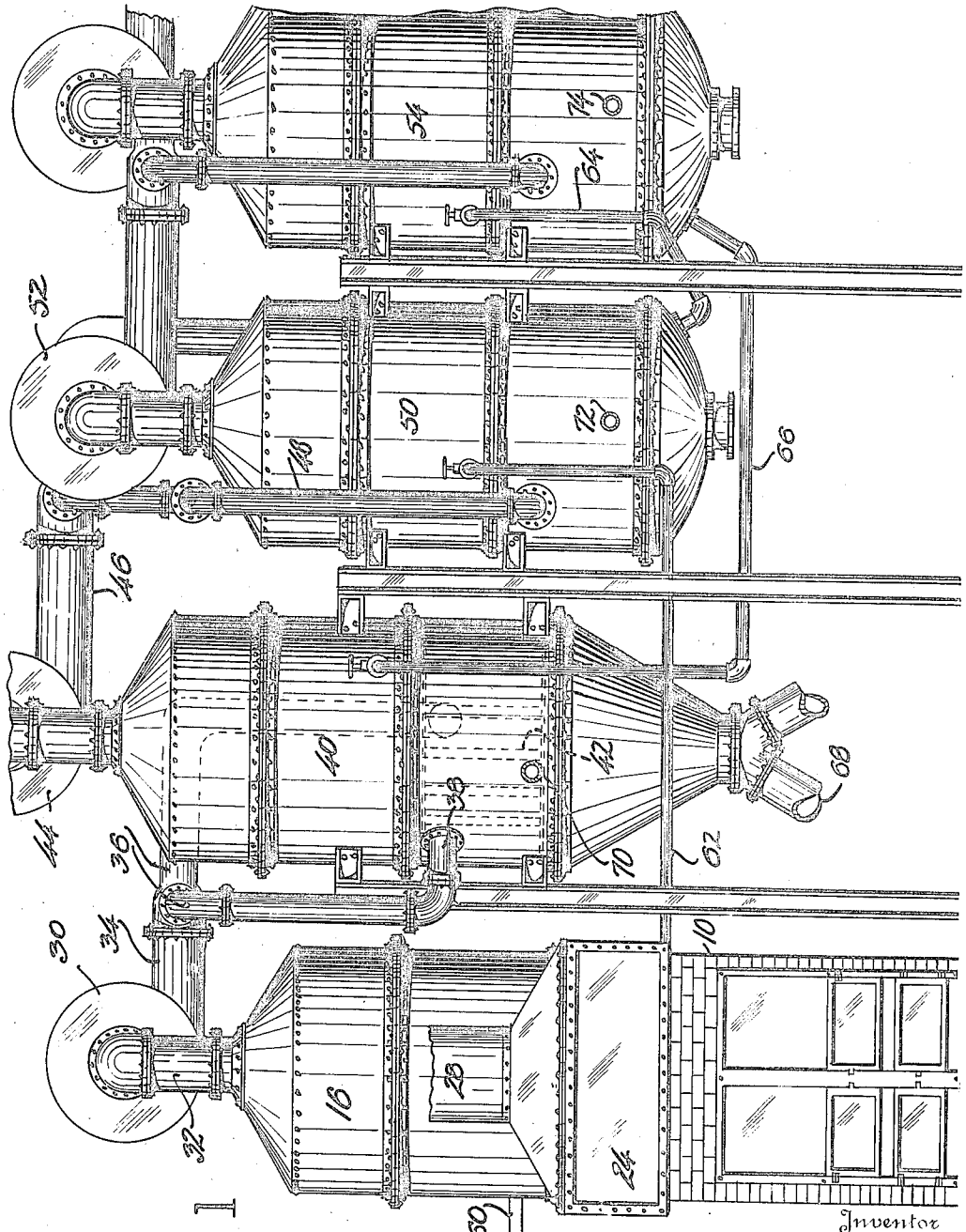


FIG 1

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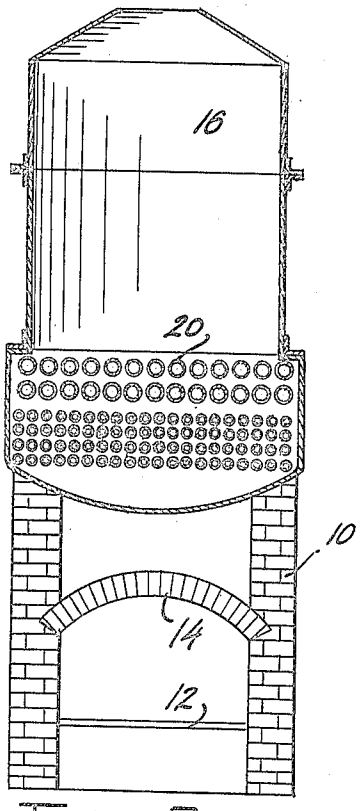


Fig 3

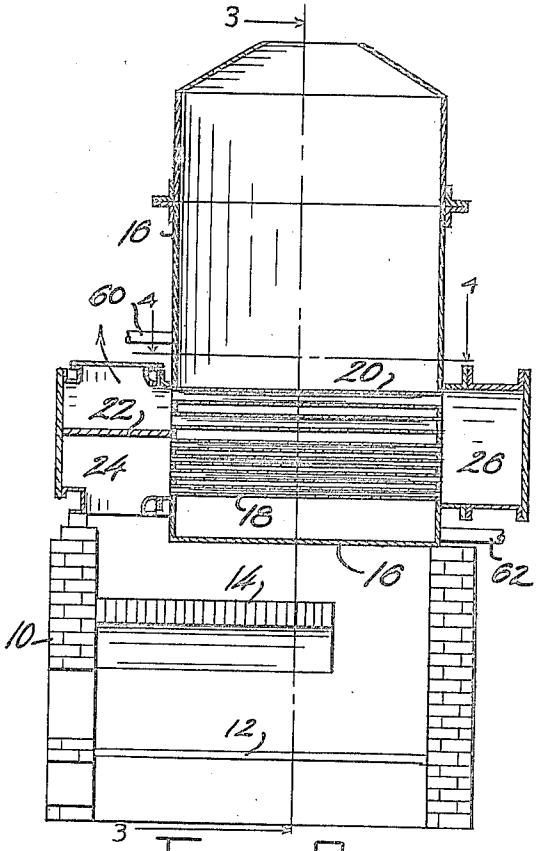


Fig 2

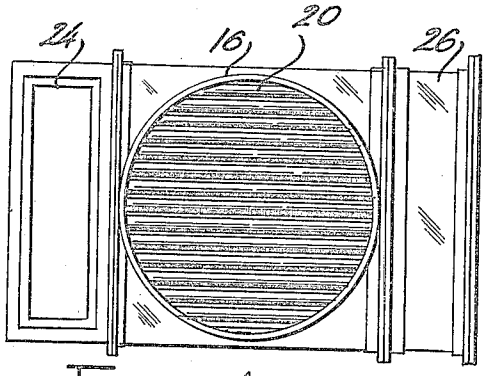


Fig 4

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UNITED STATES PATENT OFFICE.

THOMAS M. SKINNER, JR., OF DOUGLAS, WYOMING.

CONCENTRATING EVAPORATOR.

Application filed April 15, 1920. Serial No. 374,022.

To all whom it may concern:

Be it known that I, THOMAS M. SKINNER, Jr., a citizen of the United States, residing at Douglas, county of Converse, and State of Wyoming, have invented certain new and useful Improvements in Concentrating Evaporators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

The object of this invention is to provide an apparatus which may be used for economically evaporating liquors, particularly those whose residue is to be recovered. This is especially adapted for use in the sugar and potash industries.

Briefly, the invention comprises the use of a special boiler, wherein the weak liquor is initially boiled. After this treatment, the liquor itself is conducted to one of a series of evaporators for further treatment; thence to intermediate evaporators, if used, and finally to the last evaporator of the series for final treatment. The steam is taken off of the special boiler under vacuum by means of any suitable type of pump, and conducted under pressure produced by said pump into the last of the series of evaporators. The steam thus introduced under pressure is thereby brought to a higher temperature, and is passed into a sort of tube boiler in the evaporator, whereby the liquor receives the last heat treatment in the evaporation process. In this final evaporator, the steam or vapor produced is withdrawn under vacuum, and introduced under pressure by a pump, such as first described, into such intermediate evaporators as may be employed, and this process is repeated for each of the other evaporators.

In the drawings:

Fig. 1 shows a side elevation of the special boiler of my invention, coupled with the last evaporator of the series and two other evaporators.

Fig. 2 is a vertical section through the special boiler.

Fig. 3 is a vertical section on the line 3—3 of Fig. 2; and

Fig. 4 is a horizontal section on the line 4—4 of Fig. 2.

A furnace 10 is provided which has a grate 12, and a fire wall 14 to carry the products of combustion to the back of the furnace. Upon the furnace there is mounted a special boiler 16, which contains a lower series of small tubes 18, horizontally disposed, and an upper series of larger tubes 20, also horizontally disposed. The products of combustion pass along under the bottom of the boiler 16 into the lower portion of a header 24, divided by a partition 22, into upper and lower compartments. The heated products pass thence through the tubes 18 to a header 26 at the opposite side of the boiler, and are returned through tubes 20 to the upper compartment of header 24, whence they escape by stack 28. Above the top of the boiler 16 a suitable pump 30 is positioned, this pump being connected with the boiler by a pipe section 32. The pump 30 may be of any suitable type which will withdraw the steam or vapor from the boiler 16 under vacuum and discharge it into an evaporator under pressure.

A conduit 34 leads from the pump 30 and is provided with a pair of branches 36, which are connected at 38 with an evaporator 40, which is the last of the series. Within said evaporator 40 a sort of tube boiler 42 is provided, into which the steam is introduced by the pump 30 for the purpose of treating the liquor within said evaporator.

The steam or vapor arising from such treatment is withdrawn under vacuum from said evaporator 40 by means of a pump 44, similar to pump 30, which introduces said steam or vapor under pressure by means of conduits 46 and 48, into the first evaporator 50 of the series. The process is repeated in the evaporator 50, the vapors being carried away by pumps 52 and introduced into an intermediate evaporator 54, and so on, in case other evaporators are used.

The liquor which received its first treatment in the boiler 16 is introduced thereto by means of a pipe 60, and is conducted therefrom by means of a pipe 62, the liquor being discharged from pipe 62 into said first evaporator 50. After receiving treatment in the evaporator 50, it is conducted to the next evaporator 54 by means of pipe connection 64. Assuming that only as much apparatus is employed as is shown, the liquor is conducted by pipe 66 from evaporator 54 and introduced into the final evaporator 40 of the series, where it receives its last

treatment from the steam which is being introduced directly from the boiler 16. The product will be withdrawn from the take-off indicated as 68. The evaporators 40, 50 and 54 are shown provided respectively with draw-offs 70, 72 and 74, for the water of condensation remaining after the steam introduced into the respective evaporators has been spent.

From the foregoing, it will be seen that I have provided means for employing the weak liquor itself as a medium for supplying the steam which is required to carry on the various evaporators of the series. By withdrawing the steam under vacuum, and then introducing it into the next chamber under pressure, the maximum of efficiency is obtained from a given amount of fuel. At the same time, a great saving will be brought about, especially in those sections where water supply is a serious consideration. The water which is used to produce the liquor thus serves also to provide the steam to the system.

I claim:

1. An evaporating apparatus comprising a boiler for the reception of a weak liquor, means in said boiler whereby the liquor will be subjected to direct heat, a series of evaporating units, means for conducting liquor directly from the boiler to one of said units, and a connection for conducting steam from the boiler to the last evaporator in the series.

2. An evaporating apparatus comprising a boiler for the reception of a weak liquor, means in said boiler whereby the liquor will be subjected to direct heat, a series of evaporating units, means for conducting liquor directly from the boiler to one of said units, and a pump for withdrawing steam from the boiler and conducting it to the last evaporator, in the series under increased pressure and temperature.

3. An evaporating apparatus comprising a boiler to receive weak liquor, a series of evaporators, means for leading the heated liquor from the boiler to the first evaporator of the series, means for leading said liquor from one evaporator to another, a connection leading from the upper portion of the boiler to the last of the series of exaporators, a pump in said connection to withdraw vapors from the boiler by vacuum and introduce them into said last evaporator under increased pressure, and connections and a pump for taking the vapors from said last evaporator by vacuum and introducing it to the first under increased pressure

4. An evaporating apparatus comprising a boiler to receive weak liquor, a series of evaporators, means for leading the heated liquor from the boiler to the first evaporator of the series, means for leading said liquor from one evaporator to another, a connection leading from the upper portion of the boiler to the last one of the series of evaporators, a pump in said connection to withdraw vapors from the boiler by vacuum and introduce them into said last evaporator under increased pressure, and connections and a pump for taking the vapors from said last evaporator by vacuum and introducing it to the first under increased pressure.

In testimony whereof I affix my signature.

THOMAS M. SKINNER, JR.