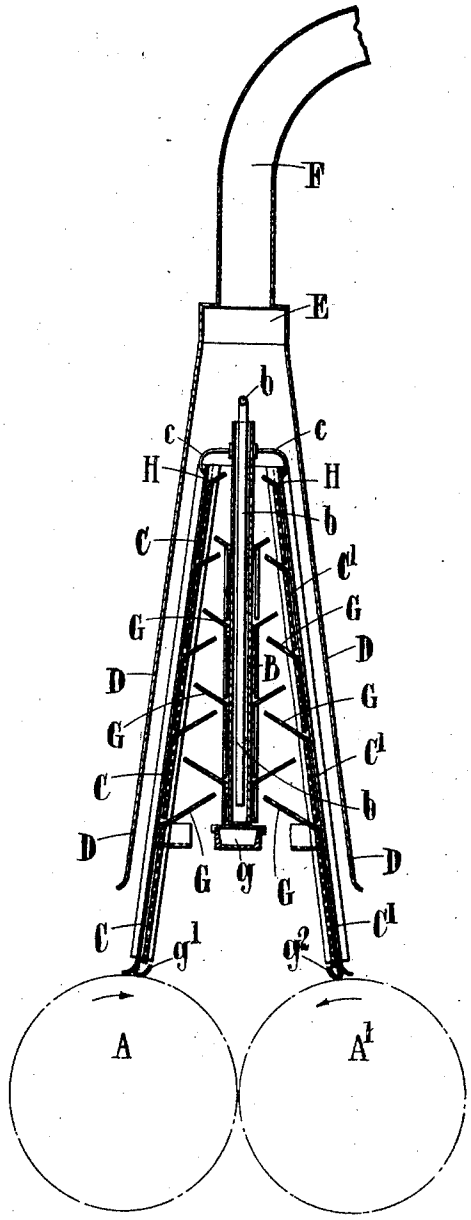
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EVAPORATING APPARATUS

Filed Dec. 22, 1925



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UNITED STATES PATENT OFFICE.

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EVAPORATING APPARATUS.

Application filed December 22, 1925, Serial No. 77,027, and in Great Britain December 23, 1924.

This invention has reference to evaporating apparatus of the kind used for evaporating milk and other similar purposes, in which the evaporation of a liquid or a fluid substance is effected at atmospheric pressure by bringing it into contact with the peripheries of steam-heated rolls.

An object of the invention is to provide simple and efficient evaporating apparatus of the kind referred to which will utilize most of the heat emanating from the steam-heated rolls.

A further object is to provide apparatus of the general character indicated which will enable the evaporation process to be controlled or regulated in a simple manner.

Further objects and advantages of improved apparatus in accordance with the invention will be apparent to those versed in the art from the following description and the claims appended thereto.

The invention broadly stated resides in the provision of a preheater arranged above the drying rolls and adapted to utilize the heat of the steam or vapour resulting from evaporation of the liquid or fluid under treatment thereon in a simple and efficient manner. It is preferred to provide evaporating sheets or plates over the surfaces of which the liquid passes before reaching the rolls to increase the evaporative capacity of the apparatus, said sheets or plates being preferably heated by the steam or vapour of the liquid under treatment.

The invention is more particularly pointed out in the appended claims.

In carrying our invention into practice a preheater is arranged above the V-shaped space between a pair of rotatable steam-heated rolls which are arranged side by side in the usual way; the liquid to be evaporated overflows from the said pre-heater on to evaporating surfaces (plates or sheets of any suitable section and shape) which deliver it upon the peripheries of the rolls; and the pre-heater and the said evaporating surfaces are enclosed by an outer casing or hood which is open below and terminates at the top in an exhaust chamber. The vapour given off during the evaporation on the rolls passes up between the walls of the pre-heater and the evaporating plates or sheets, baffles being provided for directing it alternately upon the sides of the pre-heater and the inner faces of the said plates or sheets in order to obtain a pre-determined preliminary heating of the liquid in the pre-heater and the liquid which is flowing down on the outer faces of the plates or sheets; and we provide a fan or exhauster for drawing off air and vapour from the exhaust chamber so that currents of air of suitable velocity are caused to flow up between the outer casing and the evaporating surfaces over which the liquid is flowing down.

Our invention is illustrated diagrammatically in the accompanying drawing, which shows in end elevation a pair of steam-heated rolls A, A′, a preheater B arranged above the V-shaped space between the said rolls, evaporating sheets C, C′, on to which the liquid overflows from the said pre-heater, an outer casing D which encloses the said reservoir and evaporating sheets, and an exhaust chamber E from which vapour and air are drawn off by a fan or exhauster (not shown) through a pipe F.

The pre-heater B shown in the drawing is in the form of a deep narrow trough, into which the liquid is introduced at the bottom of the trough through a supply pipe b, and from which the liquid displaced upwards by the incoming cold feed overflows on to the evaporating sheets C, C′, through pipes c, the overflow being regulated by controlling the supply so that an approximately uniform film of the liquid flows down upon the outer faces of the said sheets. Suitable weirs may be provided in place of these pipes.

Fixed baffles G are provided for deflecting the ascending vapour alternately upon the walls of the pre-heater and the inner faces of the evaporating sheets; and adjustable baffles H are provided for regulating the effect of the suction created by the fan on the steam space between the pre-heater and the evaporating sheets, thus controlling the heating of the liquid in the preheater and consequently to some extent the evaporation.

Suitable gutters, such as indicated at g, g', g^2, are provided for collecting and carrying off condensation water.

The heat radiated from the bare portions of the rolls, from which the dried product has been stripped, may be utilized to heat more or less the currents of air which pass up between the casing D and the outer faces

of the evaporating sheets, the velocity of these currents being determined by the area of the cross section of the air passages or by the speed of the fan. The evaporative effect of counter-currents of air flowing over the descending films of liquid is considerable, and this, in conjunction with the preliminary heating of the liquid in the preheater and the further transfer of heat units to it as it flows over the heated evaporating sheets, practically enables a second effect evaporation to be effected without substantially increasing the cost of the operation; further, owing to the shorter time required to boil off the pre-heated and partially concentrated liquid on the steam heated surfaces of the rolls, the dry product obtained is of better quality and appearance than that obtained heretofore.

We claim:—

1. Evaporating apparatus for evaporating a fluid substance at atmospheric pressure comprising steam-heated drying rolls, a preheater for said fluid substance arranged above said drying rolls, vapour directing means for directing vapour produced from the fluid on to the surface of said preheater.

2. Evaporating apparatus for evaporating a fluid substance at atmospheric pressure comprising steam-heated drying rolls, a preheater for said fluid substance arranged above said drying rolls, vapour directing means for directing vapour produced from the fluid on to the surface of said preheater and means for conducting the fluid from said preheater on to said rolls.

3. Evaporating apparatus as claimed in claim 2 wherein the means for conducting the fluid from said preheater on to the rolls comprise evaporating surfaces and means for conducting the fluid from the preheater on to said surfaces.

4. Evaporating apparatus for evaporating a liquid substance at atmospheric pressure comprising steam-heated drying rolls, a preheater for said liquid arranged above said rolls, evaporating sheets forming a substantially enclosed space for heated vapour rising from said rolls about said preheater, means for conducting the liquid from the preheater after passage therethrough on to the outer surfaces of said sheets whence the liquid flows down said surfaces and on to the said rolls.

5. Evaporating apparatus as claimed in claim 4 comprising also a hood spaced from the outer surfaces of said sheets and means for inducing the heated vapour rising from said rolls to flow up inside said sheets and for inducing a counter current of air to pass over the outer surfaces of said sheets.

6. Evaporating apparatus for evaporating a liquid substance at atmospheric pressure comprising steam-heated drying rolls, a preheater for said liquid arranged above said rolls, evaporating sheets forming a substantially enclosed space about said preheater, means for directing heated vapour rising from said rolls alternately upon the sides of the said preheater and the inner faces of the said sheets, means for regulating the speed at which said vapour passes through said space, means for conducting the liquid from said preheater on to the surfaces of said evaporating sheets, a hood spaced from but partially enclosing said sheets and a conduit through which air can be drawn over the evaporating surfaces of said sheets in the opposite direction from that in which the liquid flows thereover on its passage to the drying rolls.

In testimony whereof, we have signed this specification.

JOHN GOLDING.
JOHN CHRISTOPHER STEAD.