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PATENTED JULY 21, 1903.

N. GERBER.  
VACUUM PAN.

APPLICATION FILED JAN. 27, 1902.

NO MODEL.

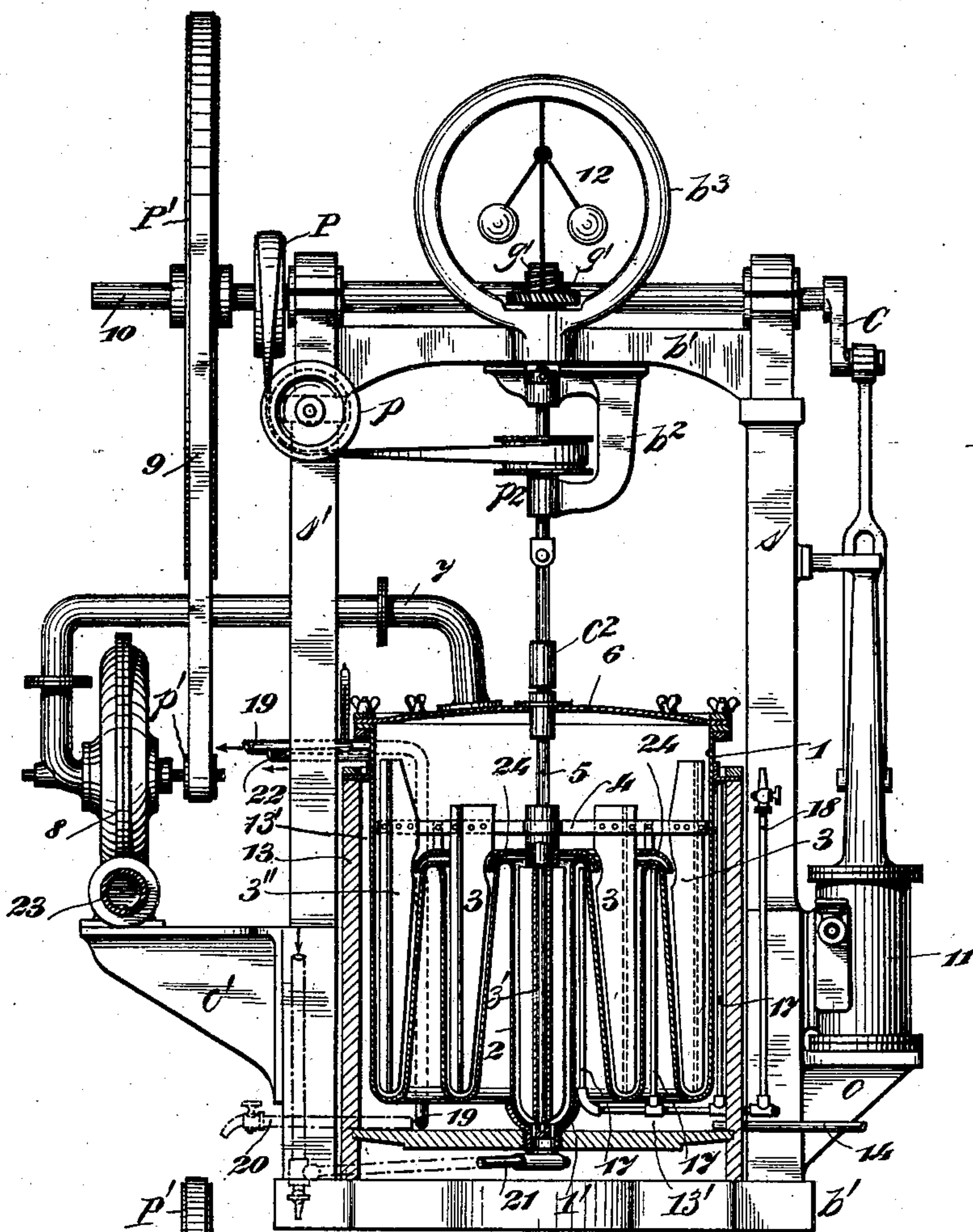


Fig. 1.

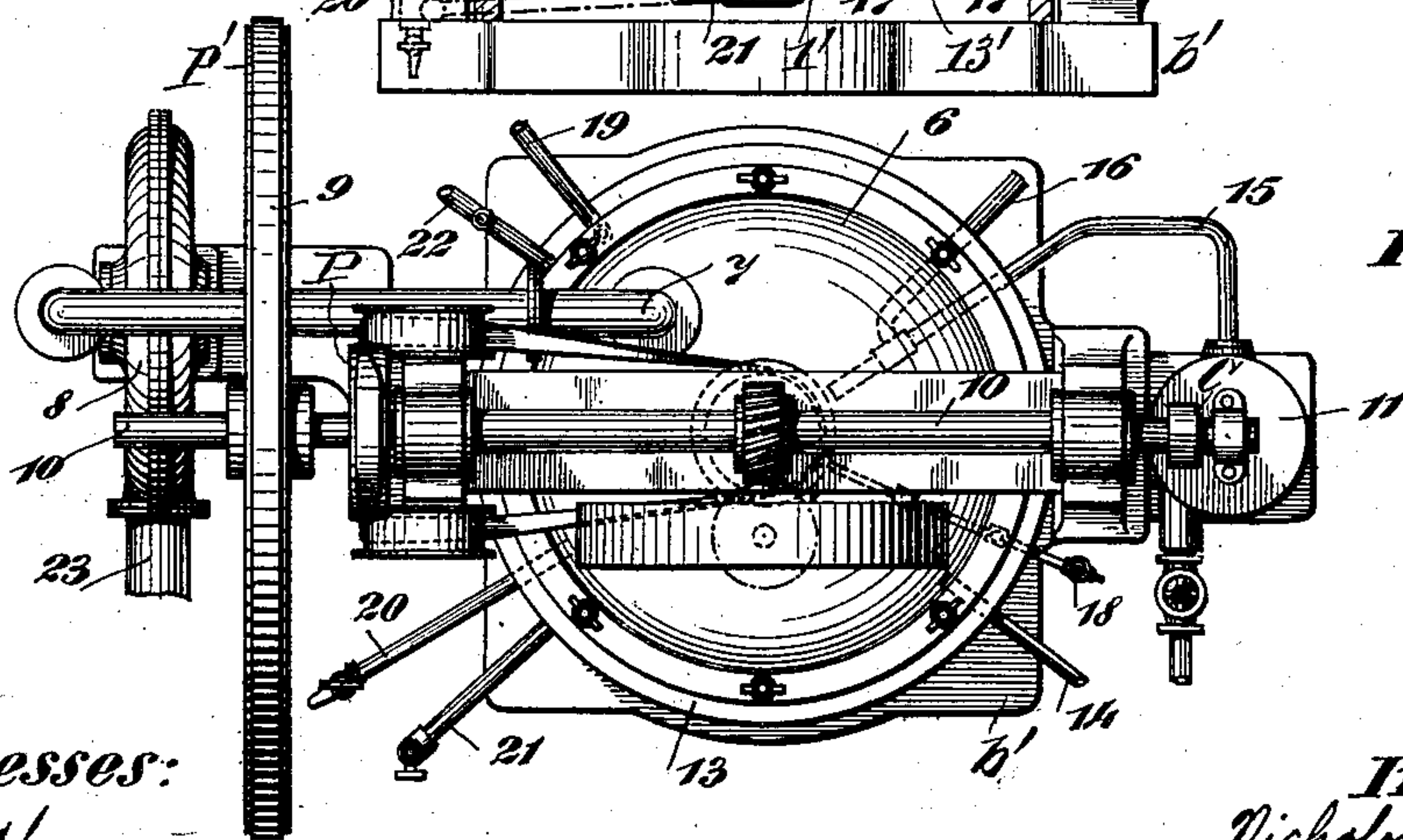


Fig. 2.

Witnesses:

*Attest.*

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# UNITED STATES PATENT OFFICE.

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## VACUUM-PAN.

SPECIFICATION forming part of Letters Patent No. 734,228, dated July 21, 1903.

Application filed January 27, 1902. Serial No. 91,458. (No model.)

*To all whom it may concern:*

Be it known that I, NICHOLAS GERBER, a citizen of Switzerland, residing at Zurich, Switzerland, have invented new and useful  
5 Improvements in Continuous Evaporators, of which the following is a specification.

This invention has relation to evaporators; and it has for its object certain improvements, hereinafter fully described, whereby the effi-  
10 ciency of the apparatus is materially enhanced and the cost of operating the same reduced.

In the accompanying drawings, Figure 1 is an elevation, partly in section; and Fig. 2, a  
15 plan view of an evaporator embodying my invention.

To diametrically opposite sides of a suitable base *b* are secured standards *s* and *s'*, connected near their upper ends by a cross-beam  
20 *b'*. The standard *s'* has formed thereon or secured thereto a console *c'* for a suction and forcing fan 8, and the standard *s* has formed thereon or secured thereto a console *c* for a steam-engine 11, whose piston is connected by  
25 a connecting-rod *r* to a crank *C* on the driving-shaft 10, which has its bearings in the upper ends of the standards *s* and *s'* and carries two belt-pulleys *P* and *P'*. The belt-pulley *P* is belted to a pulley *p* on a stirrer-shaft 5,  
30 the belt being suitably guided by a pulley *p*<sup>2</sup>, the upper end of said shaft 5 having its bearing in a bracket *b*<sup>2</sup>, secured to the cross-beam *b'*. The pulley *P'* is belted by belt 9 to a pulley *p'* on the driving-shaft of the suction and  
35 forcing fan 8, and the speed of the engine is controlled by a governor 12 of any usual or preferred construction, the governor-spindle having its bearings in a ring-bracket *b*<sup>3</sup> on the cross-beam *b'* and being geared to the driving-  
40 shaft 10 through gears *g g'*.

On the frame-base *b* is arranged a vessel 13, constructed of a material that is a non-conductor of heat—as wood, for instance—in the  
45 bottom of which vessel is formed an axial aperture in which is stepped fluid-tight the tubular axial foot of the sheet-metal evaporating-pan 1, both vessels being of cylindrical form in cross-section.

The evaporating-pan 1 projects above the  
50 containing vessel 13 and is of less diameter than the latter and has an axial tubular open-ended feed-channel 1', extending from below

the bottom of the pan a considerable distance thereinto, and is provided at its outer end with a tubular extension or foot of reduced  
55 diameter, whereby the bottom of the pan is suitably spaced from the bottom of vessel 13 to form an encompassing heating-chamber 13', closed fluid-tight at its upper end by any suitable means. The evaporating-pan is closed  
60 by a removable cover 6, which is connected by pipe 7 with the exhaust-fan 8, which latter is not here used to produce a vacuum in vessel 1, though it may be so used, if necessary, but to exhaust the hot vapors for the pur-  
65 pose of utilizing them in heating the liquid to be evaporated, with a view to economy of the heating medium.

In the tubular foot of the axial feed-channel I provide a bearing in which is stepped  
70 the stirrer-shaft 5, which latter, with a view to facilitating access to the pan 1, I make in two parts coupled together in any desired well-known manner, as by a sleeve-coupling *c*<sup>2</sup>. To the aforesaid foot of pan 1 is con-  
75 nected the feed-pipe 21, (shown in dotted lines in Fig. 1,) through which the liquid to be evaporated is fed, and 20 is a valved drain-pipe for draining from vessel 13 the hot wa-  
80 ter, if such be used as a heating medium, or the water of condensation, if steam be used. I also provide a pipe 19 for the outflow from chamber 13' of the hot water or steam and a valved air-exhaust pipe 17, having vertical  
85 branch pipes projecting into external channels in the bottom of the pan, hereinafter referred to, for exhausting the air from the heating-chamber as the hot water or steam is or both are admitted thereto in starting the  
90 evaporation.

Hot water is supplied to the heating-chamber 13' near the bottom through a pipe 14, and the exhaust-steam from the engine 11 is exhausted into said chamber through a pipe  
95 15, which has a branch pipe 16, adapted to be connected to a source of live-steam supply (not shown) for said engine, all these pipes being provided with suitable valves or stop-cocks (not shown,) while the condensate is exhausted from the evaporating-pan 1 near  
100 its upper end through a pipe 22.

With a view to expediting the evaporation by providing as large an evaporating-surface as possible without increasing or materially



increasing the dimensions of the evaporating-pan I provide the bottom of the pan with alternating internal and external circular channels of a depth equal to about two-thirds of the depth of the pan, the axial feed-channel 2 projecting a like distance into said pan, said channels having in cross-section the form of a hollow cone open at its base.

To the shaft 5 within the tubular axial channel 2 is secured a sleeve provided with stirrer-blades 3' of such a width that their edges will rotate in close proximity to the channel-wall, and said shaft carries a deflector 24, having circular channels whose outer edges are bent downwardly and overlap the upper edges 1" of the circular channel-walls, so as to leave a narrow passage between said edges and the inner faces of the circular channels in said disk 24, the latter being also provided with radial slots for the passage of the stirrer-blades 3.

The disk 24 is preferably provided with a long hub for securing it to shaft 5, and above the disk 24 said hub has radial arms 4, to which are secured stirrer-blades 3 and 3" of a shape to fit the cross-sectional configuration of the circular channels, said blades extending almost to the bottom thereof, their edges rotating in close proximity to the channel-walls. The outer stirrer-blades 3" are longer than the intermediate blades 3 and extend nearly to the outflow-pipe 22 for the condensate; their edges also rotating in close proximity to the inner periphery of the pan 1.

From the description of the construction of the vaporizing apparatus its general operation will be readily understood. I may, however, call special attention to the mode of feeding the liquid to be evaporated to the pan 1.

The feed of the liquid to the axial tubular channel 2 should be so regulated as to quantity to allow the liquid to be carried up along the walls of said channel by centrifugal action resulting from the rapid rotation of the stirrers 3', thereby causing a thin sheet or film of such liquid to be subjected to heat as it flows upward along the heated channel-walls, and to flow over in a thin sheet or film into the adjacent circular channel controlled by the deflector-disk 24 to be subjected to the heat of the inner wall of said channel and then rise therein under centrifugal action, resulting from the rotation of the stirrer-blades 3 along the outer heated wall thereof, and flow over the inner heated wall of the outer circular channel and rise under centrifugal action resulting from the rotation of the blades 3" along the inner wall of pan 1 to the outflow-pipe 22, the liquid being kept in continuous circular motion. During the evaporation the hot vapors are exhausted from the pan 1 and may be or preferably are utilized for heating the liquid to be vaporized, so that the latter passes or may pass from its reservoir to the pan at about the temperature of the exhaust-vapors for pur-

poses hereinabove stated. According to the character of the liquid to be condensed I may use hot water or hot water and the exhaust-steam from the engine, or I may use moderately-heated water and live steam, or I may use exhaust-steam only or live steam only.

In the evaporation or condensation of liquids, as milk, which are liable to "burn" when brought into contact with highly-heated surfaces I employ the water-bath as a source of heat-supply, in conjunction with the exhaust-steam from the engine, as a means for utilizing the heat thereof, which would or might otherwise be wasted. On the other hand, for such liquids as can be condensed without injury by other heating media I can use live steam together with exhaust-steam. Finally it will readily be understood that the described apparatus may be used as a cooler or refrigerator by substituting a refrigerant for the heating medium. This is of importance, especially in the production of highly-condensed milk, whose quality is very materially enhanced if the condensate is cooled immediately after condensation or at least before it cools down to atmospheric temperature under atmospheric influences, while the operations of condensation and cooling can be carried on simultaneously by providing two apparatuses such as described.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. An evaporating-pan comprising closed concentric vessels forming between them a heating-chamber, the inner vessel having in its bottom concentric alternating external and internal channels of a depth exceeding one-half the depth of said vessel, means for supplying heat to and exhausting the heating medium from the heating-chamber, and means for exhausting vapor from the inner vessel, for the purpose set forth.

2. A cylindrical evaporating-pan having deep concentric alternating internal and external channels in its bottom, said channels of conical form in cross-section, and an axial tubular feed-channel extending from said bottom to the upper or inner edge of the channel-walls, for the purpose set forth.

3. A cylindrical evaporating-pan having deep concentric alternating internal and external channels in its bottom, and an axial tubular feed-channel extending from below said bottom to the upper or inner edge of the concentric channel-walls, said feed-channel having a tubular extension of reduced diameter at its outer end, in combination with an encompassing vessel forming a chamber around the pan, the outer vessel having in its bottom an aperture for the reception of the tubular extension of the feed-channel of the pan, for the purpose set forth.

4. A cylindrical evaporating vessel having deep, concentric alternating internal and external channels, and an axial circular feed-channel extending from below the bottom of



the pan to the upper edge of the channel-walls and having a tubular extension of reduced diameter at its outer end, and an encompassing vessel forming a chamber between it and the pans, the outer vessel provided with an aperture in its bottom for the reception of the aforesaid extension of the axial feed-channel; in combination with a revoluble shaft carrying stirrer-blades extending nearly to the bottom of the aforesaid internal concentric and axial channels and of a slightly smaller diameter than said channels, for the purpose set forth.

5. A cylindrical evaporating vessel having deep, concentric alternating internal and external channels, and an axial circular feed-channel extending from below the bottom of the pan to the upper edge of the channel-walls and having a tubular extension of reduced diameter at its outer end, and an encompassing vessel forming a chamber between it and the pans, the outer vessel provided with an aperture in its bottom for the reception of the aforesaid extension of the axial feed-channel; in combination with a revoluble shaft carrying stirrer-blades extending nearly to the bottom of the aforesaid internal concentric and axial channels and of a slightly smaller diameter than said channels, and a circularly-channeled deflecting-disk on said shaft proximate to the upper edges of the internal channel-walls, said disk having the outer walls of its channels bent downward and

overlapping the aforesaid upper edges of the channel-walls, for the purpose set forth. 35

6. A cylindrical evaporating-pan having alternating internal and external deep circular channels in its bottom and an axial tubular feed-channel extending from below said bottom to the upper edge of the circular channel-walls and provided at its outer end with an extension of reduced diameter, an encompassing vessel forming a chamber between it and the pan from which the latter projects, a fluid-tight joint between the pan and the upper end of the outer vessel, the latter having an aperture in its bottom in which the extension of the aforesaid feed-channel is fitted fluid-tight, a feed-pipe fitted to said extension, means for supplying a heating or cooling agent to the aforesaid chamber, means for exhausting such agent near the upper end thereof, and a valved air-exhaust pipe having branches extending upwardly into the external circular channels in the bottom of the pan; in combination with a revoluble stirrer-shaft carrying stirrer-blades extending into the internal circular channels of said bottom, for the purpose set forth. 40 45 50 55

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses. 60

NICHOLAS GERBER.

Witnesses:

A. LIEBERKNECHT,

A. MATTI.