

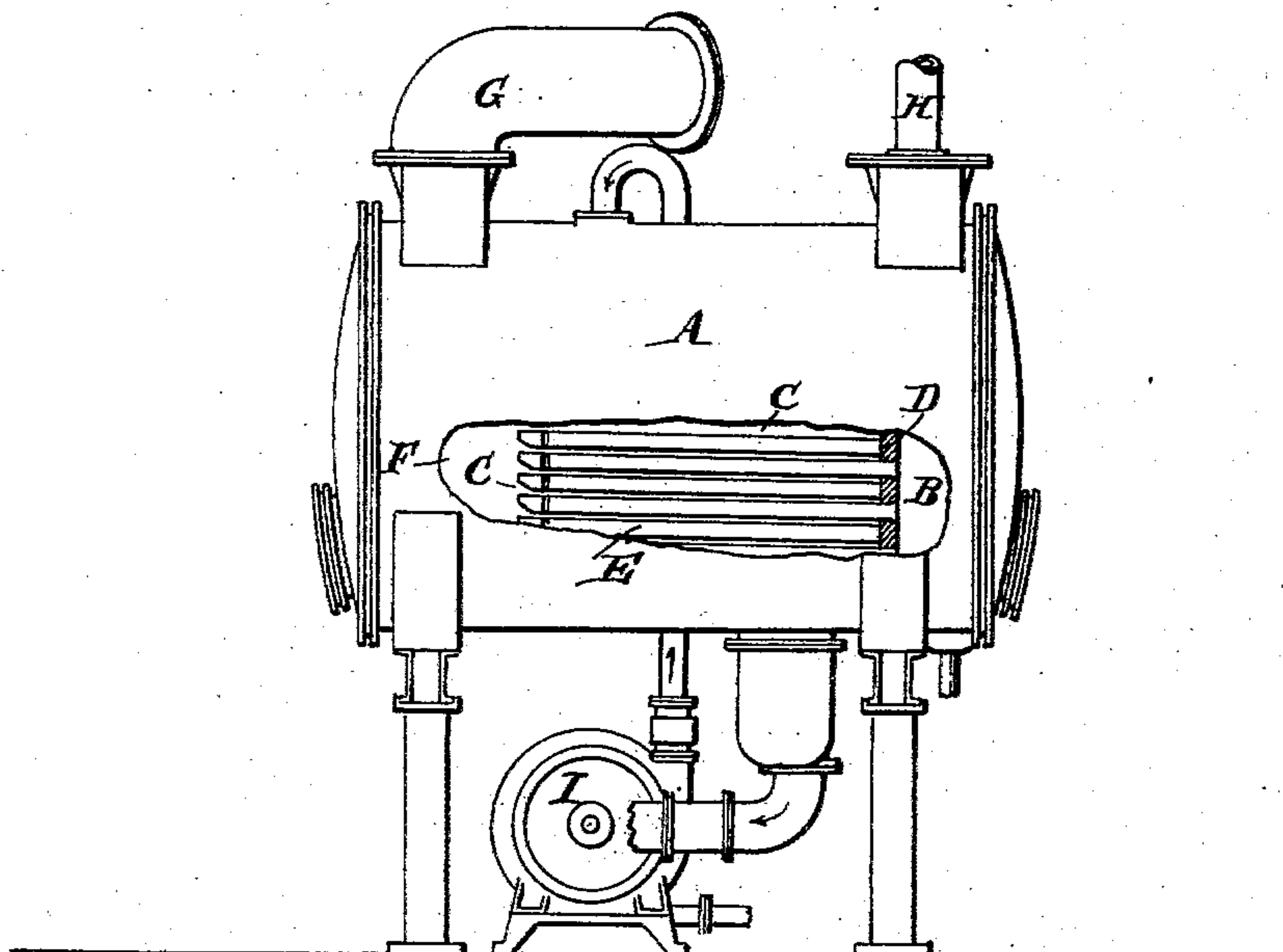
No. 740,449.

PATENTED OCT. 6, 1903.

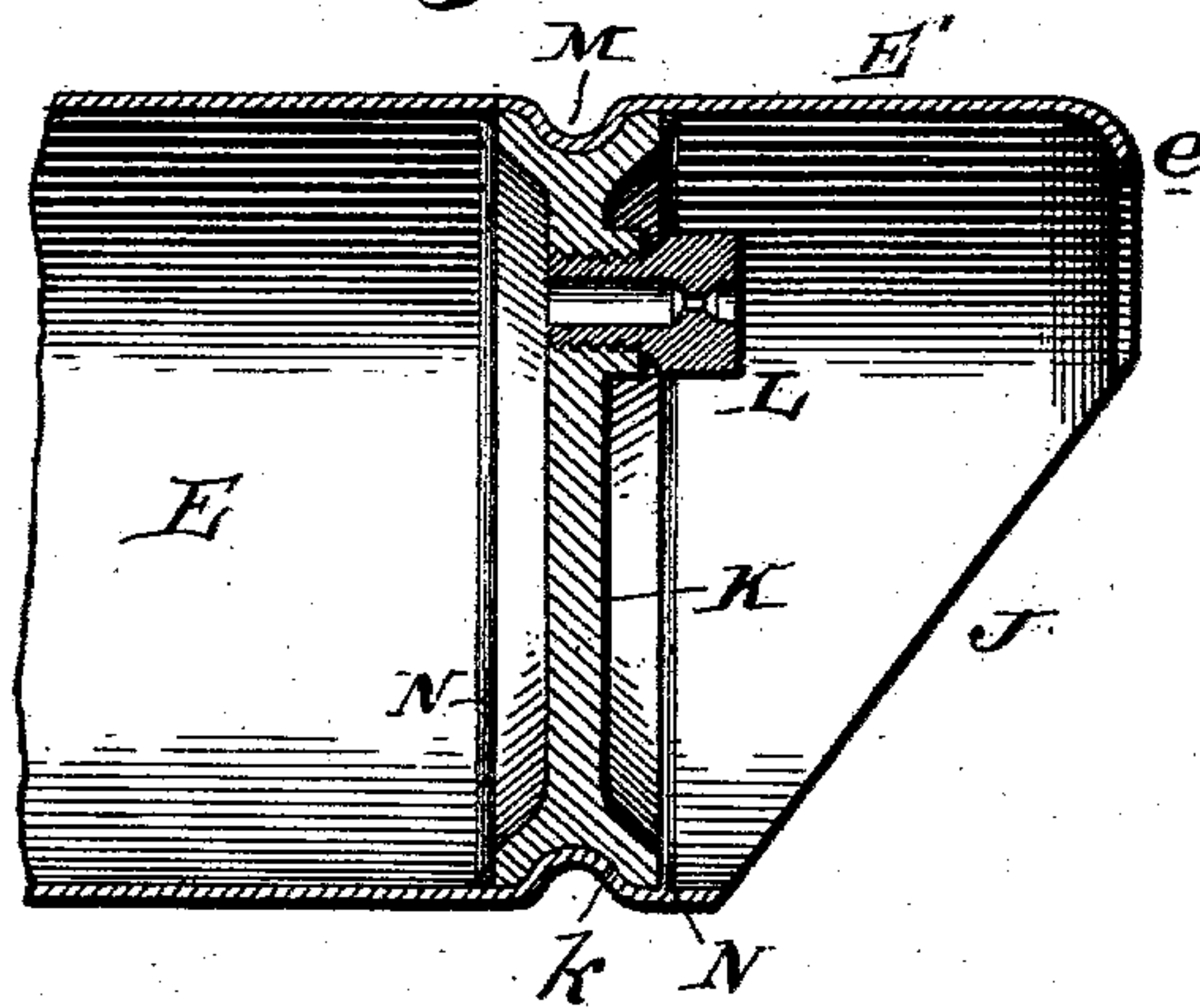
S. M. LILLIE.  
TUBE FOR EVAPORATORS.  
APPLICATION FILED APR. 1, 1903.

NO MODEL.

*Fig. 1.*



*Fig. 2.*



*Witnesses:*

*Louis D. Heinrichs*  
*R. M. Kelly*

*Inventor*

*S. Morris Lillie*

*By*

*W. H. M. S. D.*



## UNITED STATES PATENT OFFICE.

SAMUEL MORRIS LILLIE, OF PHILADELPHIA, PENNSYLVANIA.

## TUBE FOR EVAPORATORS.

SPECIFICATION forming part of Letters Patent No. 740,449, dated October 6, 1903.

Application filed April 1, 1903. Serial No. 150,605. (No model.)

*To all whom it may concern:*

Be it known that I, SAMUEL MORRIS LILLIE, of the city and county of Philadelphia, State of Pennsylvania, have invented an Improvement in Evaporating-Tubes for Evaporators, of which the following is a specification.

My invention has reference to evaporating-tubes for evaporators; and it consists of certain improvements, all of which are set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

The object of my invention is to provide a strong, durable, and inexpensive construction of closed end of evaporating-tubes more especially designed for use in evaporators known in commercial use as of the "Lillie" type.

In carrying out my invention I provide the evaporating-tube with a plug to close it, the said plug having a grooved periphery and held in place by forcing inward the metal of the tube to form an annular groove upon the outside and an annular tongue upon the inside and the joint so formed being preferably made air-tight by soldering or sweating the parts into a tight union. The plug is desirably placed at a short distance from the end of the tube, which forms a hood or shield over a vent-aperture in the plug of the tube. The aperture may be formed through a nipple secured to the plug.

My invention also comprehends minor details of construction, which, together with the foregoing features, will be better understood by reference to the drawings, in which—

Figure 1 is an elevation of what is known as a "Lillie" evaporator, with part in section, and constituting one effect and embodying therein my improvement; and Fig. 2 is a sectional elevation of the plugged end of one of the evaporating-tubes.

The "effect" shown in Fig. 1 comprises the case A, having one end formed into a steam-chamber and receiving exhaust or other steam from pipe H. The tube-plate D separates the steam-chamber B from the vapor chamber or space C occupied by the evaporating-tube E.

F is the front vapor-space and opens into the vapor-main G, leading to the steam-chamber of the next effect, if used in a multiple effect.

I is a circulating-pump for drawing the liquor (cane-juice, extracts, glue, or other substance) from the case A and circulating it over the evaporating-tube E, the result being to condense the steam in the tubes, and thereby cause the latent heat thus given up to be absorbed by the liquor being concentrated, with the result that a portion of its volume in form of vapor is drawn off by exhaust-vapor main G.

The evaporating-tubes E are preferably of copper and open at the end where they fit into the tube-plate D, being expanded or otherwise secured in said plate. These tubes extend horizontally from said tube-plate into the vapor-space and have their other ends free and formed as shown in Fig. 2. The tube E at a short distance from its end is closed by a plug K, of brass or other material, and having an annular groove *k* formed in its periphery. The metal of the tube is bent inward at M to fit into this groove. This securely holds the plug from displacement and removes the excessive strains from the solder N, which is "sweated" in to secure the plug and tube together with an air-tight joint. By securing the plug in position in this way it is evident that it is accurately and speedily done and there can be no possibility of displacement or tilting of the plug during the sweating operation. Through the upper portion of the plug K is secured a vent-nipple L, having a small aperture through which air or other gases may pass from the tubes into the vapor-space. By putting the vent aperture or nipple high up on the face of the plug it is above the water of condensation that may collect in the tubes, so that the said water shall not clog the vent-aperture.

As the fluid to be evaporated is circulated by the pump I over the evaporating-tubes, it is possible to prevent the descending flood of liquor rushing over the vent-nipples and thus interfering with their function, and to accomplish this I extend the end of the evaporating-tubes beyond the plug K, as indicated at E', so as to form a hood or shield from above to the vent-nipple. As it is desirable to prevent any collection of the fluid by the tubes, I consider it better, but not necessary to my invention, to bevel off the under end of the tube, as at J, almost reaching to the plug.



The upper end of the tube above the beveled portion may also be turned downward, as at *e*, to shed the liquor from the tube and prevent it running under the upper surface thereof, as will be readily understood.

While my invention has special reference to evaporating-tubes for multiple effects, such as used in sugar-refining, I do not confine myself to any particular use therefor.

While in most instances my invention is employed for evaporating, it is equally applicable to cases where the effect is used for condensing. In the latter case the falling fluid which passes over the tubes is cold water, and the steam is fed into the interior of the tubes, wherein it is condensed. The use of the effect as a condenser is therefore alternative use and is clearly within the scope of my invention as claimed.

The annular groove on the plug and depressed portion of the tube fitting together in effect constitutes a tongue-and-groove joint, and it is evident that, broadly considered, it is immaterial on which part the tongue or groove may be located, though I prefer the construction as shown. The details, however, may be modified without departing from the spirit of my invention.

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

1. An evaporating-tube consisting of a tube of ductile metal having an annular depressed portion near one end, in combination with a plug fitting the interior of the tube and having an annular grooved periphery into which the annular depression of the tube fits.

2. An evaporating-tube consisting of a tube of ductile metal having an annular depressed portion near one end, in combination with a plug fitting the interior of the tube and having an annular grooved periphery into which the annular depression of the tube fits, and an air-tight union between the tube and plug consisting of a fusible-metal joint between them.

3. An evaporating-tube consisting of a tube of ductile metal having an annular depressed portion near one end in combination with a plug fitting the interior of the tube and having an annular grooved periphery into which the annular depression of the tube fits, and an air-tight union between the tube and plug consisting of a fusible metal sweated into position about the peripheral groove and circumference of the plug and upon the interior of the tube adjacent to these parts to form a joint between them.

4. An evaporating-tube consisting of a tube of ductile metal having an annular depressed portion near one end, in combination with a plug fitting the interior of the tube and having an annular grooved periphery into which the annular depression of the tube fits, and a vent arranged through the plug.

5. An evaporating-tube consisting of a tube

of ductile metal having an annular depressed portion near one end, in combination with a plug fitting the interior of the tube and having an annular grooved periphery into which the annular depression of the tube fits, and a vent-nipple arranged in the plug out of the center so as to be considerably nearer the periphery at one place than the periphery diametrically opposite.

6. An evaporating-tube consisting of a tube having the end beveled off to form an overhanging hood or shield, in combination with a plug fitting the interior of the tube back of the overhang and having a vent-aperture opening through the plug and shielded by the extended or hood portion of the tube.

7. An evaporating-tube consisting of a tube having the end beveled off to form an overhanging hood or shield *E* and provided with the end *e* curved downward to form a drip-flange, in combination with a plug fitting the interior of the tube back of the overhang and provided with a vent-aperture opening through the plug and shielded by the extended or hood portion of the tube.

8. The combination of an evaporating-tube of ductile metal, and a plug fitting its interior united to the tube and held against longitudinal movement through the tube by an annular tongue and groove the annular tongue being upon one of the parts and the groove upon the other, with a vent-aperture opening through the plug.

9. The combination of an evaporating-tube of ductile metal, and a plug fitting its interior united to the tube and held against longitudinal movement through the tube by an annular tongue and groove the annular tongue being upon one of the parts and the groove upon the other, with a sweated air-tight joint of fusible metal between the tube and plug, and a vent-aperture opening through the plug.

10. In an evaporator, the combination of a steam-chamber, a vapor-chamber, a tube-plate separating said chambers, horizontal evaporating-tubes opening through said tube-plate and extending into the vapor-chamber and having their ends closed by plugs united to the tubes by a tongue-and-groove joint.

11. In an evaporating apparatus, the combination of a steam-chamber, a vapor-chamber, a tube-plate separating the said chambers, horizontal tubes opening through said tube-plate and having their bodies near their extended or free ends closed by plugs fitting their interior portions a short distance from the extreme ends and in which said plugs are provided with vent-apertures opening through them and shielded by the extended ends or hood portions of the tube.

In testimony of which invention I hereunto set my hand.

S. MORRIS LILLIE.

Witnesses:

R. M. KELLY,  
WM. ROONEY.