

(No Model.)

2 Sheets—Sheet 1.

H. EGELLS.

APPARATUS FOR COOLING AND FREEZING LIQUIDS.

No. 272,667.

Patented Feb. 20, 1883.

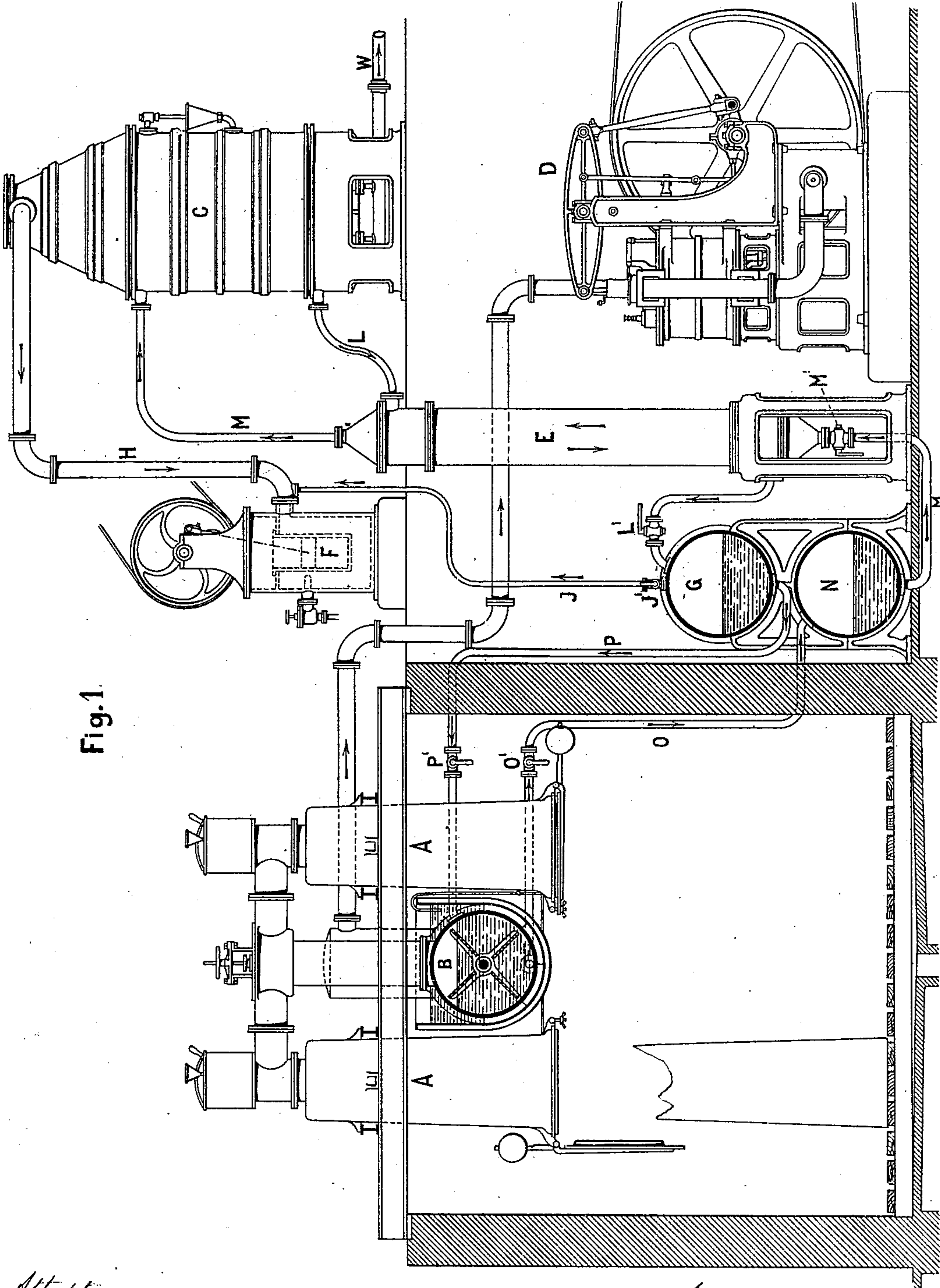


Fig. 1.

Attest  
Jm. f. Jayers.  
Geo. L. Wheelock.

Inventor:  
Hermann Egells.  
124 Knight Bros attys

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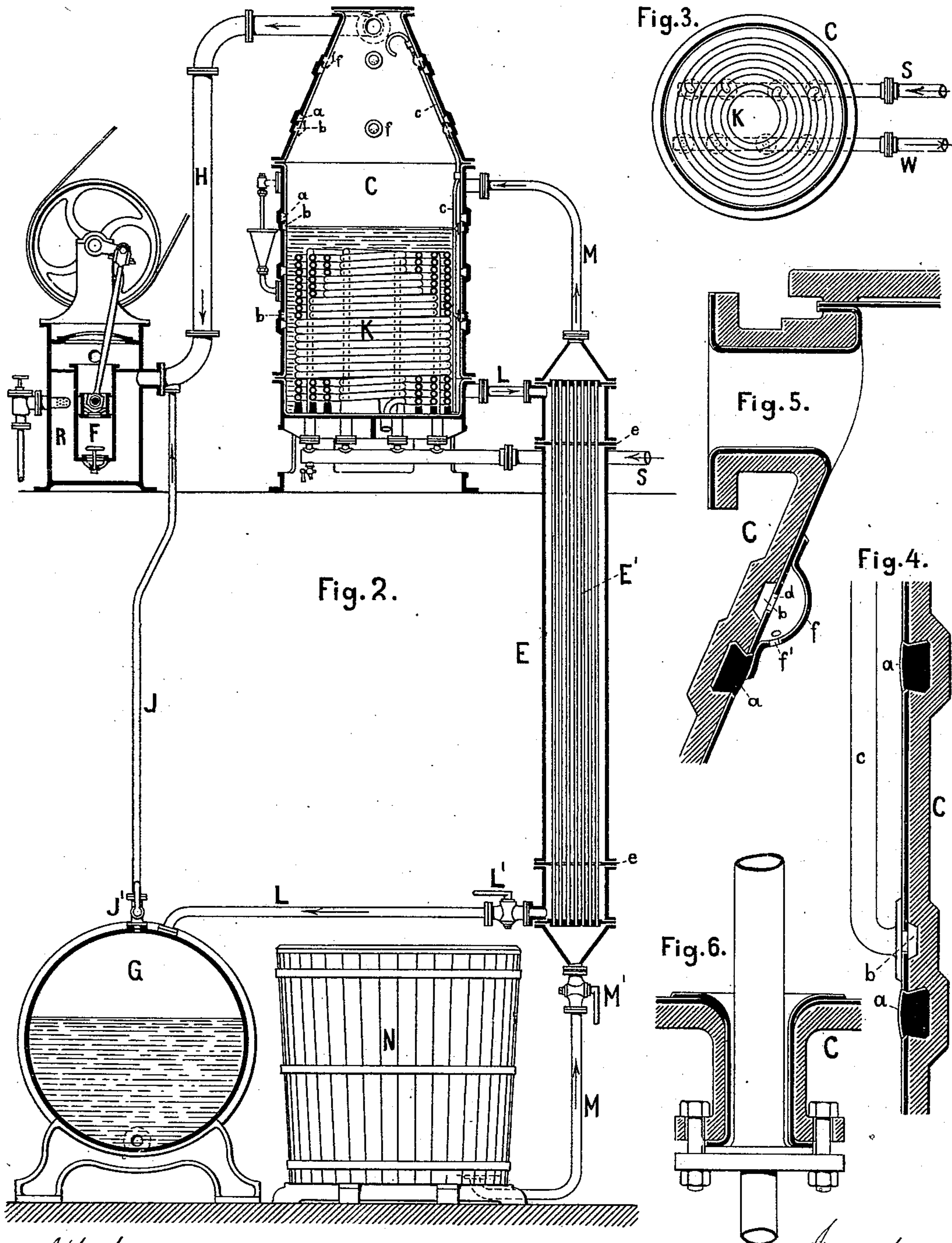
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# UNITED STATES PATENT OFFICE.

HERMANN EGELLS, OF BERLIN, GERMANY.

## APPARATUS FOR COOLING AND FREEZING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 272,667, dated February 20, 1883.

Application filed December 29, 1882. (No model.) Patented in England October 7, 1882, No. 4,770.

To all whom it may concern:

Be it known that I, HERMANN EGELLS, councilor of commerce, residing in Berlin, Kingdom of Prussia, German Empire, have invented new and useful Improvements in Apparatus for Cooling and Freezing Liquids, also applicable for other purposes, (for which I have obtained Letters Patent in Great Britain, No. 4,770, October 7, 1882,) of which the following is a specification.

My invention relates to the ice-making machine described in the specification of the United States Letters Patent No. 236,471, and in which the ice or cold is produced by the evaporation of water *in vacuo*, the vapors generated being mostly absorbed by sulphuric acid.

The improvements consist, first, in a novel combination of the parts of the concentrating apparatus for sulphuric acid, which allows the acid to be raised into the concentrator without its passing any pump; secondly, in the means employed for attaching the leaden lining to the walls of the concentrating-vessel; and, thirdly, in the appliances for preventing such lining from being pressed away from the wall of the vessel by air, or by the steam of any moisture happening to penetrate between the wall and the lining.

On the annexed two sheets of drawings, Figure 1 is an elevation, partly in section, of a vacuum ice-making machine provided with my improvements. Fig. 2 is a sectional view of the acid-concentrating apparatus; Fig. 3, a horizontal section of the boiler thereof, while Figs. 4, 5, and 6 show the arrangement of the lining to a larger scale.

The refrigerators A, the absorber B, the compound air-pump D, and the heat-exchanging apparatus E (shown in Fig. 1) are substantially the same as in the machine described in the specification of the aforesaid Patent No. 236,471. The concentrator C, Figs. 1 and 2, is also constructed on the same principle as formerly, inasmuch as it consists of a closed vessel in which the acid diluted in B by the absorption of vapor is heated by steam passing through the coils of pipes K, while a vacuum is created above the acid; but the machine has been simplified by a new combination of parts which

allows the pumps formerly used for pumping the acid into and out of the concentrator to be dispensed with.

The passage of the acid through the apparatus is caused by means of the air-pump F, which serves to keep up the vacuum in the concentrator C. The diluted acid is contained in the vessel or reservoir N, open to the atmosphere, the concentrated acid in the reservoir G, which is hermetically closed. The latter is ordinarily placed at a lower level than the concentrator C, so that the acid may flow by gravity through the connecting-pipe L from C to G.

M is the pipe connecting the vessel N with the concentrator. The same discharges into the latter at a point above the level of the acid.

The air-pump F communicates with the top of the concentrator C by the pipe H, and, besides, with the reservoir G by the pipe J, so that when the cock J', inserted in J, is open for communication between F and G there will be the same vacuum in C as in G, in consequence whereof the acid is free to flow from C to G. This flow may be regulated by the cock L'. To the heating-coils K steam is admitted by the pipe S, while the water of condensation is drawn off by the pipe W.

Between the concentrator C on one hand and the reservoirs N and G on the other, the heat-exchanging apparatus E is by preference placed as in the former machine. The same consists of a cylinder containing the pipes E', so arranged that the hot concentrated acid will flow downward around the tubes, while the weak acid, which is cold, ascends within them, the latter being thus heated on its way to C by the concentrated acid, which on its part is cooled.

In order to render the transference of heat from the hot acid to the cold acid more complete, diaphragms *e* have been introduced which have holes a little larger than the tubes passing through them, and thereby cause the hot acid to flow closely along the tubes.

In order to promote the removal of vapor from the concentrator, a condenser, R, is combined with the air-pump, as shown in the drawings; or the same is placed between the pump and the concentrator. Instead of this air-pump,



however, a compound air-pump or any other suitable exhausting apparatus or ejector working by means of steam, air, or water may be used.

5 A vacuum having been created by the pump F, and the cock M' being open, acid will be sucked from the vessel N through pipe M into the concentrator. After having been freed from the excess of water by the combined action of the steam in the coils K and of the vacuum the acid is allowed to flow off by the pipe L into the reservoir G. The flow of the acid through the pipes may be so regulated by the cocks M' and L' that the supply to the concentrator from N and the discharge from the same to G will be continuous and in proportion to the concentrating capacities of the apparatus.

20 It is not absolutely necessary that the reservoir G be placed lower than the concentrator. The same may be arranged at an equal height, or even somewhat higher; but in this case a flow of acid from C to G can only be produced by employing means for creating a higher vacuum in G than in C.

25 Between the reservoir G and the absorber B, Fig. 1, communication is established by the pipe P, while O is the pipe conducting the acid to the vessel N. The acid in B having become diluted to a degree as to be lacking in efficiency, the absorber is shut off from the refrigerators and air is admitted into the same. The acid is then drawn off by cock O' into N. A vacuum having hereupon again been created in B, the cock P' opened, and air admitted into G by the cock J', which is provided with three ways, or by other suitable means, concentrated acid will be sucked into B from G. The entrance of air meanwhile into C by the pipe L may be prevented by a check-valve or by the cock L'. When the absorber is filled up to the required level the cocks P', J', and L' (the latter in case of its having been used) are then again adjusted as before. An intermittent emptying and filling of the absorber B has thus to take place, while the concentrating operation goes on continuously.

50 The concentrator C is conveniently made in the form shown in the drawings and of cast-iron; but in order to resist the corrosive action of the acid it is provided internally with a lead lining. This lining may be secured to the iron by means of dovetail plugs *a*, inserted into recesses in the walls of the vessel, as shown in Figs. 4 and 5. In order to carry out this mode of fastening, a hole is cut into the lining opposite to each recess, and of about the size thereof. So much molten lead is then poured into the recess that it will slightly project from the surface of the lining, whereupon its edges are hammered close to and over the edges of the latter. Finally the edges of both parts are soldered together by means of the gas blow-pipe. The plugs may, however, also be formed by inserting a piece of lead of suitable form

and size into each recess and expanding it by hammering.

As there is a vacuum inside of the concentrator, any air penetrating from the outside, or moisture happening to enter between the wall of the vessel and the lining, will have the tendency to cause the lining to bulge inward. To prevent this, annular grooves *b*, Figs. 2 and 4, are made in the iron, and these are all put in communication with a pipe, *c*, which extends nearly to the top of the vessel, and terminates in a downward bend to prevent any access of acid to the pipe. The pressure between the lead lining and the outer iron case is thus maintained the same as that within the vessel. Such of the grooves *b* as are sufficiently high above the level of the acid may simply be put in communication with the inside of the vessel by a hole, *d*, in the lining, (see Fig. 5;) but in order to prevent any acid from finding its way into the said hole it is advantageous to protect the same by a cap, *f*, having perforations *f'*, through which any air or vapor from behind the lining may pass out.

Wherever pipes branch off from the concentrator the lead lining should extend into and through the same, as shown in Figs. 5 and 6, the latter figure representing the section of a tubular attachment, through which a branch of one of the pipes S and W passes.

The described improvements may also be used together with refrigerators of different design. These may, for instance, consist in horizontal cylinders with stirring apparatus, similar to the absorber B, and serving to cool water to any temperature above the freezing-point, or saline solutions to a lower degree, the latter being in such case employed for conveying the cold to an ice-making tank or other place where it is to be utilized. The improvements are, however, also applicable, independently of the ice-making machine, for the sole purpose of concentrating sulphuric acid.

I claim as my invention—

1. The concentrator C, the air-pump F or its described equivalent, the closed reservoir G, vessel N, and connecting-pipes H, J, L, and M, combined together substantially as and for the purpose specified.

2. In combination with the concentrator C, the lead lining attached to the walls thereof by means of the plugs *a*, as hereinbefore described.

3. In the concentrator C, provided with a lead lining, the grooves *b*, communicating with the space above the acid, substantially as and for the purpose stated.

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

HERMANN EGELLS.

Witnesses:

CARL PIEPER,  
B. ROl.