H. W. COLBY.

AMMONIA CONDENSER FOR REFRIGERATING APPARATUS.

APPLICATION FILED MAY 3, 1906.

924,738.

Patented June 15, 1909.

2 SHEETS—SHEET 1.

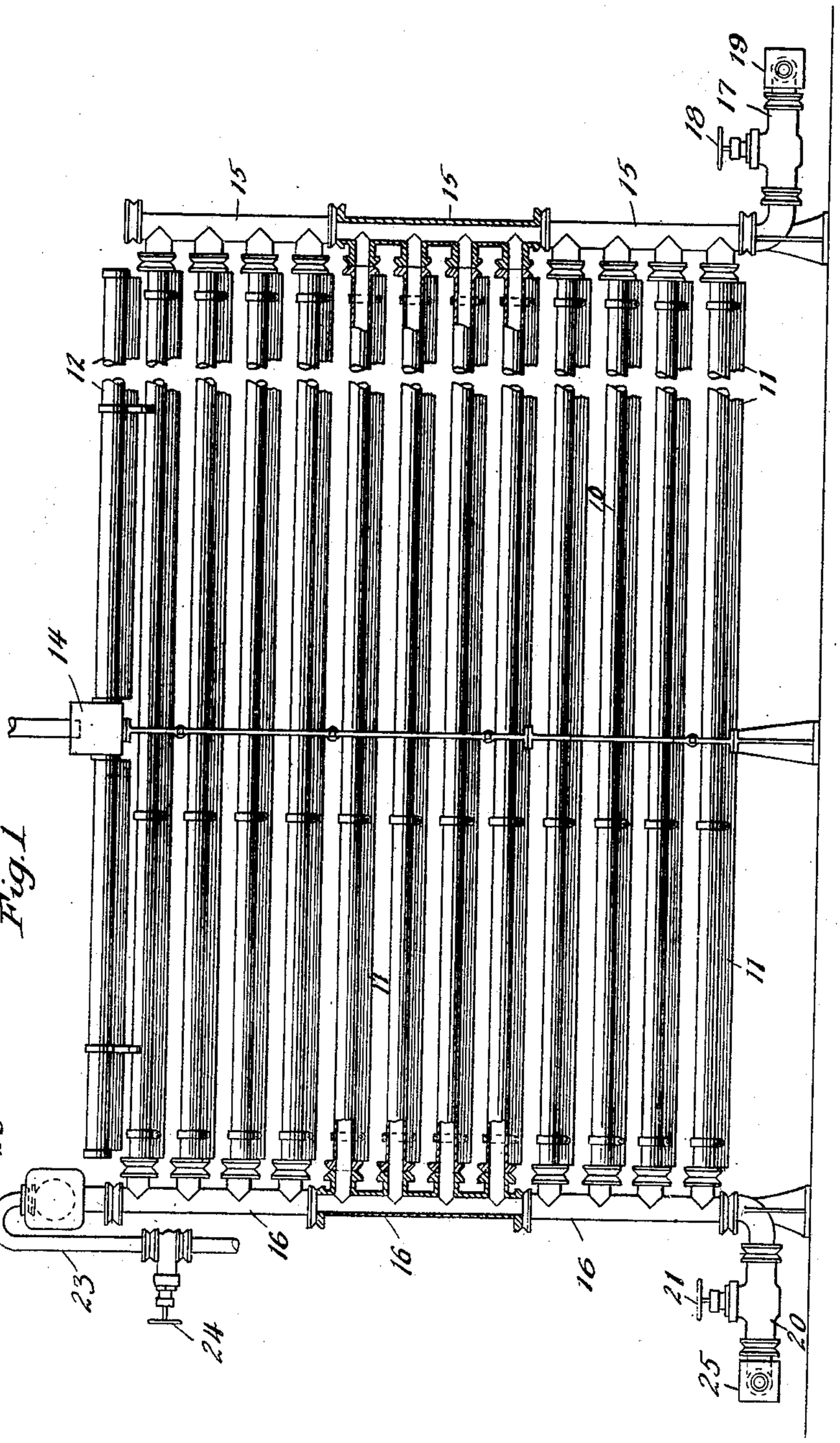

Fig. 1.

Witnesses:

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2 SHEETS—SHEET 2.

Fig. 2

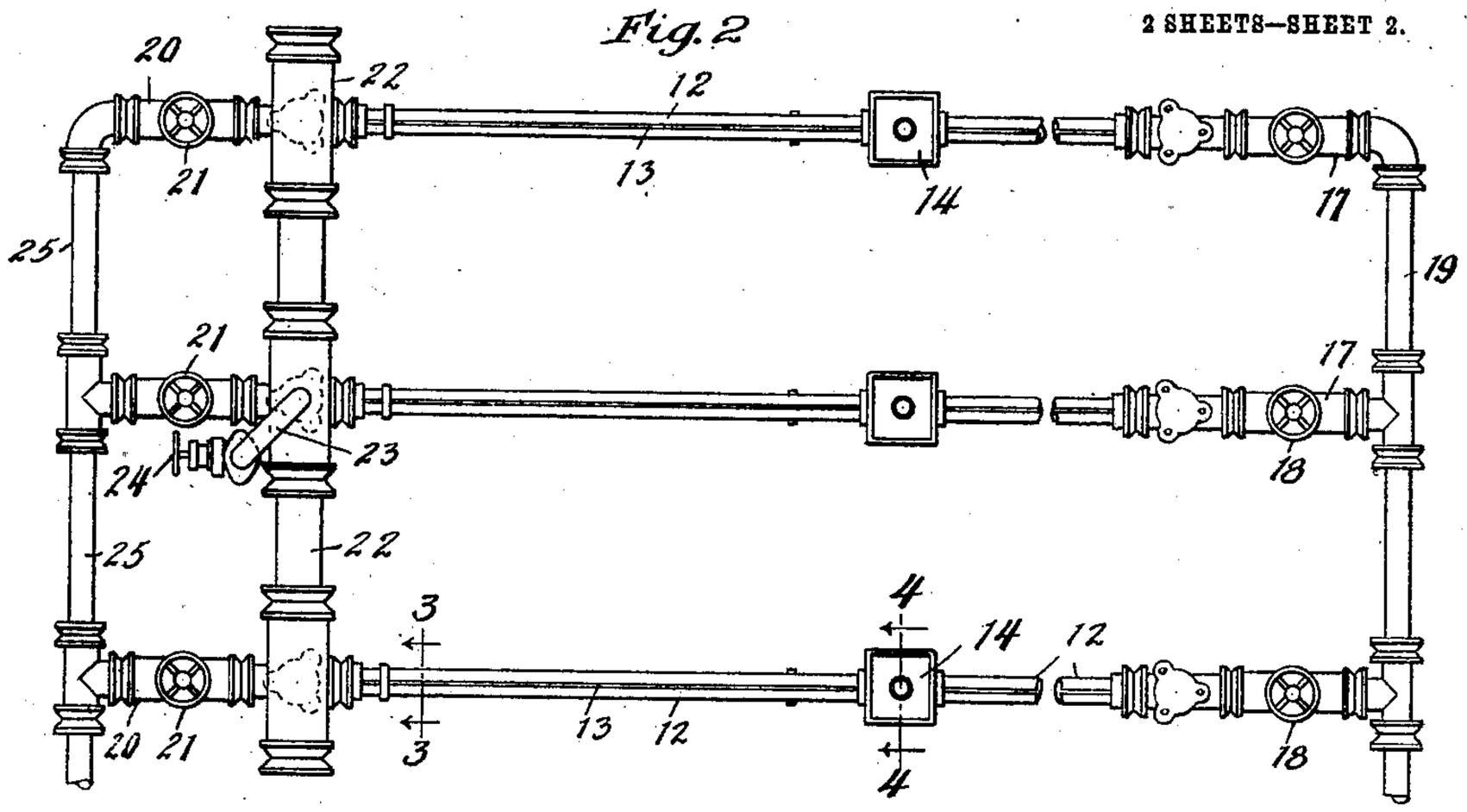


Fig. 3

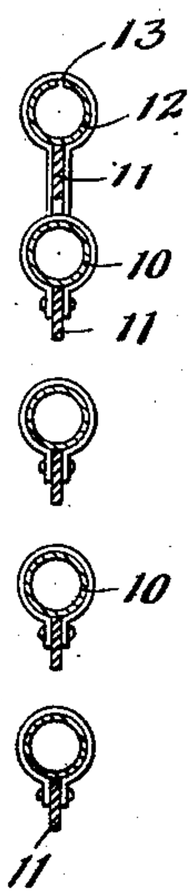
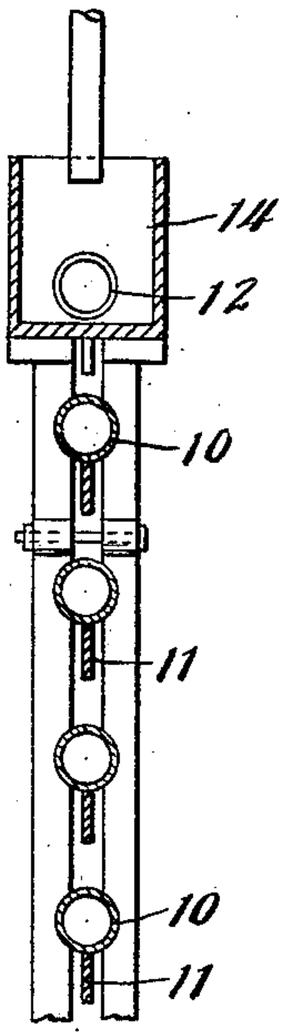


Fig. 4



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UNITED STATES PATENT OFFICE.

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AMMONIA-CONDENSER FOR REFRIGERATING APPARATUS.

No. 924,738. Specification of Letters Patent. Patented June 15, 1909.

Application filed May 3, 1906. Serial No. 314,968.

To all whom it may concern:

Be it known that I, HARRY W. COLBY, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Ammonia-Condensers for Refrigerating Apparatus, of which the following is a specification.

This invention relates to an improvement in the means for condensing ammonia vapor from the gaseous to the liquid state, the liquid to be used for refrigerating purposes.

The object of my invention is to produce a condenser which shall be simple in construction, easily kept in order, economical in its operation, and which shall quickly and effectively separate the fixed or uncondensed portions of the gas as well as whatever air may be contained, from the condensable portions of the gases, whereby the latter may be more quickly and effectively cooled and brought to the liquid state, and thus making the entire service of the condenser more efficient and economical in operation.

My improved condenser consists essentially in so constructing the condensing pipes or chambers that the gas is free to enter every part of the condensing chamber simultaneously, as contradistinguished from the usual method of leading the gas in a continuous thread or current in at one end of the coil of pipes and out at the other end.

The nature of the invention will more fully and particularly appear from the subjoined description and the accompanying drawings, and will be summed up in the claims appended hereto.

In the accompanying drawings which form a part of this specification, Figure 1 is a side elevation of my improved condensing apparatus. Fig. 2 is a top or plan view of the same; Fig. 3 is a partial section on the line 3—3 of Fig. 2; and Fig. 4 is a partial section on the line 4—4 of said Fig. 2. The two latter figures are shown taken on a somewhat larger scale than Fig. 1.

In respect to the manner of feeding the water and dripping the same over the pipes to produce the cooling effect, my apparatus does not materially differ from some already in use; that is to say, I build a grid or vertical grille work of horizontal pipes 10, 10, etc., and provide each with the usual drop bar or flange 11, 11, etc. I also provide the customary water supply pipe 12, having a slot 13 in its upper edge, and being connected with the usual water tank 14. In the drawing at Fig. 2, three of these vertical grilles of pipes each provided with its water supply device are shown placed side by side. The water flows into the tank 14 and thence into the pipe 12 and overflowing through the slot 13 flows down around the pipe and to the drop bar 11 and thence to the pipe 10 immediately below, and so from pipe to pipe throughout the whole vertical grille. The pipes 10, 10, etc., are each connected at one end to an up-pipe 15 and at the other end to a down-pipe 16. Each of the up-pipes 15 is connected to a gas supply pipe 17 having a shut-off valve 18, and each of the gas supply pipes 17 are connected to a horizontal gas leader 19, so that when all of the valves 18 are open, gas is supplied to all of the vertical up-pipes 15 and consequently to all of the horizontal condensing pipes 10 in each of the vertical grilles. At the other end of the grilles the down-pipes 16 are at their lower ends each connected to the liquid escape pipes 20, and these in turn to a liquid leader 25; each of the escape pipes 20 being provided with a shut-off valve 21. At the outlet end of the condenser and at the upper end of the down-pipes 16 is a cross header 22 connecting all of said down-pipes, and in this header 22 is provided one or more outlet pipes 23 having a valve 24 to permit the escape of the fixed gases.

The operation of the apparatus is as follows: The ammonia gas or vapor is admitted through the pipes 19 and 17 to the up-pipes 15 (one or all of them as desired) and passes at once to all of the pipes 10 of the grille, moving toward the down-pipes 16. In the meantime the water has been turned on and begins to drip down over the pipes 10 from the highest one to the lowest one. The flow of the gas being from the up-pipe side toward the down-pipe side, and the hot gas being free to enter all of the pipes 10 simultaneously, it will be seen that the water dripping over the pipes 10 becomes heated most at the up-pipe end of said pipes 10, and as the gas passes through these pipes 10, it becomes cool and the water at the cool end of the pipes is cooler than at the hot end of the pipes. However, as the water is cooler at the upper pipe than at the lower one, and is being continually warmer as it passes from the successive pipes on its way down, the

condensation of the gas will be most rapid in the upper pipes 10 and consequently the pressure within the upper pipes will be lessened and consequently the hot gas will flow to that point, the whole series of cooling pipes being each connected to a common supply and each having a common discharge, the result is that wherever the condensation is most rapid, there the supply of hot gas will be greatest. This gives the full effect to the cooling operation of the water itself as well as to the cooling effect of the evaporation of the water. And the entire result is more satisfactory and economical than in those condensers in which all of the gas is compelled to pass through every part of every pipe of the condenser whether the pipe be in condition to cool the gas or not. In my apparatus, the gas will only go to those parts of the condenser where it is needed and will be supplied most rapidly to that part where the condensing action is most rapid.

The fixed or permanent gases, of course, cannot be condensed in the ordinary ammonia condenser, nor can they be any more condensed in the present invention. However, in my condenser, these gases do not interfere in any way whatever with the condensation of the condensable gases, as they do materially interfere in the ordinary condensers. The fixed or permanent gases so called in my apparatus, being uncondensed rise naturally to the highest part of the condensing apparatus and escape into the header 22. From here they are drawn off through the pipe 23 and let down into a water tank wherever they bubble out and are treated in the usual manner of treating such gases. It will be seen that as these fixed gases are of the same temperature and along the same pressure as the condensable portion of the gas, they travel with the same speed as said condensable portions of the said gas and reach the down-pipe at the same time and continuously; but being uncondensed, they do not descend the down-pipe, but on the contrary, pass freely up and out of the fixed gas outlet. This action, it will be understood, prevents entirely the formation of pockets or accumulations in the cooling parts of the condenser where such pockets or accumulations directly interfere with the cooling action.

It will be seen that essentially my condenser consists of a cooling grille of pipes having at one end a hot gas inlet common to all the pipes, and at the other side a cool gas or liquid outlet common to all the pipes and in which outlet the liquid is separated from the fixed or permanent gas by gravity.

I sometimes prefer, especially if the horizontal pipes 10 are of great length, to give these pipes a slight downward inclination from the hot end to the cool end, in order to facilitate the more rapid flow of the condensed gas. This does not interfere materially with the free passage of the fixed or permanent gas. So too, I have shown the inlet or supply pipe for hot gas as being located at the bottom of the up-pipe, and this I consider the slightly better way as it saves unnecessary piping. But the condenser will be just as effective if the supply of hot gas is supplied to what I have called the up-pipes at any point in their height, at the top, at the middle or at the bottom, the only essential being that the hot gas shall be let into the condensing pipes simultaneously at one side and the cool gas and liquid taken out at the other, and the cooling water be allowed to drip from pipe to pipe over the entire series.

It is not essential that the fixed gas shall be let into a common header in a condenser for a separate outlet from each up-pipe might be provided, though the common header is a convenience and the single outlet quite effective where a multiplicity of grilles is employed. I have found it an improvement to provide means for cooling the header chamber 22, especially where the pipes 10 are not very long, in order to condense and liquefy any condensable gases which may rise into this part in company with the fixed gases. I have shown a cooling pipe 26 for spreading or dripping the water on this header pipe—see Fig. 1.

I claim:—

1. In an ammonia condenser, the combination of a condensing chamber divided into a plurality of compartments, a water drip for cooling the compartments, a fixed gas outlet at the upper part of the cooler end of the condenser, and a duct to said gas outlet which duct is directly open to each of the said compartments, substantially as described.

2. The combination of the grille of condensing pipes, of means for wetting the exterior of said pipes with water or other cooling medium, a common supply of hot gas to one end of said pipes and a common outlet for the liquid at the other end of said pipes, the said common outlet having a straight conduit leading to each pipe of the grille, and means for separating the permanent gases from the condensable gases, said means consisting of an outlet for the fixed gases in the upper part of the condenser at the cool end thereof the said common outlet having an open outer passage to each pipe of the grille, having at its top a fixed gas outlet, and having at its bottom a liquid outlet.

3. In an ammonia condenser, the combination of a condensing chamber divided into a multiplicity of compartments, means for delivering the ammonia vapor and fixed gases to all of said compartments simultaneously, means for cooling said compartments, a draw-off for the liquid communi-

cating with each of the said compartments individually, an escape pipe for the fixed gases, and a straight conduit leading to said escape pipe and communicating with each of the said compartments individually, substantially as set forth.

4. In an ammonia condenser, the combination of a series of substantially horizontal condensing pipes, a vapor pipe or chamber communicating with each of said condensing pipes, means for cooling the condensing pipes, a pipe or chamber for receiving the liquid and fixed gases communicating with each of the condensing pipes at their other ends from the vapor chamber, a draw-off for the liquid leading from the lower end of the receiving chamber, and an escape pipe for the fixed gases leading from the receiving chamber at a point above the draw off, substantially as set forth.

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Witnesses:
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