(No Model.) 4 Sheets—Sheet 1.

T. L. RANKIN.

REFRIGERATING APPARATUS.

No. 266,391. Patented Oct. 24, 1882.

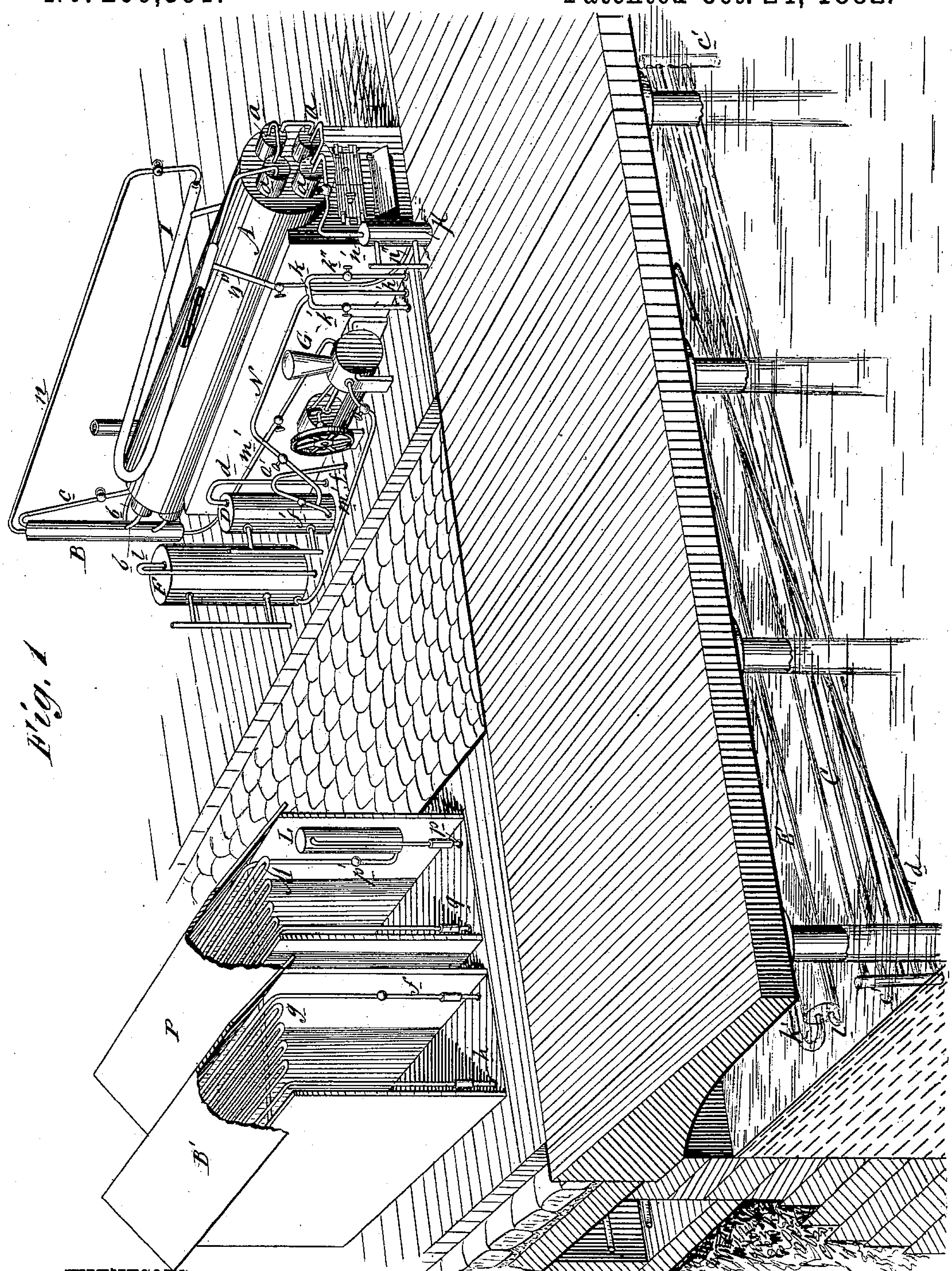

Fig. 1

WITNESSES:

C. Neveux

C. Sedgwick

INVENTOR:

T. L. Rankin

BY Munn & Co

ATTORNEYS.

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.)

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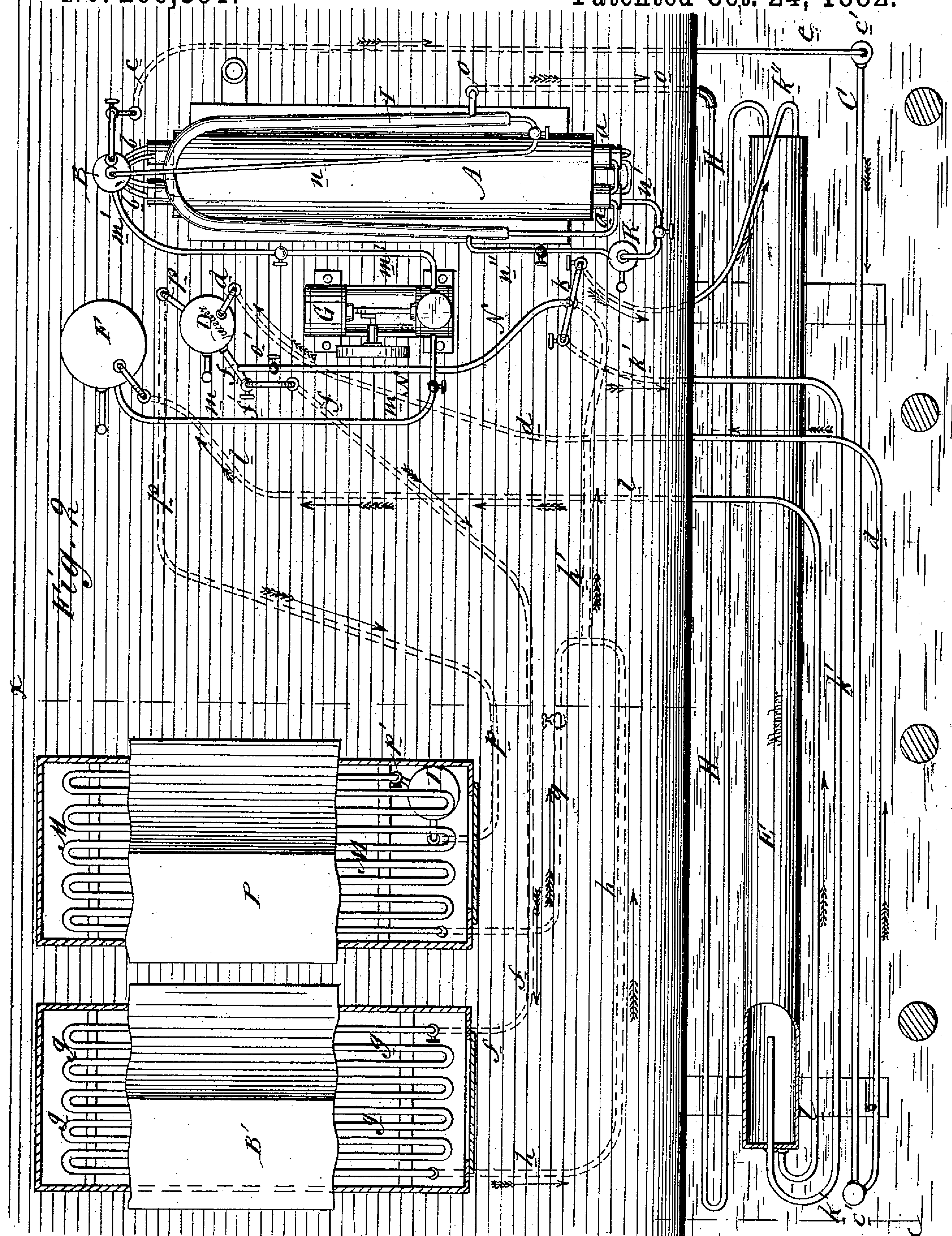

Fig. 2

WITNESSES:

C. Neveux

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T. L. RANKIN.

REFRIGERATING APPARATUS.

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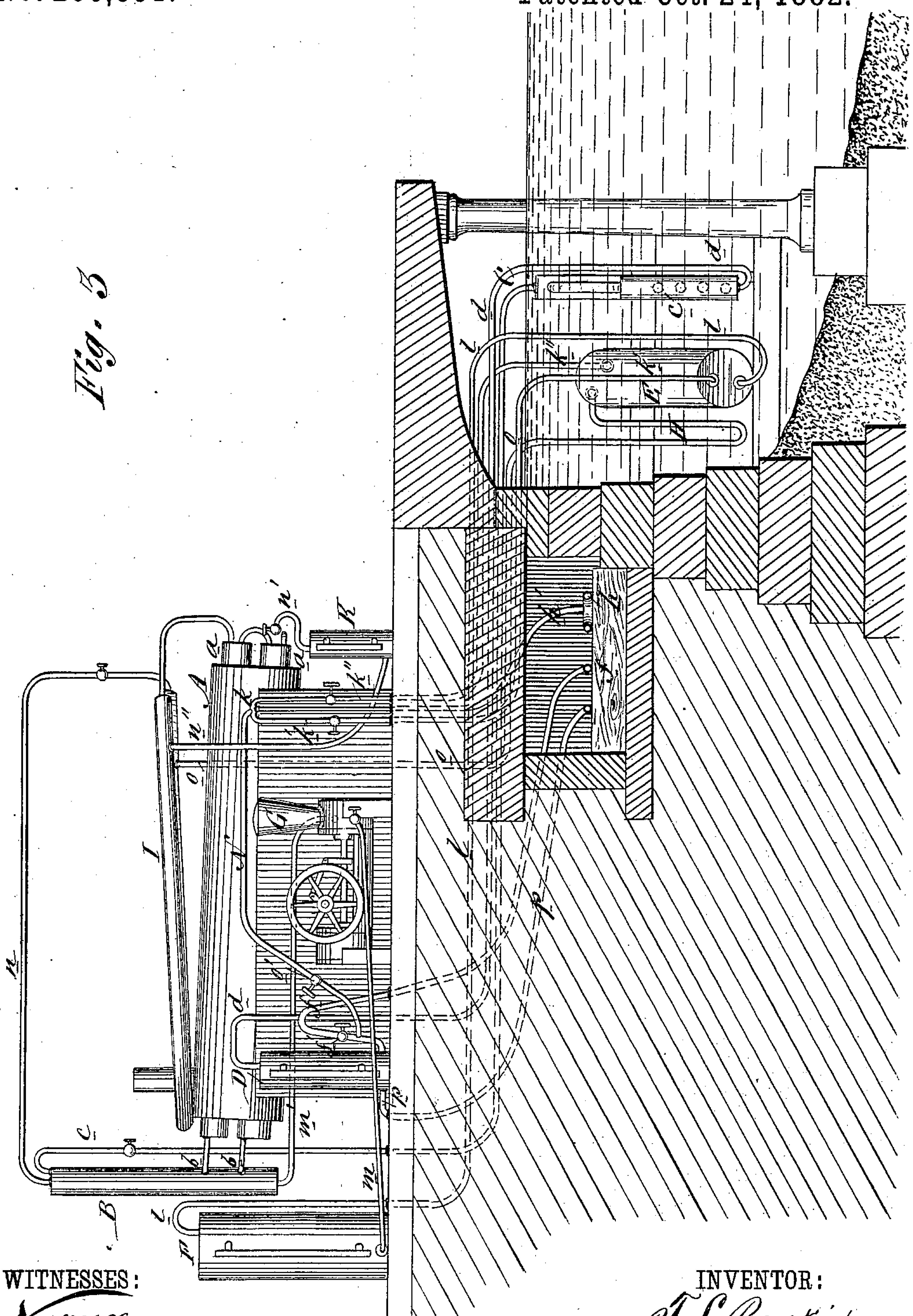
Fig. 3



WITNESSES:

C. Neveux

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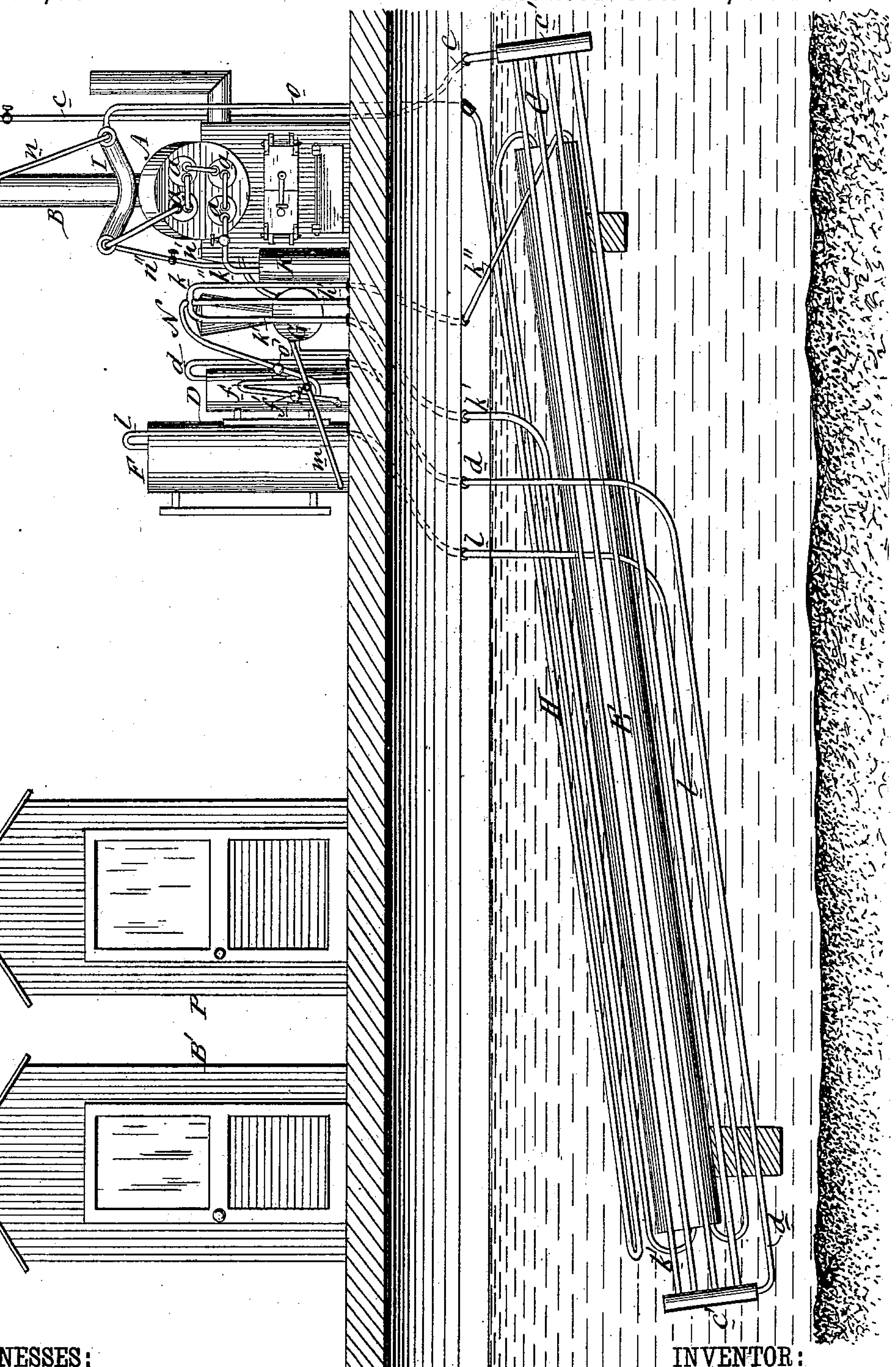
(No Model.) 4 Sheets—Sheet 4.

T. L. RANKIN.

REFRIGERATING APPARATUS.

No. 266,391. Patented Oct. 24, 1882.

Fig. 4



WITNESSES:

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C. Sedgwick

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ATTORNEYS.

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

THOMAS L. RANKIN, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO CHARLES A. RANDALL, TRUSTEE, OF SAME PLACE.

REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 266,391, dated October 24, 1882.

Application filed March 17, 1880. (No model.)

To all whom it may concern:

Be it known that I, THOMAS L. RANKIN, of the city, county, and State of New York, have invented a new and Improved Refrigerating Apparatus; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to certain improvements in refrigerating apparatus of that general construction in which aqua ammonia or other volatile liquid is vaporized in a still by heat, the gas then purged of aqueous vapor, then condensed or liquefied in a coil surrounded by water, the liquefied gas then stored in a receiver, and from the receiver is allowed to expand into pipes in the refrigerating-room to produce the useful effect, and is then returned, after expansion, to an absorber surrounded by water, when it is reabsorbed by the weak liquor drawn off from the still, and this strong liquor then forced by a pump back into the still, and while in transit to the still has its temperature raised by an equalizer, which imparts to the strong liquor the heat of the weak liquor as it passes from the still to the absorber.

Many forms of apparatus operating on this general principle have been heretofore invented, some of which have proved commercially successful; but the difficulty has been that the power required for creating a forced circulation of water for cooling the absorber and condenser and the loss by radiation from the pipes that carry the liquid and gas very materially diminished the percentage of profit.

The object of this invention is to reduce the cost of such artificial refrigeration.

To this end the invention consists in submerging the cooling-coils, condenser, and absorber of a refrigerator that operates with aqua ammonia or other volatile liquid in a river, lake, pond, canal, or other natural or topographical body of water, and in conducting the pipes of the apparatus underground from the submerged devices to the still and to and from the structures or buildings to be refrigerated; and it consists, further, in a pipe arranged to indicate to the operator the working condition of the apparatus, and also in an absorber of peculiar form, all of which is hereinafter fully described.

Figure 1 is a perspective view of the apparatus in position. Fig. 2 is a plan of the same with parts removed the better to exhibit other parts. Fig. 3 is a vertical sectional elevation on line $x x$, Fig. 2. Fig. 4 is a front elevation of a portion of the apparatus in position.

In the drawings, A represents the still containing the receiving-tubes a a for aqua ammonia, which tubes a a being partly filled with aqua ammonia, the ammoniacal gas is driven off by heat through the pipes b b into the aqueous-vapor condenser B, where the aqueous vapor is condensed by a coil containing cold aqua ammonia which is passing through it. From this aqueous-vapor condenser B the gas passes over through a pipe, c, into the condenser C, Figs. 2 and 3, which condenser C is submerged in water, as shown, and is placed so that the headers c' are vertical, Fig. 4, in order that the liquid forming from the said gas may accumulate in the lower return-pipe, d, whence it is forced by the continuous pressure from the still A up into the liquefied-gas receiver D, Figs. 2 and 3, from which receiver D the liquefied gas is expanded into pipe f and through the valve f', Fig. 2, the pipe f being led underground into the expanding-pipes g g within the building B' that is to be refrigerated. The liquefied gas then expanding within the expansion-pipes g, and thereby absorbing the heat of the room and its contents and cooling them down to the desired low temperature, then flows back in a gaseous form through the underground-pipe h into the pipe h', into the T-pipe k, whence it flows through the two pipes k' k'', the bulk of it through k' into the lower end of the absorber E, where it is absorbed by the weak water therein, while the balance enters through pipe k'' into the upper end of the absorber E and expands on the surface of the weak water therein, and thereby presses a portion of the contents of the absorber E, which contents have now become a strong solution, out through the pipe l into the strong-water receiver F, whence this strong water is drawn by the pump G through the pipe m and forced into the aqueous-vapor condenser B and pipe n to the inner pipe of the equalizer I, and thence to the still A, the weak water from the still at the same time passing off through pipe n' into the weak-water receiver K, whence it flows through the valved pipe n'' into the outer pipe of the equalizer I, and where it becomes somewhat cooled by imparting some of its heat to the strong water passing to the still A through the inner pipe of said equalizer I. This weak water then flows through the pipe o to the cooling-coil H, and thence into the absorber E, where it absorbs the gases returning from the refrigerating-rooms through the pipes k' k''.

In the circulation just described the liquid from the liquid-receiver F flows into the expansion-pipes in the refrigerated building or room B′ through a small pipe of half-inch diameter, or thereabout, the pressure of the liquid being strong enough while passing through this small half-inch pipe to maintain itself at about forty pounds to the square inch, the valve in this small pipe being opened just sufficient to effect this purpose. At this pressure the liquid will not expand enough to frost the pipe until it reaches the larger expansion-pipes that are in the building to be refrigerated. In this instance, when the refrigerating-liquid is passed through the small pipe under pressure, I employ another valved pipe, N, and this is an indicator-pipe, which leads above ground from the liquid-receiver F, near the stills, and connects with the return-pipe that conducts the gas to the absorber from the refrigerated rooms. By turning the valve in this indicator-pipe just off its seat the operator in charge of a still can determine the refrigerating quality of the liquid which is passing to the refrigerating building or rooms, for if the liquid have proper refrigerating qualities a foot or two of this pipe immediately beyond the opened valve will instantly become frosted by the passage through it of a small quantity of the said liquid, while the absence of frost on the pipe at such times will indicate that the liquid is lacking in proper refrigerating qualities, and the operator must at once take measures to assure the proper conditions. When the liquefying-pressure is carried through the pipes to the building P, which shows a slight modification, the liquid is allowed to pass freely out of the receiver D, through the pipe p, to the receiver L, where said liquid is expanded through valve p' into the expansion-pipes M and back to the absorber E through the valved pipe q and pipes k k' k''. In this latter case the indicator-pipe N is also used to indicate that the machine is making good liquid for use at the house to be refrigerated, which indication is shown by the frosting of the pipe N for a short distance in turning the valve o' just off its seat. In both instances the expanded gas flows back from the refrigerated buildings through a pipe leading to a submerged absorber; but before reaching the said absorber the said gas is divided into two currents, one of which currents flows to the lower end of the absorber and discharges up through the water, and is absorbed therein, this being the larger current, while the other current flows into the upper end of the absorber and creates within it a sufficient pressure of gas upon the surface of the water therein to press said water up in the receiver that is placed by the pump, thus reducing the work of the pump. From this receiver the pump forces the rich liquor into the still to be used over again. The gas driven from the still passes to the submerged condenser, from which the accumulation is forced out by the constant pressure from the still into a liquid-receiver, whence it is expanded through suitable pipes into the buildings or rooms to be refrigerated. The weak water is forced by the gas-pressure in the still from the lower still-tube up through the equalizer and down into a looped submerged cooling-coil that discharges into the upper end of the submerged absorber.

This apparatus is especially adapted to the economical refrigeration of breweries, packing-houses, and other establishments that require refrigerating apparatus of great capacity.

Heretofore a serious item of the running expenses of artificial refrigerators has been the cost of the water required for the cooling-coils, condensers, and absorbers in order to insure the correct working of the apparatus and process. This serious and in many instances heretofore insuperable objection is removed by submerging the cooling-coils, condenser, and absorber in a neighboring body of water, substantially as shown. These submerged parts of the apparatus are of simple construction, the absorber E consisting simply of a straight wrought-iron pipe or tube of suitable dimensions for proper radiating-surface, having its heads welded or firmly screwed in to prevent the escape of gas. The length of the connecting-pipes of these submerged parts makes said pipes sufficiently flexible to permit said parts to be raised to the surface of the water for examination and repairing; or the connecting-pipes may be attached to the cooling-coils, condenser, and absorber by flexible or movable joints, which will permit the easy adjustment of said condenser, &c. It is found, too, that in leading the pipes underground from the refrigerating apparatus to the buildings to be refrigerated and allowing the gas to expand within coils or receivers within said buildings, there is no appreciable diminution in the effective action of the gas even if passed from the liquefied-gas receiver to said buildings through a mile, or thereabout, of pipe. Hence it will be seen that buildings remote from a body of water can be cheaply refrigerated by this process and apparatus, and indeed that many buildings may be easily refrigerated from one source, simply by a proper system of underground pipes connecting with a refrigerating apparatus placed conveniently near a body of water sufficient for cooling purposes.

I am aware of the Patents No. 213,138 and No. 213,954, and I do not claim anything shown therein.

Having thus described my invention, what I claim as new is—

1. A refrigerating apparatus consisting of a still or apparatus for vaporizing a volatile liquid, a refrigerating room or inclosure with expansion-pipe, and an absorber and condenser, the said absorber and condenser being immersed in or located below the level of a natural or topographical body of water, and having their connecting-pipes extended to the vaporizing device and the refrigerating-room beneath the ground, to take advantage of the non-conducting properties of the earth and the economical cooling effect of said natural body of water, as and for the purpose described.

2. The combination, in a refrigerating apparatus, of a still for the volatile liquid, a refrigerating room or inclosure with expansive pipes, an absorber and condenser, and pipes located underground connecting these devices, of an indicator-pipe, N, with valve located above ground and connecting the liquefied-gas receptacle with the absorber-pipes for the purpose of enabling the operator to test the effectiveness of the apparatus, as described.

3. The absorber E, arranged in inclined position in the water and having pipe k at its lower end, and a pipe, k^2, at its upper end, both communicating with the discharge end of the expansion-pipes of the refrigerating-room and combined with the same, as described, to divide the gas and cause one portion to be absorbed and the other portion to supply the pressure for raising the enriched liquor to its receiver and thus reduce the work of the pump, as described.

THOMAS L. RANKIN.

Witnesses:
JOHN M. ROBB,
WILLIAM F. ROBB.