(No Model.) 4 Sheets—Sheet 1.

T. C. EASTMAN.

METHOD OF AND APPARATUS FOR COOLING THE AIR IN REFRIGERATING ROOMS.

No. 306,724. Patented Oct. 21, 1884.

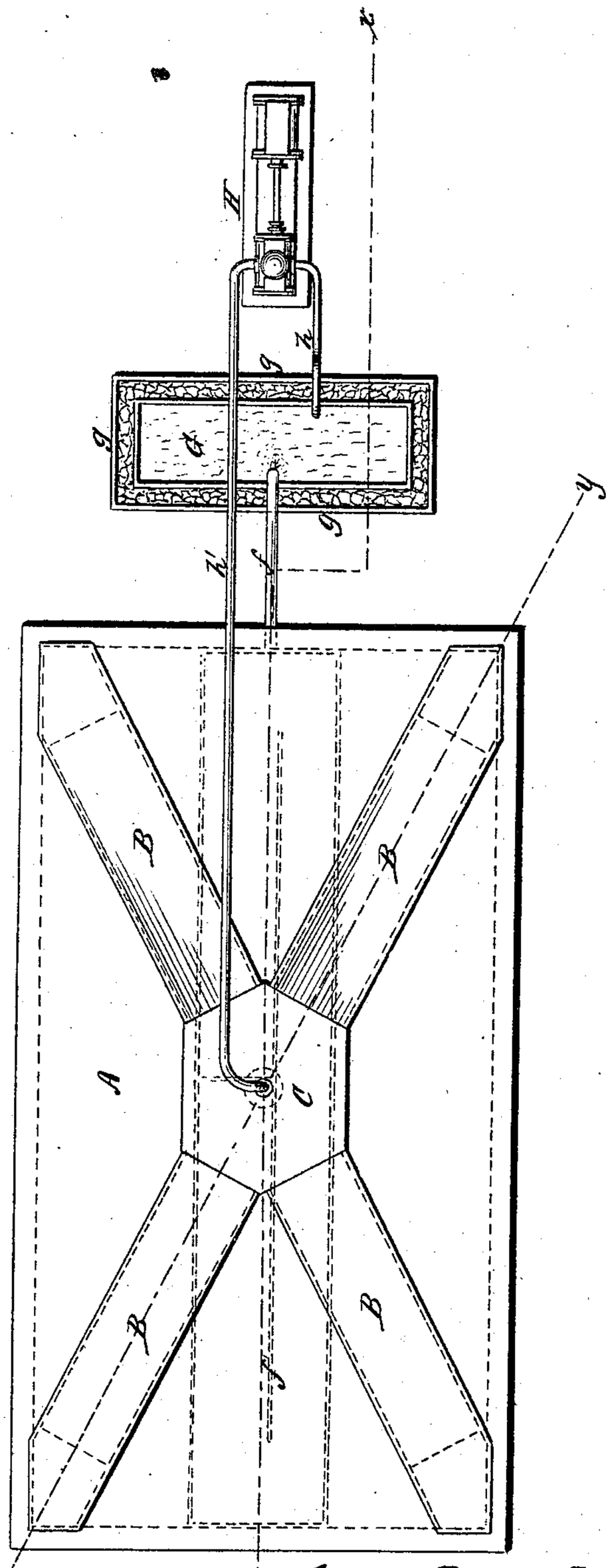

Figure 1.

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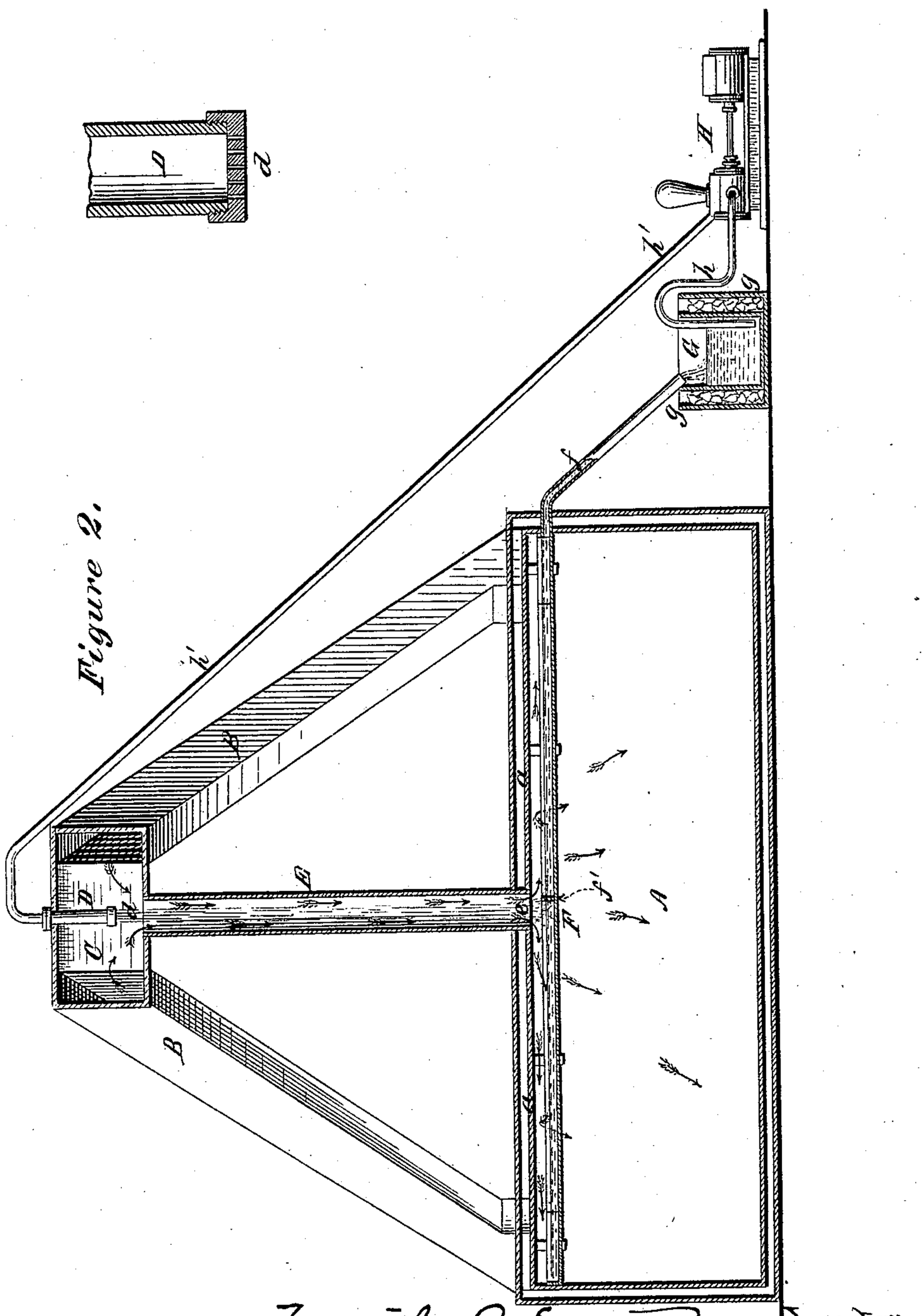

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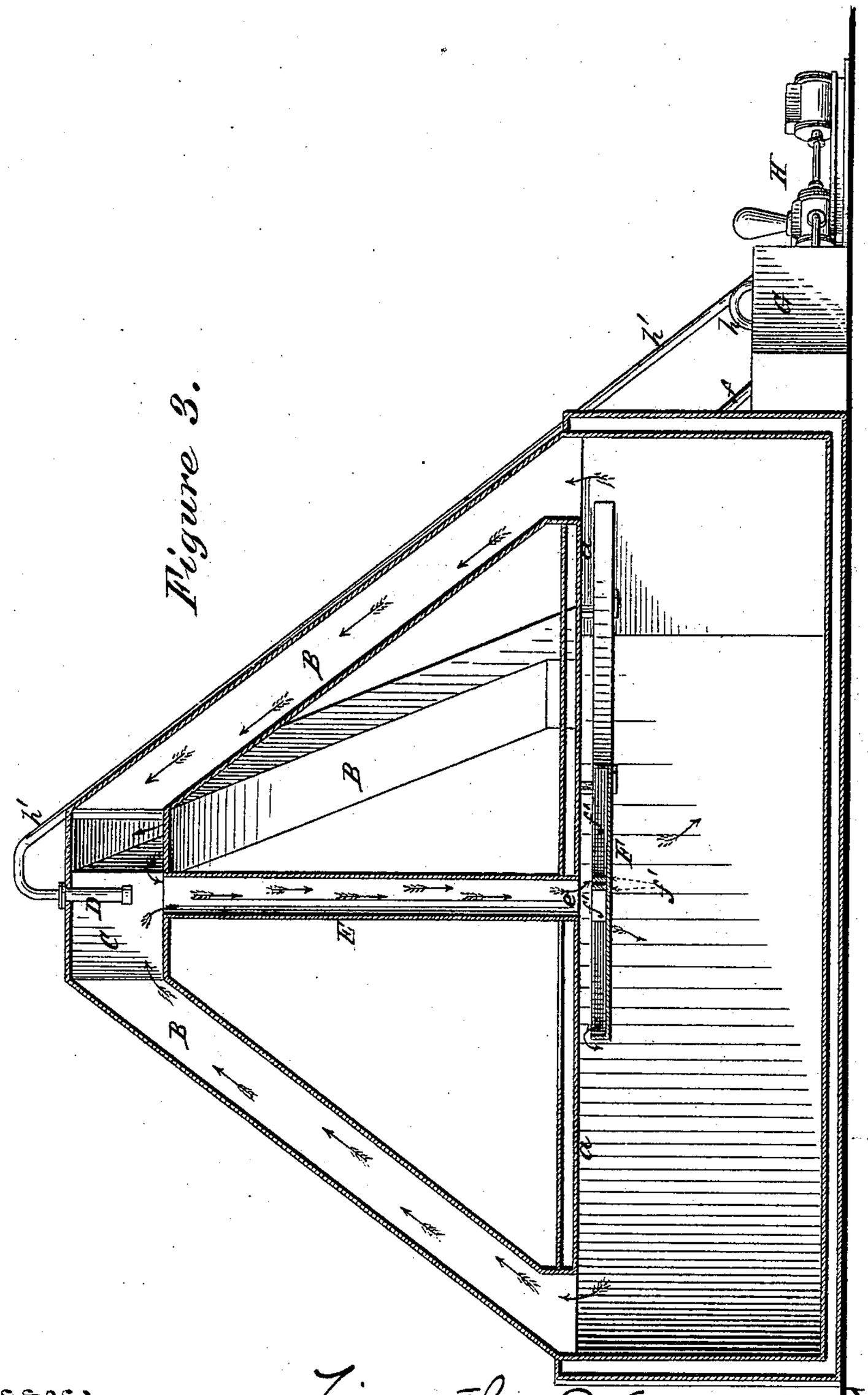
METHOD OF AND APPARATUS FOR COOLING THE AIR IN REFRIGERATING ROOMS.

No. 306,724. Patented Oct. 21, 1884.

Figure 3.



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T. C. EASTMAN.

METHOD OF AND APPARATUS FOR COOLING THE AIR IN REFRIGERATING ROOMS.

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Figure 5.

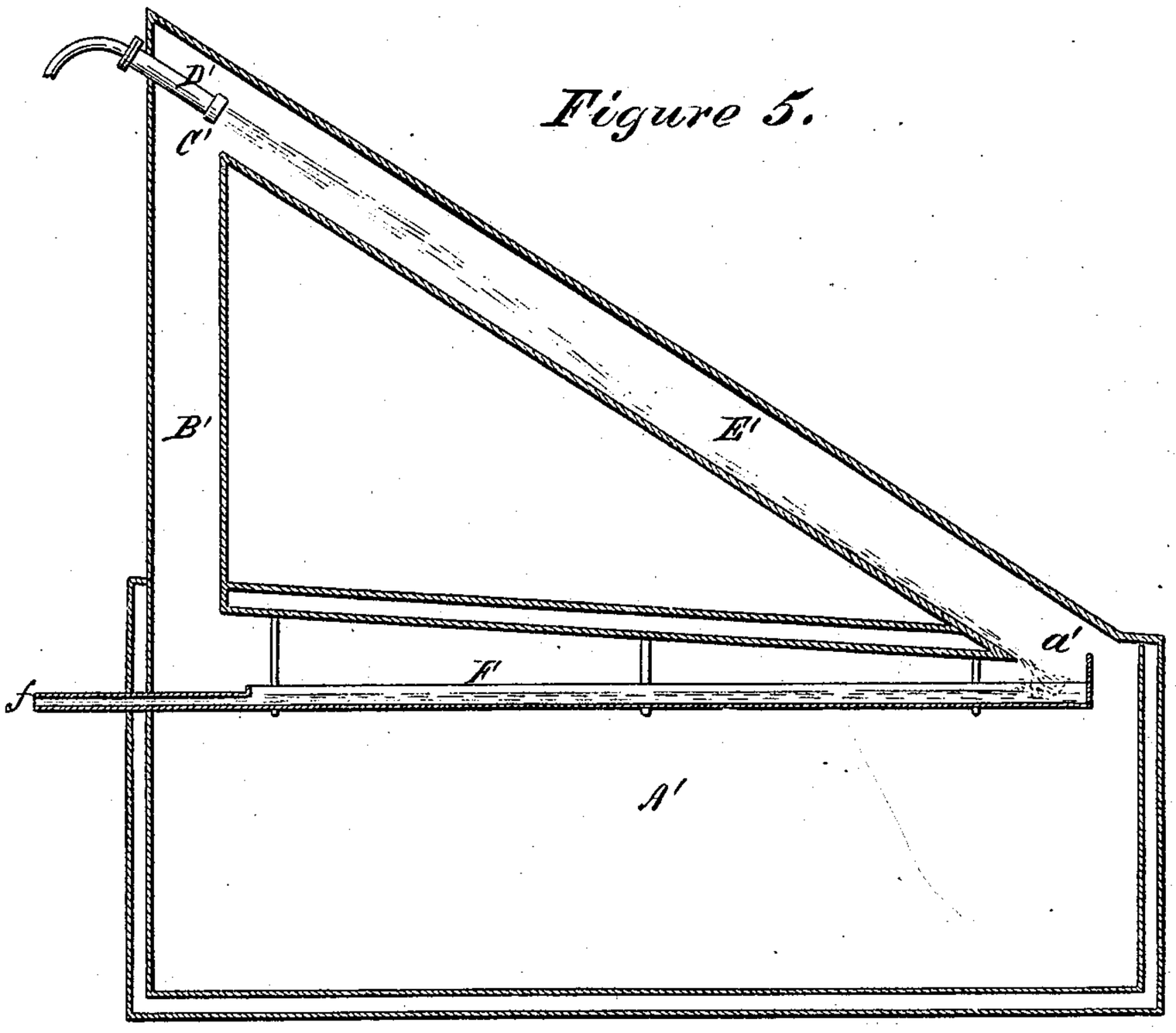
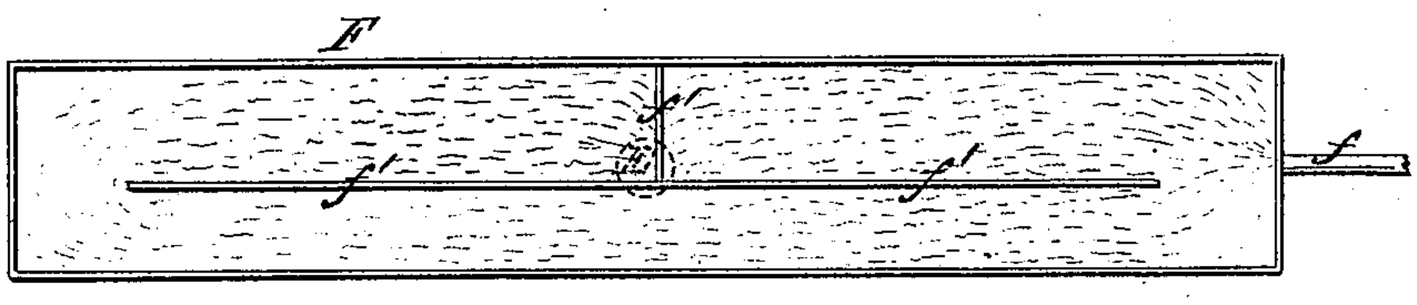


Figure 4.



Witnesses:
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UNITED STATES PATENT OFFICE.

TIMOTHY C. EASTMAN, OF NEW YORK, N. Y.

METHOD OF AND APPARATUS FOR COOLING THE AIR IN REFRIGERATING-ROOMS.

SPECIFICATION forming part of Letters Patent No. 306,724, dated October 21, 1884.

Application filed March 6, 1884. (No model.)

To all whom it may concern:

Be it known that I, TIMOTHY C. EASTMAN, a resident, respectively, of the city, county, and State of New York, and a citizen of the said State, have invented an Improved Method of and Apparatus for Cooling the Air in Refrigerating-Rooms, of which the following is a specification.

My invention consists in injecting into a refrigerating-room air drawn from such room and cooled by direct contact with a stream or jet of cold liquid projected downward through a pipe terminating at its lower end within the refrigerating-room and above a trough which catches and conducts off the cooling-liquid. This pipe for convenience I call the "injector-pipe." Its upper end is suitably elevated above the refrigerating-room, and has no direct communication with the outer atmosphere, but is connected with an uptake flue or flues extending upward from the top of the refrigerating-room. The air cooled by contact with the liquid falls to the bottom of the refrigerating-room and displaces the less cool air therein. The nozzle or nozzles of the pipe or pipes which supply the cold liquid are inserted in the top of the injector-pipe and the jet or jets of liquid projected downward into the injector-pipe and create a downward current of air therein. Air to take the place of that thus carried down the injector-pipe is of necessity drawn from the refrigerating-room through the uptake-flues. The air drawn into the injector-pipe, being cooled by contact with the sprays or stream of cold liquid, falls by its own gravity to the lower part of the refrigerating-room and displaces the less cool air therein, which is thereby driven out through the uptake flue or flues. It will thus be seen that by my invention I establish a continuous air-circuit, in one part of which the air is cooled by direct contact with a cold liquid, and that two causes operate to keep up the circulation of air in the circuit: first, the difference of gravity between the cooled air in the injector-pipe and the less cool air in the refrigerating-room, and, secondly, the mechanical influence of the downwardly-projected jets or stream of liquid in creating through the injector-pipe a downward current of air drawn from the refrigerating-room through the uptake flue or flues. The trough for catching and conducting off the cooling-liquid projected through the injector-pipe is preferably arranged near the ceiling of the refrigerating-room, and may, if desired, have considerable horizontal area, so that the cooling-liquid which it receives will present a large condensing-surface for the condensation of any vapors which may rise to the upper part of the refrigerating-room. When the trough is of large area, it will be desirable to employ in it vertical partitions, by means of which the cold liquid falling into the trough will be kept in motion in a continuous path from the point where it is received to the point where it is discharged from the trough. For the cooling-liquid I prefer to use a strong brine, which may be rendered cool preparatory to its introduction into the injector-pipe by being introduced into a reservoir or tank the hollow walls of which are filled with ice, or may be otherwise cooled by any of the various known methods. The reservoir for containing the cooling-liquid, which, for convenience, I will herein call the "brine-reservoir," may be placed above the refrigerating-room, so that the cooling-liquid will fall by its own gravity into the injector-pipe, in which case the cooling-liquid, after its discharge from the receiving-trough within the refrigerating-room, may be conducted to a tank, from which it will be pumped into the elevated reservoir. Instead of being elevated, the brine-reservoir may be placed below the level of the receiving-trough, so that the cooling-liquid discharged from the receiving-trough will flow directly into the brine-reservoir. In this case the pump will be employed to force the cooling-liquid from the brine-reservoir into a service pipe or pipes extending upward and connecting with the nozzle or nozzles of the injector. The injector-pipe and the uptake-flues connected with the upper end of the injector-pipe may be arranged in various ways. Thus the injector-pipe may be vertical and the uptake-flues inclined from the top of the injector-pipe to a part of the top of the refrigerating-room distant from the place where the lower end of the injector-pipe is inserted; or the injector-pipe may be inclined downward from an air-chamber suitably elevated above the refrigerating-room, into which chamber the upper ends of

the uptake-flues are inserted. In either case the nozzle or nozzles will be so placed as to project the cooling-liquid directly into the upper end of the injector-pipe—in the one case in a vertically-downward direction, and in the other case in a downwardly-inclined direction corresponding with the angle of inclination of the injector-pipe. The ceiling of the refrigerating-room may, if desired, be inclined downward from the places where the uptake-flues are inserted to the place where the injector-pipe is inserted.

The accompanying drawings of a refrigerating-room provided with apparatus suitable for carrying out my invention are as follows:

Figure I is a top view of a refrigerating-room provided with four uptake-flues joined to a central air-chamber at the top of the injector-pipe, also showing the brine-reservoir and the service-pipe for supplying the cooling-liquid to the injector-nozzle. Fig. II is a vertical section through the line X X on Fig. I; Fig. III, a vertical diagonal section through the line Y Y on Fig. I. Fig. IV is a top view of the receiving-pan, showing the vertical partitions by means of which the cooling-liquid received in the trough or pan is kept in motion from the place where it is received to the point where it is discharged. Fig. V is a vertical section illustrating the modifications in which an inclined injector-pipe is employed.

It will of course be understood that the dimensions of the uptake-flues, injector-pipe, &c., will be varied according to the size of the refrigerating-room in connection with which they are to be employed.

In Figs. I, II, and III of the drawings I have represented apparatus which I have found in practice to be effectual for the cooling of a refrigerating-room forty-five feet long, twenty-four feet wide, and fourteen feet high. The refrigerating-room A is shown merely in outline, as the door or doors for allowing access to its interior will, as usual, be variously arranged, as may be most convenient in each particular case, and according to the character of the material which is to be stored in the refrigerating-room. The ceiling *a* of the refrigerating-room is perforated at the corners to permit the insertion of the lower ends of the uptake-flues B B B B, which are convergently inclined and united at their upper ends to the air-chamber C, in the top of which the injector-nozzle D is inserted, and in the bottom of which the upper end of the injector-pipe E is inserted. In the apparatus represented in the drawings the injector-pipe is two feet in diameter and twenty-four feet long, and each of the uptake-flues has a cross-area of twelve feet, each flue being three feet by four. The lower end, *e*, of the injector-pipe is inserted in an opening in the central part of the ceiling *a* of the room immediately over the receiving trough or pan F, which is suitably supported a few inches below the ceiling, and which is provided with an outlet through the discharge-pipe *f*, by which its contents are discharged into the brine-reservoir G, which is fourteen feet long, four feet wide, and five feet in depth. The hollow walls *g* of the brine-reservoir may be filled with ice for the purpose of cooling the brine, or the ice may be put directly into the brine; or any other suitable means may be employed for cooling the liquid contents of the reservoir. A suitable force-pump, H, has an induction-pipe, *h*, inserted in the brine-reservoir, and a four-inch eduction-pipe, *h'*, extending upward to the injector-nozzle D, the lower end of which nozzle is perforated with parallel holes for the discharge into the injector-pipe of the vertically-downward jets *d*. The receiving trough or pan is represented as extending lengthwise entirely across the refrigerating-room. When thus constructed, it will be desirable to provide it with vertical partitions, arranged similarly to the partitions *f' f'*, (shown in Fig. IV,) for the purpose of keeping the entire liquid contents of the trough in motion from a point immediately under the injection-pipe to the outlet through the discharge-pipe *f*.

In operation the cooling-liquid projected downward from the nozzle carries with it air from the chamber C, and creates a downward current of air in the injector-pipe E. The partial vacuum thus created in the elevated chamber C is necessarily supplied by air drawn from the refrigerating-room through the uptake-flues B B B B. The air drawn into the injector-pipe is cooled by direct contact with the stream or jets of water projected downward from the nozzle, and tends to fall by its own gravity to the bottom of the refrigerating-room A. The less cool air therein contained is thus displaced and finds its outlet from the refrigerating-room through the uptake-flues. A difference between the temperature of the air injected into the refrigerating-room and the temperature of the air previously contained therein would of itself be sufficient to cause a circulation upward through the uptake-flues and downward through the injector-pipe; but, in addition to this cause of circulation, there is a mechanical cause working cumulatively with the first—to wit, an injecting operation consisting of the downward injection of air drawn from the chamber C by the jets or stream of cooling-liquid projected from the nozzle D downward into the injector-pipe E—and the latter cause would be operative in producing a circulation of air, even if the temperature of the air in the refrigerating-room were as low as the temperature of the cooling-liquid.

I do not consider it in all cases necessary to employ a receiving pan or trough of large area. For some purposes it will be sufficient to employ a receiving-trough of sufficient area merely to receive and conduct off the cooling-liquid projected through the injector-pipe.

In the modification illustrated in Fig. V the injector-pipe E' is inclined, instead of being vertical, in which case the injector-nozzle D', as will be seen, is inserted in the side of

the air-chamber C′ upon an angle coinciding with the angle of inclination of the injector-pipe E′. The uptake flue or flues B′ take the air from one end of the refrigerating-room A′, and the cold air is injected through the opening *a′* in the ceiling at the opposite end of the refrigerating-room.

What I claim as new and my invention, and desire to secure by Letters Patent, is—

1. The process of cooling the air of a refrigerating-room herein described, which consists in setting the air of the refrigerating-room into circulation through a continuous circuit, in one part of which the air is brought into direct contact with a stream or jets of a cooling-liquid projected into that part of the circuit and acting to set the air in that part of the circuit in motion, and to thereby draw air from one part of the refrigerating-room and inject it into another part of the refrigerating-room.

2. In apparatus for cooling the air of a refrigerating-room, an injector consisting, essentially, of an injector-pipe inserted in the ceiling of the room and extending upward therefrom, and a nozzle for projecting into the upper part of the injector-pipe a jet or jets of a cold liquid, in combination with an uptake flue or flues extended upward from the top of the refrigerating-room and connected with the injector-pipe, and suitable means for receiving and conducting off the cold liquid projected through the injector-pipe.

3. An injector-pipe extending upward from the top of a refrigerating-room, and means for projecting a cold liquid downward into the said pipe, in combination with the trough or pan F, supported near the ceiling of the refrigerating room A, and provided with a suitable discharge-pipe, as and for the purposes set forth.

4. An injector-pipe extending upward from the top of a refrigerating-room and connected with uptake-flues, also extending upward from the top of the refrigerating-room, and provided with a suitable nozzle for projecting liquid downward into the injector-pipe, in combination with a reservoir, means for cooling the liquid contents of the reservoir, means for conducting the same to the said nozzle, and a pan or trough arranged within the refrigerating-room for receiving and conducting off the cold liquid projected from the nozzle into the injector-pipe.

In witness whereof I have hereunto set my hand.

TIMOTHY C. EASTMAN.

Witnesses:
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GEO. H. SONNEBORN.