No. 697,679. Patented Apr. 15, 1902.

A. SIEBERT.

AIR COOLING APPARATUS.

(Application filed Oct. 4, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. I.

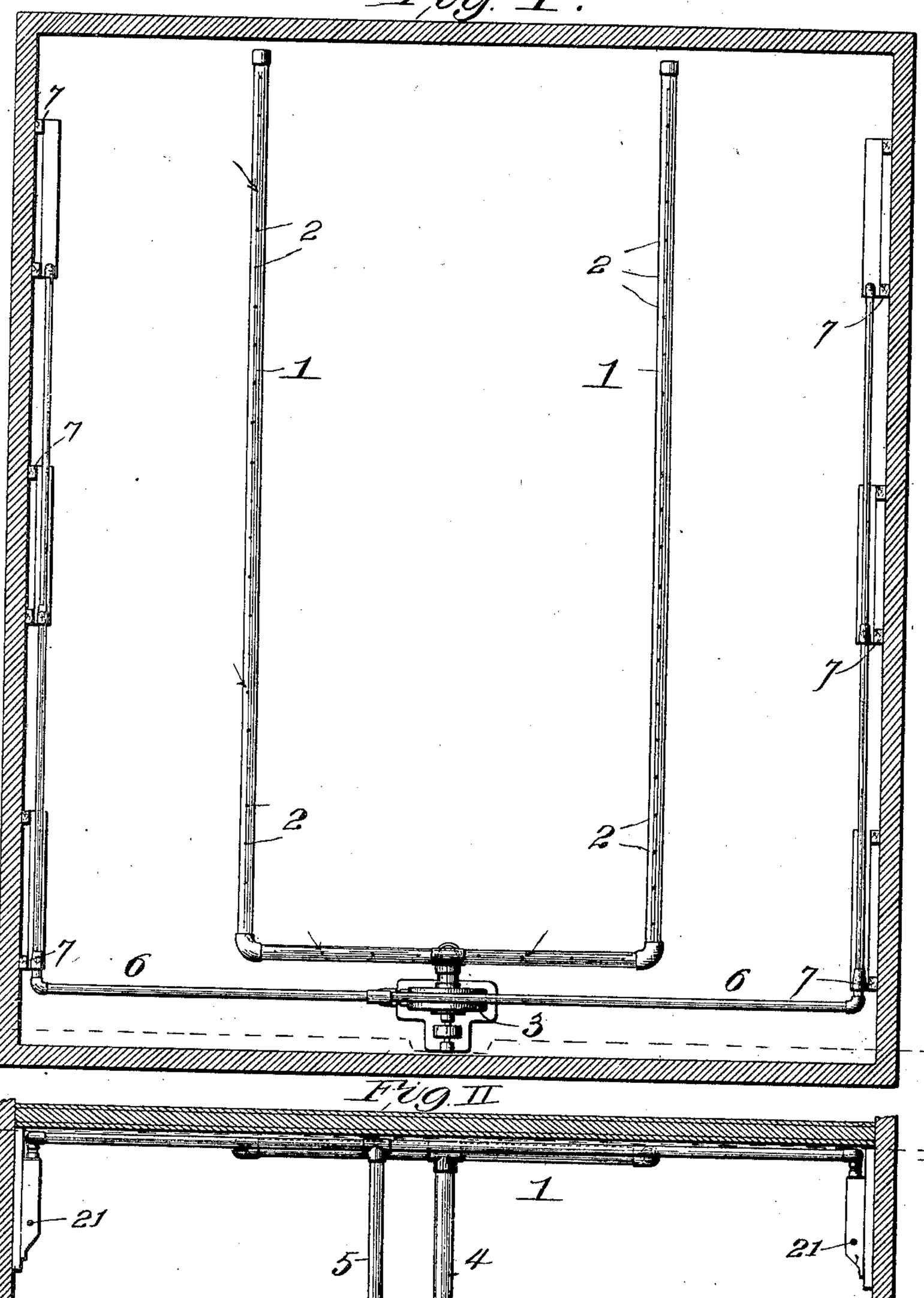
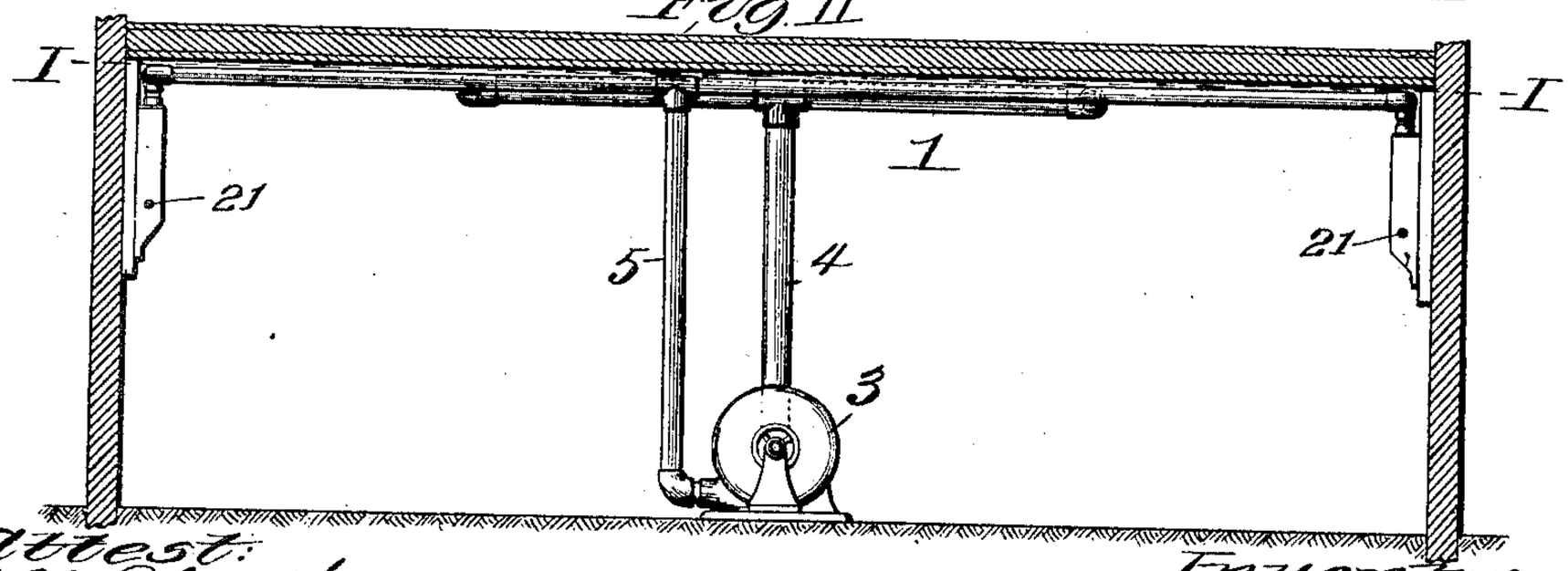


Fig. II



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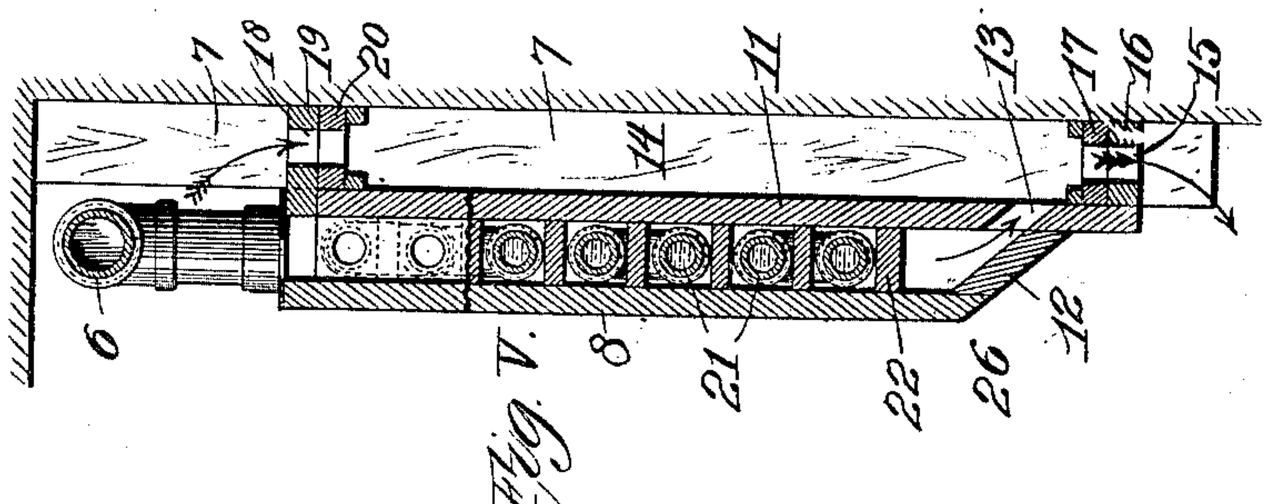

Fig. V.

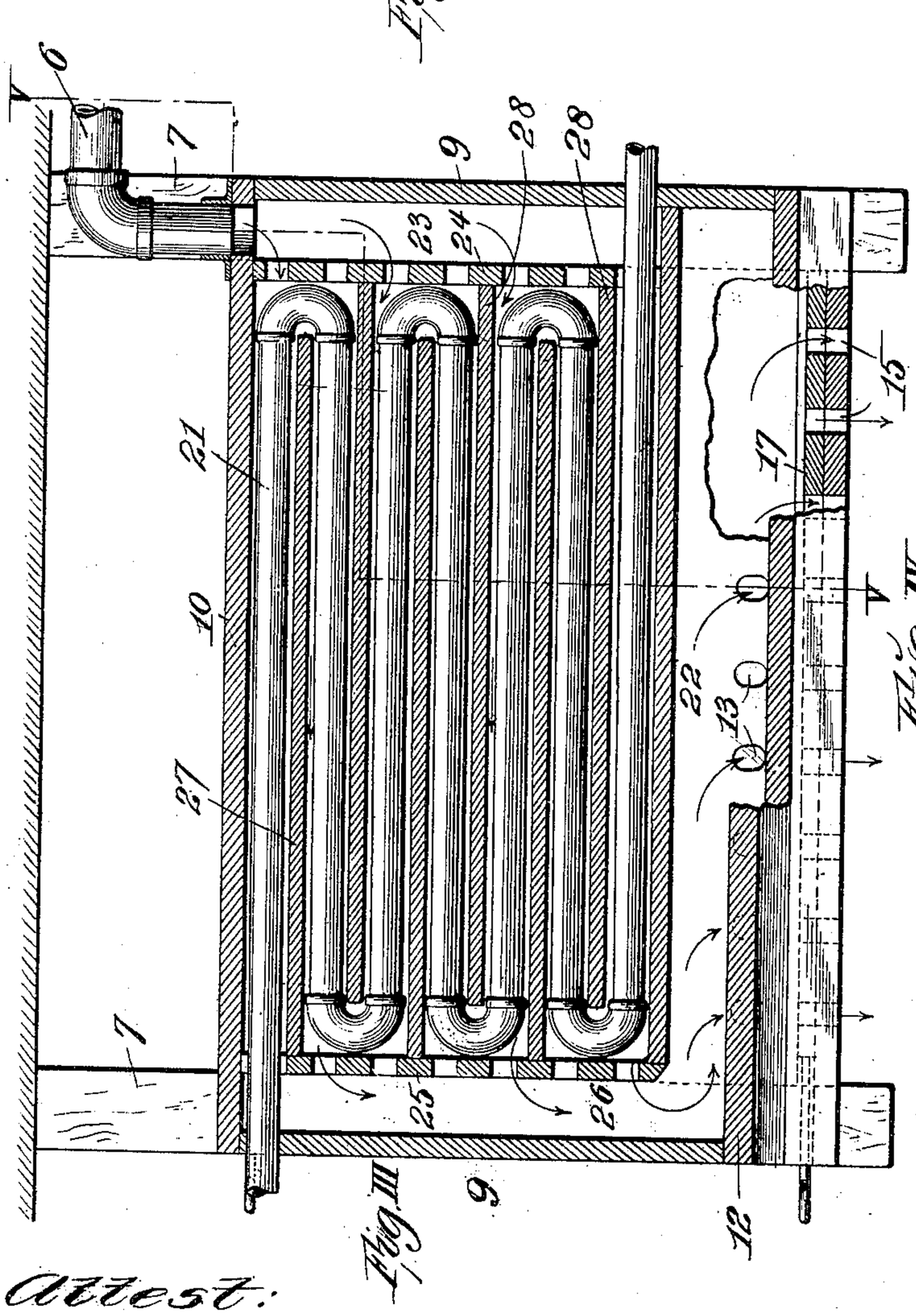

Fig. III.

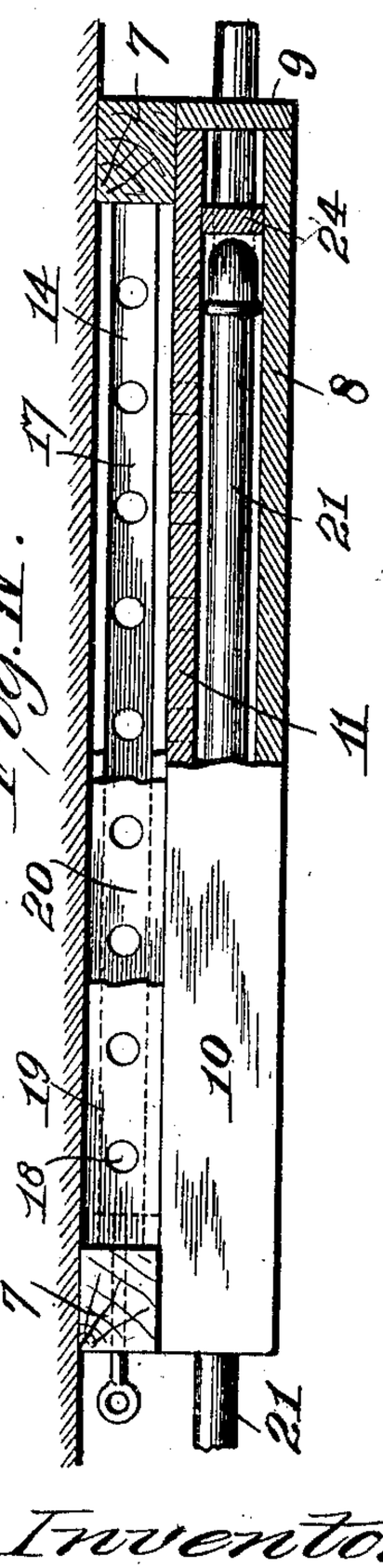

Fig. IV.

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UNITED STATES PATENT OFFICE.

ALFRED SIEBERT, OF ST. LOUIS, MISSOURI.

AIR-COOLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 697,679, dated April 15, 1902.

Application filed October 4, 1901. Serial No. 77,569. (No model.)

To all whom it may concern:

Be it known that I, ALFRED SIEBERT, a citizen of the United States, residing in the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Air-Cooling Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to an apparatus for cooling the air in storage or other rooms to maintain a continued definite temperature of the air.

My invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

In producing an efficient and inexpensive air-cooling apparatus it is imperative that the following points be observed: The air must be caused to move over the cooling-surfaces in the thinnest possible film and with the greatest possible velocity to derive the utmost benefit from the area of pipe constituting the cooling-surface. The difference of temperature between the air to be cooled and the air subsequent to its being cooled must be as great as possible, and still the air must not be cooled to so low a temperature that the efficiency of the apparatus is impaired. The air delivered from the cooling apparatus into the room should be but slightly cooler than the temperature desired throughout the room and should be evenly and thoroughly distributed over the room with not too great a velocity. The humidity of the air should be predetermined by the size and arrangement of the apparatus, whereby the apparatus acts in a self-regulating manner with respect to the maintenance of the proper degree of humidity.

I have, with the points above referred to in view, devised the cooling apparatus which forms the subject-matter of this application and which is illustrated in the accompanying drawings.

Figure I is a top or plan view of my cooling apparatus, the wall of the room in which the apparatus is located being shown in horizontal section taken on line I I, Fig. II. Fig. II is an end view of the apparatus with the walls of the room shown in vertical section taken on line II II, Fig. I. Fig. III is a vertical longitudinal sectional view taken through one of the cooling-boxes of my apparatus. Fig. IV is a view, partly in plan and partly in horizontal section, of the cooling-box. Fig. V is a vertical cross-sectional view through the cooling-box, taken on line V V, Fig. III.

1 designates suction-mains provided throughout their lengths with perforations 2, through which air may enter said pipes. These suction-mains are located in close proximity to the ceiling of the room in which the cooling apparatus is utilized, being so placed that they receive the warm air that constantly rises to the ceiling, which is drawn into said mains by a blower 3, that has communication with the mains through a pipe 4. (See Fig. II.) The warm air delivered to the blower 3 from the suction-mains passes from said blower into a conducting-pipe 5, that leads to conveying-pipes 6, which extend to the air-cooling boxes of the apparatus, that contain cooling-coils. The cooling-boxes are mounted against uprights 7, and the body of each box comprises a front wall 8, end walls 9, a top 10, a back wall 11, and a bottom 12, that preferably extends on a downward incline from the front wall 8 to the rear wall 11. The rear wall 11 is provided with a series of apertures 13, that lead from the interior of the cooling-box at the lower end thereof into the air-mixing chamber 14, produced by the space existing between the rear wall 11 and the wall of the room in which the apparatus is located and between the uprights 7, by which the cooling-box is supported. Exit of air from the mixing-chamber 14 is provided for through a series of outlet-orifices 15, contained by a strip 16, located between the rear wall of the cooling-box and the wall of the room. The exit of air through the discharge-orifices 15 is through a slide-valve 17, mounted on the strip 16. Warm air enters the mixing-chamber 14 through the inlet-orifices in a strip 19, the entrance of air to the mixing-chamber through said orifices being regulated by a slide-valve 20.

On the interior of the cooling-box is a coil 21, through which cooling medium of any suitable description, such as ammonia, is circulated to maintain a low temperature in the coil. The coil occupies a position between the top 10 of the cooling-box and a

floor 22, elevated above the bottom 12 of the box, and the air that is introduced into the cooling-box through the conveying-pipe 6 first enters a receiving-chamber 23 and passes therefrom through a perforated vertical partition 24 into the space occupied by the cooling-coil 21, from which space it escapes through a perforated partition 25 at the opposite end of the coil and descends into the discharge-chamber 26, that extends downwardly to the apertures 13, through which the air that has been cooled in passing about the cooling-coil 21 escapes into the mixing-chamber to mingle with the air that enters said mixing-chamber through the inlet-orifices 18. The folds of the cooling-coil 21 are separated by longitudinal partitions 27 and 28, the partitions 27 extending from the perforated wall 25 to their terminations within the return-bends at the opposite ends of the coil, but remote from the partition 24, and the partitions 28 extending from the perforated partition 24 within the folds of the coil approximately the same distance from the partition 25 as that occupied by the partitions 27 from the vertical partition 24.

I place the cooling-boxes as close as possible to the ceiling of the room, so as to acquire a downward current of the air into the mixing-chambers 14 through the inlet-orifices 18, and the warm air near the ceiling of the room is drawn through the inlet-orifices into the mixing-chambers by induction that is created by the passage of cooled air from the cooling-boxes 21 through the apertures 13, that lead from the cooling-boxes into said mixing-chambers, the current of air forced through said apertures 13 from the conveying-pipe 6 through the cooling-box acting as an injecting medium by which the outside air is drawn into the mixing-chamber 14 and delivered therefrom through the outlet-orifices 15, the air drawn directly from the room into said mixing-chamber being of considerably greater quantity than that passes through the cooling-coil compartment in the cooling-box.

In order to convey the air being cooled by the coil 21 in a very thin film over the coil, the coil-pipes should be of small diameter and the coil should be so arranged within the box and positioned between the partitions 27 and 28 between the folds thereof as to provide narrow spaces between the pipes and the surrounding inclosures for the air to pass over in a thin strata, so that it will be quickly and efficiently cooled as it is forced through the cooling-box from the conveying-pipe 6.

In the practical use of my cooling apparatus the greater quantity of air subjected to cooling agency enters the mixing-chambers 14 by the injecting action of the air forced through the cooling-boxes about the cooling-coils, and as the greatly-cooled air that has passed over the cooling-coils enters said mixing-chamber it mingles with the uncooled air therein, thereby lowering the temperature of the uncooled air and at the same time raising the temperature of the cooled air, so that the bodies of air neutralize and an even desirable temperature of air is produced. Furthermore, the velocity of the cooled air that has passed through the cooling-coil compartment from the conveying-pipe 6 is decreased, a result that is necessary to increase the efficiency of the cooling-coils and to induce large quantities of uncooled air into the mixing-chamber. This reduction of velocity of air passed through the cooling-compartment is essential, inasmuch as while it is necessary to provide a certain current to induce the uncooled air into the mixing-chamber and create a gentle current of air throughout the room it is also essential that the velocity of such current be insufficient to cause a drying action on materials stored in the room, a result that would be occasioned by too great a velocity of current.

With regard to the humidity maintained in the room being cooled by my apparatus it is evident that for a certain temperature of the cooling medium and a certain temperature of the air entering the cooling-boxes the length of the cooling-coils is fixed and that therefore the humidity in any room supplied with the apparatus may be governed by the coils used. Therefore to arrive at the length of coil required in each instance to acquire a given humidity it is necessary to ascertain what temperature reduction is necessary to bring air of a certain percentage of humidity to its dew-point, as then any greater percentage of moisture which the air contains will be condensed and retained in a cooling-box constructed according to my invention, and the cooled air that is mixed with the uncooled air will afford absolutely the required humidity in the room. Should, however, the air become too dry at any time, the humidity may be easily increased by the introduction of saturated air into the room to raise the degree of humidity.

The suction-mains 1 and the conveying-pipe 6 may be provided with suitable shut-offs to regulate the quantity of air entering into or conducted through said pipes in order to maintain a proper supply of air to the cooling-boxes, according to the needs in keeping the temperature of the room at the point desired.

While I have described the warm air that enters the mixing-chambers 14 as being drawn thereinto by induction occasioned by the discharge of air from the cooling-boxes of the apparatus, I do not limit myself to this arrangement, as it is obvious that instead of inducing the warm air into said mixing-chambers it can be delivered thereinto at a low velocity by the use of pipes connected to the blower 3 or to a separate blower.

I claim as my invention—

1. In an air-cooling apparatus, a cooling-box comprising a coil-chamber, having perforated end-partitions, a cooling-coil arranged

within the coil-chamber, partitions arranged between the folds of the coil, a receiving-chamber communicating through one of the perforated partitions with the coil-chamber and a discharge-chamber with which the coil-chamber communicates through the other perforated partition.

2. In an air-cooling apparatus, the combination of a cooling-box comprising a coil-chamber having perforated end partitions a cooling-coil arranged within the coil-chamber, partitions arranged between the folds of the coil, a receiving-chamber communicating through one of the perforated partitions with the coil-chamber, and a discharge-chamber with which the coil-chamber communicates through the other perforated partition; and an air-mixing chamber communicating with the discharge-chamber of the cooling-box.

ALFRED SIEBERT.

In presence of—
E. S. KNIGHT,
M. P. SMITH.