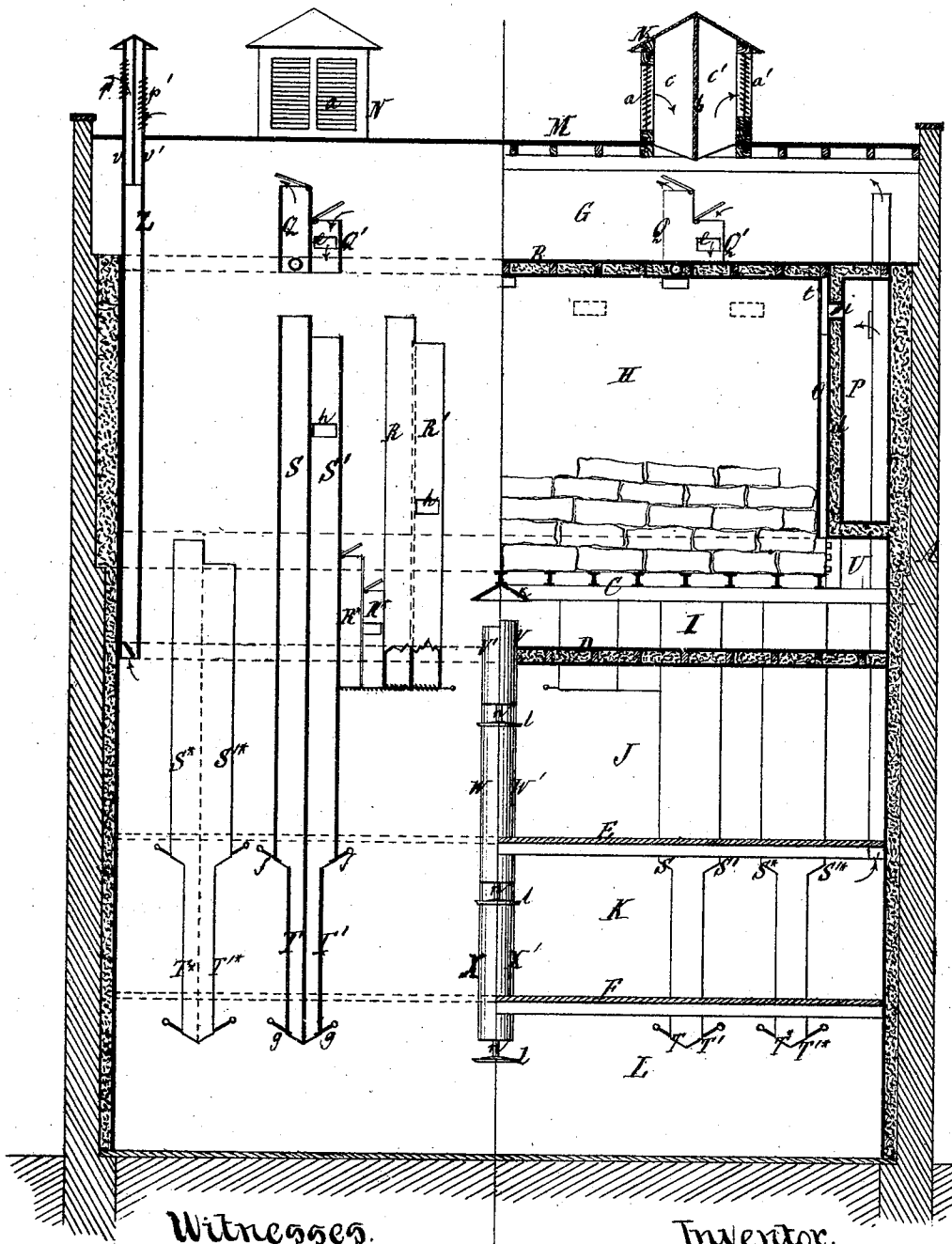
2 Sheets--Sheet 1.

A. PFUND.

Improvement in Refrigerator-Buildings.

No. 130,311. Fig. 1. Patented Aug. 6, 1872.



Witnesses.
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2 Sheets--Sheet 2.

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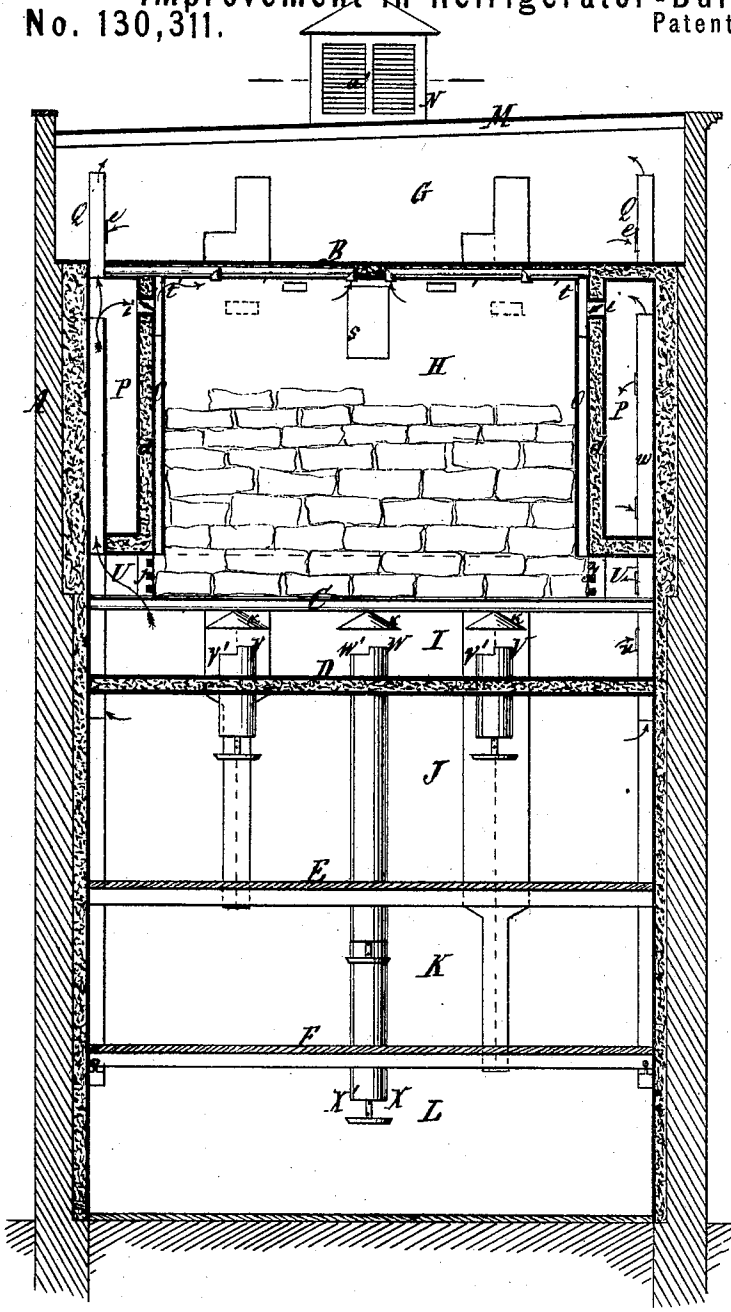


Fig. 3.

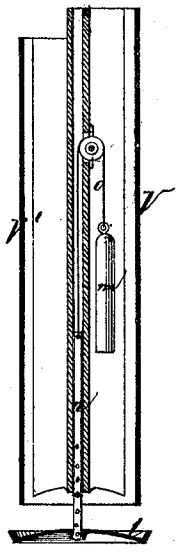


Fig. 4.

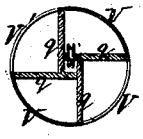
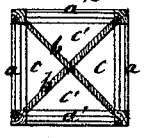


Fig. 5.



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UNITED STATES PATENT OFFICE.

ANTHONY PFUND, OF NEW YORK, N. Y.

IMPROVEMENT IN REFRIGERATOR-BUILDINGS.

Specification forming part of Letters Patent No. **130,311**, dated August 6, 1872.

To all whom it may concern:

Be it known that I, ANTHONY PFUND, of the city, county, and State of New York, have invented a new and useful Improvement in Refrigerator-Buildings; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawing forming part of this specification, in which drawing—

Figure 1 represents a longitudinal vertical section of my building, one-half of the drawing showing the air-flues close to the wall, and the other half the flues in the middle of the building, and the arrangement of the ice-chamber. Fig. 2 is a transverse vertical section of the same. Fig. 3 is a detached section of one of my combination air-flues with its damper, in a larger scale than the previous figure. Fig. 4 is a horizontal section of the same. Fig. 5 is a horizontal section of one of my ventilating-domes.

Similar letters indicate corresponding parts.

This invention relates to a system of ventilation whereby the several chambers or compartments are automatically supplied with cold air from the open atmosphere or from an ice-chamber, while by the cold air descending into the said compartments the warm and foul air formed therein is forced out, the foul air being allowed to escape, and the good air being cooled off and allowed to descend again into one or the other of the compartments of the building.

In the example shown by the drawing, the letter A designates a refrigerator-building, which is divided by a series of horizontal partitions or floors, B C D E F, in a number of compartments, G H I J K L. From the roof M of my building rise one or more domes, N, which are open at the bottom, and provided in their sides with blinds or shutters *a a'*, which are situated at different heights from the roof. (See Fig. 1.) The interior of each dome is divided by diagonal partitions *b b*, Fig. 5, in four sections, *c c c' c'*, the sections *c c* communicating with the external atmosphere through the lower shutters *a*, and the sections *c' c'* through the upper shutters *a'*. By this arrangement the compartment G immediately beneath the roof is ventilated, the cold external air passing down through the lower shutters *a* and sections *c* by its own gravity, while the warm air from the interior of the compartment escapes through the sections *c'* and the upper shutters *a'*. The compartment H forms the ice-chamber, which is surrounded by a double air-space, O P, the inner air-space O being separated from the outer air-space P by a non-conducting wall, *d*. The air-space P communicates with the upper compartment G by a series of air-flues, each of which is subdivided in two flues, Q Q', one being somewhat lower than the other. These flues are provided with dampers at their tops, and the short flues Q' are also provided with side apertures *e*, so that the cold air from the compartment G will descend into the air-space P, while the warm air from this air-space rises through the flues Q, the draft of the air itself being in most cases sufficient to keep the dampers on these flues open; or, if desired, these dampers, as well as those on the flues Q', may be opened, as shown in Fig. 1 of the drawing. The air-space P communicates, by means of a series of double flues, R R' S S', with the compartments J and K, and the flues S S' are provided with extensions T T', communicating with the lowest compartment L. All these flues are arranged in pairs, and the flues R' and S' in each pair terminate at the top at some distance beneath the flues R and S, respectively, so that the cold air from the air-space P will descend through the short flues R' and S', while the warm air from the compartments J, K, and L rises through the long flues R and S. The flues S S' are somewhat wider than their extensions T T', and at their junction with said extensions are placed dampers *f*, while the bottom ends of the extensions T T' can be opened or closed by dampers *g*. By adjusting these dampers the ventilation in the compartments K and L can be regulated. The short flues R' and S' are also provided with apertures *h* in their sides, said apertures leading into the air-space P, and being situated at certain distances beneath the upper ends of said flues, so that the cold air which accumulates in the lower portion of the air-space P is enabled to find access to the flues R' S', and through them to the compartments beneath. By means of the domes N with their system of sections and shutters, and by the flues Q Q' R R'

S S′, the temperature in the interior of the building can be readily brought down to the lowest temperature of the atmosphere existing during a certain period of time; for instance, if the temperature during the night time comes down to 40°, and the shutters *a a′* are opened the cold air descends into the building and replaces the warm air contained therein, and if the shutters *a a′* are closed as soon as the temperature of the external atmosphere rises much above the minimum temperature, the interior of the building is cooled off and remains cool throughout the day, provided the walls are properly filled in with a non-conductor.

From these remarks it will be seen that as long as the temperature of the external air sinks down low enough for my purposes during any portion of the twenty-four hours of the day, I am enabled to keep the interior of my building cool without the aid of ice; but during the hot season, or whenever the temperature of the outside atmosphere does not sink down low enough for my purposes, I draw the cold air required for the ventilation of my building from the ice-chamber H. The ice-chamber is surrounded by the air-spaces O P, which communicate with each other through apertures *i*, which can be opened or closed by suitable dampers. If these air-spaces are open the air which is conducted to the air-space P chiefly through the flues Q′, and which is pure and as cool as it can be obtained from the external atmosphere, passes from said air-space P into the air-space O, the inner side walls of which are made of metal, which is in direct contact with the ice in the ice-chamber. On reaching the space O, therefore, the air is cooled off, and as it sinks down it discharges through the open bottom of said air-space, where it is brought in direct contact with the ice. By these means the ice-chamber is surrounded by a stratum of cold air and the ice is used to the best advantage. The ice rests on an open bottom, C, and the space U beneath the air-space P communicates with the ice-chamber through a grate, *j*, and it also communicates with the compartments J, K, and L by double flues S* S′*, T* T′*, and R* R′*, (see Fig. 1,) these flues being constructed like flues S S′ R R′, already described. The air which is cooled by direct contact with the ice passes down through the open bottom C into the compartment I, from which extend double flues V V′ W W′ X X′ into the lower compartments J K L. The floor D, which separates the compartments J from the compartments I, is filled with some non-conducting material to prevent condensation of moisture on the under surface of this floor, and this arrangement is of particular value if the compartment J is used as a fermenting-cellar. In this case the carbonic acid which rises from the fermenting-liquid must be carried off, and if said carbonic acid, which rises up while it is warm, should be permitted to come in contact with a cold surface in striking the partition or ceiling D, it would cool off and sink down immediately, and the compartment J would soon fill up with foul air, which, on account of its large specific gravity, would not be displaced by atmospheric air. The flues V V′, W W′, and X X′, are by preference made round, (see Fig. 4,) and they are divided by partitions *q* in four sections, two of which are lower than the others. The cold air from the compartment I descends through the short sections V′ W′ X′, and as it displaces the warm air in the compartments J K L this warm air rises through the high sections V, W, and X, whence it discharges into the compartment I, to be cooled and returned again to the compartments beneath. That portion of the air, however, which is very light escapes from the compartment I through the flues R into the air-space P, and is partially returned through the flues R′, partially carried into the inner air-space O, and partially allowed to escape through the flues Q into the compartment G. The double flues V V′, W W′, and X X′ are protected on their top by hoods *k*, so that the drip-water discharging through the open bottom of the ice-chamber cannot pass down into said air-flues. On the bottom ends of the air-flues V V′ W W′ X X′ are placed dampers *l*, which are dishing, (see Fig. 3,) so that any moisture which may drip down from the flues will collect in them, and they are secured to guide-rods *n*, which move in suitable sockets in the partition-walls of the flues, and which connect by a rope or chain, *o*, with a weight, *m*. This weight overbalances the damper, and in the guide-rod are several holes to receive a stop-pin, by means of which the damper is adjusted in the desired position. From the compartment J rises a flue, Z, up through the roof of the building, and its top end is divided off in two compartments, *v v′*, which communicate with upper and lower shutters *p p′*, respectively. By this arrangement a draft is produced in said flue, and the foul air from the compartment J can be carried out in the open atmosphere. The floor B, which forms the top of the ice-chamber H, is filled in with some non-conducting material, and in this floor is situated a series of flues, *r*, which communicate with escape-flues Q, so that the moist air which accumulates in the top of the ice-chamber is free to escape, and that no condensation takes place on the ceiling of the ice-chamber. A door, *s*, gives access to the ice-chamber, and by opening this door an increased quantity of air may be brought in contact with the ice. The inner wall of the air-space O is provided with apertures *t*, near the ceiling of the ice-chamber. These apertures form escapes for the moist or foul air which may find its way into said air-space, and this moist and foul air passes off through the flues *r*.

It will be noticed from this description that the effect of my refrigerator-building is based on the fact that the cold air, on account of its greater specific gravity, will displace the warm air, and that by these means an automatic ventilation can be produced in the interior of

the building, whereby not only the temperature is lowered and the waste of ice is prevented, but also the condensation of moisture in any part of the building is prevented.

My experience shows conclusively that by ventilating the ice-chamber in the manner above described the ice is used to much better advantage than it is if said chamber is shut off from all access to dry external air, as heretofore practiced.

The drip-water from the ice-chamber collects on the floor D, and the moist air contained in the apartment I above this floor escapes through apertures *u* in inside flues *w*, through which it is carried into the air-spaces P and U.

When my refrigerator-building is used in breweries, where the compartment J forms the fermenting-cellar, the supply of pure atmospheric air is of particular advantage. The liquid requires, for its fermentation, a certain quantity of oxygen, which is supplied from the atmospheric air, and as long as the proper quantity of air is supplied and the temperature in the fermenting-cellar is kept at the proper temperature the fermentation progresses regularly; but if the fermenting-cellar is allowed to fill with carbonic-acid and with nitrogen gas, (resulting from the atmospheric air deprived of its oxygen,) the fermentation will be interrupted and the liquid is spoiled. By my method of ventilation no such interruption can take place, and a perfect fermentation can be effected during the hot season as well as during the cold season.

My system of ventilation is applicable not only to refrigerator-buildings, but also to ordinary ice-boxes of any size, and it is obvious that the refrigerator-buildings can be made of any desirable material—wood, stone, or iron—and the walls may be filled in with cement or any other suitable non-conducting material.

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

1. The ventilated dome, partitioned to form separate flues, which communicate with the building, and with shutters arranged at different heights in the dome to produce air-currents, as and for the purposes specified.

2. In combination with the air-spaces surrounding the ice-chamber, the flues Q Q′, for allowing the warm air to ascend and the cold air to descend, the cold air serving to displace the warm air, substantially as and for the purpose set forth.

3. The combination of the flues Q Q′, air-space P, and flues R R′ S S′, with or without flues T T′ J$^{\times}$ J$^{\times}$, substantially as described, to allow the cold air to descend and to displace the hot air from the several chambers, and ventilating the chambers beneath the ice-floors.

4. The double air-space O P, surrounding the ice-chamber, in combination with one or more flues, R R′ S S′, constructed substantially as described, for the purpose specified.

5. The dishing dampers *l*, with their weights *m* and guide-rods *r*, in combination with the sectional flues V V′, W W′, or X X′, substantially as set forth.

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