D. E. SOMES.

Cooling, Freezing and Heating Apparatus.

No. 69,955. Patented Oct. 15, 1867.

Fig. 1,

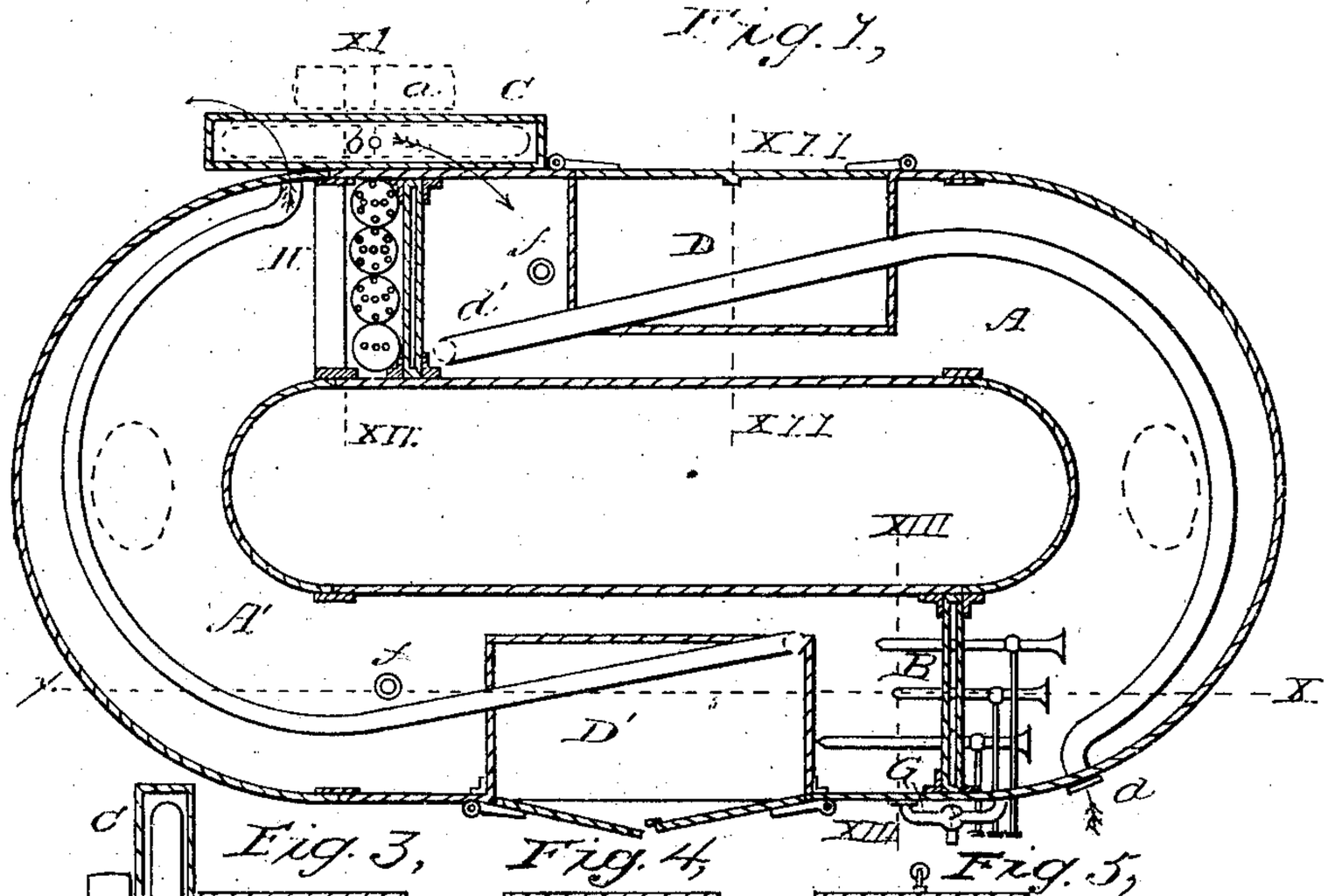

Fig. 3,

Fig. 4,

Fig. 5,

Fig. 2,

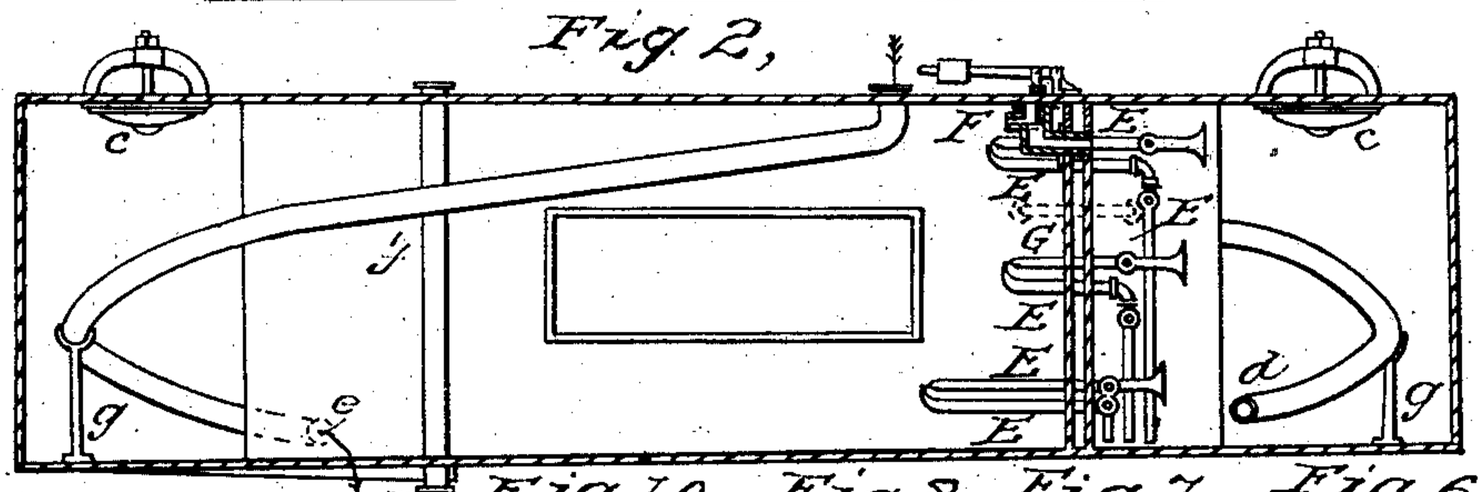

Fig. 9,

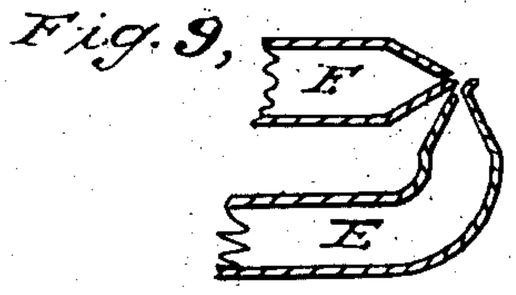

Fig. 10,

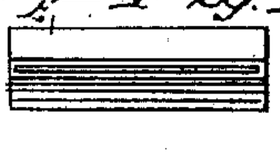

Fig. 8,

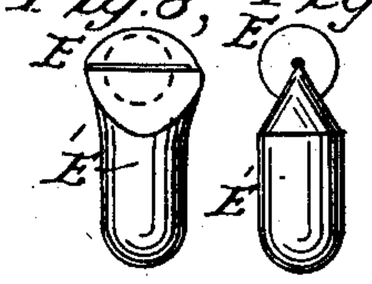

Fig. 7,

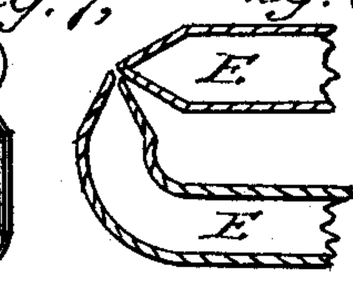

Fig. 6

WITNESSES:
Charles Herron
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D. E. Somes

UNITED STATES PATENT OFFICE.

DANIEL E. SOMES, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVED APPARATUS FOR COOLING, FREEZING, AND HEATING.

Specification forming part of Letters Patent No. **69,955,** dated October 15, 1867.

To all whom it may concern:

Be it known that I, DANIEL E. SOMES, of Washington city, in the county of Washington and District of Columbia, have invented a new and useful Apparatus for Cooling or Freezing and Heating; and I do hereby declare the following to be a full and exact description thereof, reference being had to the annexed drawings, making part of this specification, in which—

Figure 1 is a plan or horizontal section. Fig. 2 is a longitudinal vertical section on the line X X of Fig. 1. Figs. 3, 4, and 5 are vertical transverse sections on the lines, respectively, XI XI, XII XII, and XIII XIII of Fig. 1. The remaining figures show parts in detail, and will be more particularly referred to hereafter.

In all the figures like parts are indicated by the same letters of reference.

A A′ is a tubular chamber, constructed of sheet or plate iron, glass, copper, or other suitable material, of from one-eighth to one-fourth of an inch in thickness. It may be circular, oval, or, as shown in the drawing, rectangular in cross-section, and is composed of two straight sides or lengths, connected by curved or semicircular continuations, while all the joints and connections are firmly bolted or riveted together and calked to render the structure air and steam tight. This chamber is divided into two nearly equal divisions or compartments, A A′, by partitions B B′, each formed of two or more plates, so as to have one or more non-conducting spaces within them. The compartment A is that in which compression of air or gases, or both, and heating, is effected, and A′ is the vacuum-chamber, or the division or compartment in which rarefaction and cooling occurs. In this division are placed suction and force pumps of about three inches diameter of plunger, which are located near the partition B, and are so arranged that they will draw from the bottom of the cooling-division A′, and discharge or force through the partition B into the heating-division A. They are worked by any power applied through the pulley *a*, and are regulated by a fly-wheel revolving within an air-tight case, C, attached to the outside of the chamber A A′, and connected with one of the pumps by a pipe, *b*, through which it is kept exhausted of air, thus permitting the fly-wheel to revolve in a vacuum. The shaft of the fly-wheel, which is also the crank-shaft of the pumps, passes through and revolves in packing-rings, forming its bearings in the sides of the case C. In the straight sides of the divisions A A′ are constructed recesses or cases D D, about three feet long, one foot six inches wide, and one foot deep, extending across from the outside of the chamber, where they are open, to within about six inches of the back or inner side plate of the chamber. Their mouths or openings are closed by tight doors when necessary, as shown in Fig. 1.

Access is obtained to each of the divisions or compartments A A′ through man-holes *c c*, (shown by dotted lines in Fig. 1,) and constructed and closed in the manner ordinarily adopted in steam-boilers.

One or more pipes, from four to six inches diameter, enter the heating-division A of the apparatus, at near the point marked *d*, and, after traversing nearly the entire length of the division, rises through the top plate at *d′*, where it can be joined by another pipe to conduct away its contents. Other and similar pipes descend through the top of the chamber in the cooling-division A′, and, after traversing its length in the same manner as in the heating-division, pass out through the side of the chamber, as at *e*. Other pipes *f f′* may also be introduced, passing vertically through the different compartments of the apparatus, having flanges or other means of connection with continuations. The pipes *d d′ e* are supported on crutches *g g* in such a manner that expansion and contraction may take place without straining them. Smaller pipes E pass from the heating-compartment, where their ends are belled, as shown in the drawing, through the partition B′, into the vacuum or cooling compartment A′, where they terminate each in a minute aperture, giving a horizontal direction to whatever of fluids or gases may be ejected therefrom. (See Figs. 6 and 7, showing section and end view.) The end of the pipe may terminate in a slit produced by flattening the end, as shown in Fig. 8; or the pipes, instead of being round or cylindrical, may be square or oblong in section, and have the terminal opening a narrow slit as long as the width of the pipe.

Whatever may be the shape of the pipes E, they will each be mated by another pipe, E′, of the same shape, rising from quite near the floor of the heating-compartment A, where they are open, to near the under side of the pipes E, when they turn, and also pass through the partition B′ parallel with the pipes E into the vacuum-chamber A′, where they turn up and terminate in openings similar in all respects to those of the pipes E, except that their jets will be vertical instead of horizontal. The orifices of each pair of pipes, thus constituting an atomizer, are so near together that their jets will impinge against each other, and produce a lateral spreading of the fluid or gas, or whatever may be ejected through them. Each of the pipes E E′ is provided with a stop-cock, *h*, the stems of which pass through stuffing-boxes in the side of the chamber A to the outside, where they can be operated. The pipes E′ may have a lip projecting from one side of the terminal opening, in such a manner as to intercept the jet and cause it to spread in spray when it may be deemed expedient to dispense with the use of the pipe E, and it is closed by its stop-cock. A pipe perforated with a number of minute holes may extend from the division A into the division A′ as far as may be desired, so that jets of spray may be thrown in the chamber A for its whole length, if necessary. A safety valve-chamber, F, is placed in the cooling-compartment, which connects by its openings both divisions A A′. The valve-stem rises through a stuffing-box in the top plate of the chamber, and is attached to a weighted lever on the top of the chamber in the ordinary manner. When the weight of the "pea" is overcome by pressure on the under side of the valve from the heating-division, the escape will be into the cooling-division. Another pipe, G, (see Fig. 1, and dotted lines, Fig. 2,) connecting the heating and cooling divisions, but passing from one to the other on the outside of the walls of the apparatus, is furnished with a branch, G′, terminating in the open air, and is provided with a stop-cock, *i*, so constructed that communication between the two divisions may be closed or opened, and either or both divisions allowed to communicate with the external air through the branch G′. The floor or bottom of the vacuum-chamber has a regular fall from the partition B′ to the pumps near the partition B. At this point a shallow depression or well, H, will be made still lower in the floor, from which the pumps that are to force liquids will draw them as they collect after falling on the floor of this division from ejection by the pipes E′, or their equivalents.

The top, bottom, and sides of the apparatus may, if necessary, be constructed of two or more walls, so as to have one or more spaces between them, which may be filled wholly or in part with frigorific compounds, or have nothing but an air-space as a surrounding non-conductor to preserve the temperature within the chambers A A′ from being affected by the outside air. The apparatus may also be lined throughout in both chambers by any material that will resist the action of acids, and protect the iron plates of the structure from corrosion. Among the most effective agents to this end may be enumerated copper, tin, fire-brick, tile, soap-stone, wood, cork, glass, porcelain, and enamel.

In the operation of my apparatus such volatile cooling agents as ether, ammonia, hydrocarbon, alcohol, carbonic acid, chloroform, and the like, benzine, naphtha, petroleum, or their equivalents, are placed, either singly or in combination, or combined with other agents and compounds to be hereinafter named, in the vacuum-chamber, and are forced by one or more of the pumps through the partition B into the heating-division A, while at the same time the air in the cooling-division A′ is being exhausted by the other pumps, and being also forced through the partition into the heating-chamber, where it is compressed, so as to produce a considerable degree of warmth.

It may be here remarked that I do not intend to be confined to the use of reciprocating or plunger pumps, but shall adopt rotary or other pumps or forcing-engines or blowers, as the circumstances of the location may require.

The pipes E do not return the air to the vacuum-chamber through the partition B′ as fast as it is forced into the heating-division, owing to the difference in the openings of the pumps and pipes. Pressure is therefore induced upon the liquids which have been forced into the heating-division, and they will rise in the pipes E′, and be ejected upward with great force within the vacuum-division from the minute apertures at their extremities. The jets will be met by horizontal jets of air or gas, or a combination of them, and will be spread laterally in a broad shower of fine spray, which will strike on all sides of the case D′, refrigerating them and whatever they contain to be cooled or frozen, as well as the conduit-pipes *e* and *f*, passing through the division.

The volatile agents, or such of them as are used, will flow back to the pumps, to be used over and over again, thus keeping up the cooling process as long as the pumps are kept going, which will also, by their force, keep up the pressure in the compressing and heating division. The air conducted by the pipes *e* and *f* through the vacuum-chamber becomes condensed by the process of cooling, and consequently heavier, and falls into rooms or chambers below, where it is used for various cooling or refrigerating purposes, such as the manufacture of ice, preserving food and other perishable articles, for cooling liquids, &c.

The following articles or mixtures I place, singly or in combination, or in combination with others hereinbefore named, upon the floor of the vacuum or cooling division of my apparatus, as hereinbefore set forth, when deemed expedient, and in tight chambers surrounding, or extending through, apartments or spaces in

which cooling or freezing is to be effected, or which may be used as reservoirs or collectors of air cooled by my apparatus and preservers of its low temperature: First, nitrate of potash and hydro-chlorate of ammonia with water; second, sulphate of soda and diluted sulphuric acid; third, sulphate of soda, nitrate of potash, diluted nitric acid, and hydro-chlorate of ammonia; fourth, diluted nitric acid and phosphate of soda; fifth, nitrate of ammonia, nitrate of potash, sulphate of soda, and water; sixth, sulphate of soda and muriatic acid; seventh, muriate of ammonia and nitrate of potash with water; eighth, nitrate of ammonia and crystallized carbonate of soda with water or snow; ninth, nitrate of ammonia with water or snow; tenth, phosphate of soda and diluted nitric acid and sulphurous acid; eleventh, muriate of ammonia and salt; twelfth, muriate of ammonia, nitrate of potassa, and common salt with snow; thirteenth, common salt and nitrate of ammonia with snow; fourteenth, muriatic acid and snow; fifteenth, potassa and snow or ice.

The apartments or spaces surrounded by or inclosing the aforementioned chambers should, as well as the chambers, be water-tight to prevent leakage, and such chambers may be alternated with air-spaces, if deemed desirable. The object of this arrangement is to prevent the cold air within the room or vessel from being conducted outward, or the warm air outside from being conducted inward, and also to aid in lowering the temperature within.

In the manufacture of ice these mixtures would be likely to freeze; therefore provision should be made for expansion; but when it is desired to cool air or liquid without reducing the temperature to the freezing-point, such provision will not be necessary.

When the apparatus is used for manufacturing ice on a large scale, or for cooling large buildings, as granaries, hospitals, packing-houses, fruit-houses, chambers or holds of vessels, breweries, hotels, and the like, it should be placed above the rooms to be cooled, when convenient to do so, in order that the air may fall by its own gravity through tubes or channels to the desired points. When such an arrangement is, from local circumstances, impracticable, the cooled air should be sent by force-pumps or blowing-engines, or their equivalents, where it will be required.

Vessels of war and vessels intended for the transportation of tropical fruits, grain, meats, and other kinds of food, may be prepared to keep the air below their decks pure, and at a low temperature, so that articles of a perishable nature may be preserved, and the interior of such vessels be secured against the ravages of such diseases as are favored by high temperatures, by building within them a chamber having multiple walls, roof, and floor, with one or more air-spaces within them, and through which access may be had to the interior of the chamber by means of doors so constructed as to have a space between them, and which may be so arranged as to open together or singly one after the other.

Traps through the roof may also be constructed of double or triple thickness, if necessary, but which, like the doors, should be kept tightly closed when not absolutely required to be open. These air-spaces in the walls of the chamber may, if a very low temperature is desired, be filled with any of the refrigerating or freezing compounds hereinbefore named, or a combination of them, as set forth, for the purpose of preserving the low temperature of the air in the chamber they surround, and protecting it from the influences of the outside air; while the cooling apparatus hereinbefore described may be located above, so that the air cooled by it may fall through pipes or channels to the inclosed chamber near its floor, and the air that is impure pass out through other pipes leading from the upper part of the inclosed chamber. Vessels for the transportation of grain, or such cargo in bulk as would be liable to spoil by the heat generated within itself, should have the chambers or compartments, if there be more than one, so constructed that pipes leading from the surrounding cooling-spaces may extend across them in different directions, having perforations, through which the cooled air may escape among the commodity in the chamber; the cooling apparatus placed above the cargo, or contiguous to it, keeping up the supply of cool air to the surrounding spaces, which may be, or not, supplied with refrigerating compounds as required. The pipes or tubes through which the cooled air is supplied, as well as those which permit the escape of vitiated or impure air, are provided with stop-cocks and registers, or their equivalents, for the regulation of the supply and escape. In some cases it may be expedient to dispense with the cooling and heating apparatus, with its pumps, or their equivalents, hereinbefore described, as, where a very low temperature is not required, the vessel may be so constructed that openings in the sides thereof may admit air to pipes or channels as the vessel rolls in one direction, which may be forced inward and upward, to fall again into the cooling-chamber of the vessel by the action of the water, which will rise in such openings like a piston when the vessel rolls in the other direction; such air being made to pass, on its way to the cooling-chamber, through or around spaces filled with refrigerating articles or compounds, as before set forth. Passenger and hospital ships should have pipes or channels extending from the cooling apparatus above to the cabins, state-rooms, and bays, and passing on their way, if necessary, through or around chambers or inclosed spaces made non-conducting or, by the use of the agents or compounds before named, refrigerating, so that a supply of pure and cool air is constantly given in every part of the ship. The warmth from the heating side of the apparatus may be applied to pro-

ducing rarefaction in the pipes or tubes, through which impure air will rise to be carried off as the cool air flows in; or, in a steam-vessel, the escape pipes or channels may lead into a flue terminating in the chimney, so that the heat therein may induce such rarefaction as will aid the escape. It need hardly be stated that ice for the use of passengers and patients may be manufactured on board, in the cases D of the apparatus, or in the apartments for freezing already herein described, the only additional process being that of preparing sea-water, when the supply of fresh water would not be sufficient, by any of the common and well-known methods of distillation in use on board vessels.

On railways, cars may be used that are built for the special purpose of transporting fruits, meats, milk, and other things that would be liable to spoil in carriages ordinarily used; such car to constitute a refrigerating-chamber, surrounded by air-tight spaces, as hereinbefore set forth, or not, with pipes or channels for supply of cool air and escape of foul, which spaces are to be filled, when necessary, by refrigerating agents or compounds, or act merely as non-conductors between the inside of the car and the external air, as local circumstances may require—the car to be provided with doors having non-conducting or refrigerating spaces in their thickness, as before set forth.

The heating and cooling apparatus before described is to be placed in the same or an adjoining car, and the pumps, forcing-engines, blowers, or equivalents used in compressing and rarefying, operated either by connection with the locomotive or an independent engine attached to such refrigerating-car, or by attachment to the running gear or carriage of the car, and the apparatus to be connected, by pipes or channels, with the inside of, or the spaces surrounding, the car, or both, as and for the purpose hereinbefore set forth.

In hospitals and other buildings containing many apartments the tubes or channels to conduct warm and cold air to the different rooms are to be provided with valves or registers for lowering or raising the temperature, and for graduating it to different degrees in adjacent or consecutive apartments.

The chamber or apartment in which the pumps, blowers, forcing-engines, or their equivalents, are set may communicate with the vacuum-division by an opening, which is to be fitted with a valve so constructed as to permit the flow through it into the vacuum-division of any and all gases or vapors that may accumulate in the pump-room.

Having thus described my invention, what I desire to secure by Letters Patent is—

1. The combination of the vacuum and compressing chambers, or their equivalents, with the pumps or their equivalents.

2. Atomizing-tubes, in combination with a vacuum or partial vacuum.

3. Minute holes through the wall of the vacuum-chamber for the admission of liquid, air, gas, or vapor.

4. Tube with an atomizing lip or projection, in combination with a vacuum or partial vacuum.

5. Closed air-spaces or non-conducting material or refrigerating substance or compounds surrounding a vacuum or partial vacuum.

6. A vacuum-chamber constructed substantially as and for the purpose set forth.

7. A compressing-chamber with atomizing tubes or holes, substantially as and for the purpose set forth.

8. Compressing and vacuum chambers with a safety-valve between, as and for the purpose set forth, and for other purposes.

9. Pipes and cock G, as and for the purpose described.

10. Non-conducting spaces or substances between the compressing and vacuum chambers, substantially as and for the purpose set forth.

11. The cases D, in combination with a compressing-chamber, or with a vacuum or partial-vacuum chamber.

12. Tubes or channels extending through the compressing or vacuum chamber, substantially as and for the purpose set forth.

13. Apartments or vessels constructed, substantially as herein described, to prevent conduction of heat or cold, in connection with apparatus for rarefying or expanding air, gas, or any volatile substance.

14. Chemical substances herein named, or others which may be volatilized, singly or in combination, when used in a vacuum or partial vacuum in the form of mist or spray.

15. Materials for lining the compressing and vacuum chambers, for the purposes set forth.

16. A chamber to contain liquid, air, gas, food, or any substance to be cooled, with channels, tubes, or spaces in, through, or around the same, for passing, forcing, or drawing spray formed by atomizing a liquid or liquids.

In testimony that I claim the above-described apparatus and processes, I have hereunto signed my name this 28th day of September, 1867.

D. E. SOMES.

Witnesses:
CHARLES HERRON,
JNO. D. PATTEN.