

(No Model.)

2 Sheets—Sheet 1.

C. J. H. WOODBURY.

MEANS FOR HEATING AND VENTILATING BUILDINGS.

No. 589,771.

Patented Sept. 7, 1897.

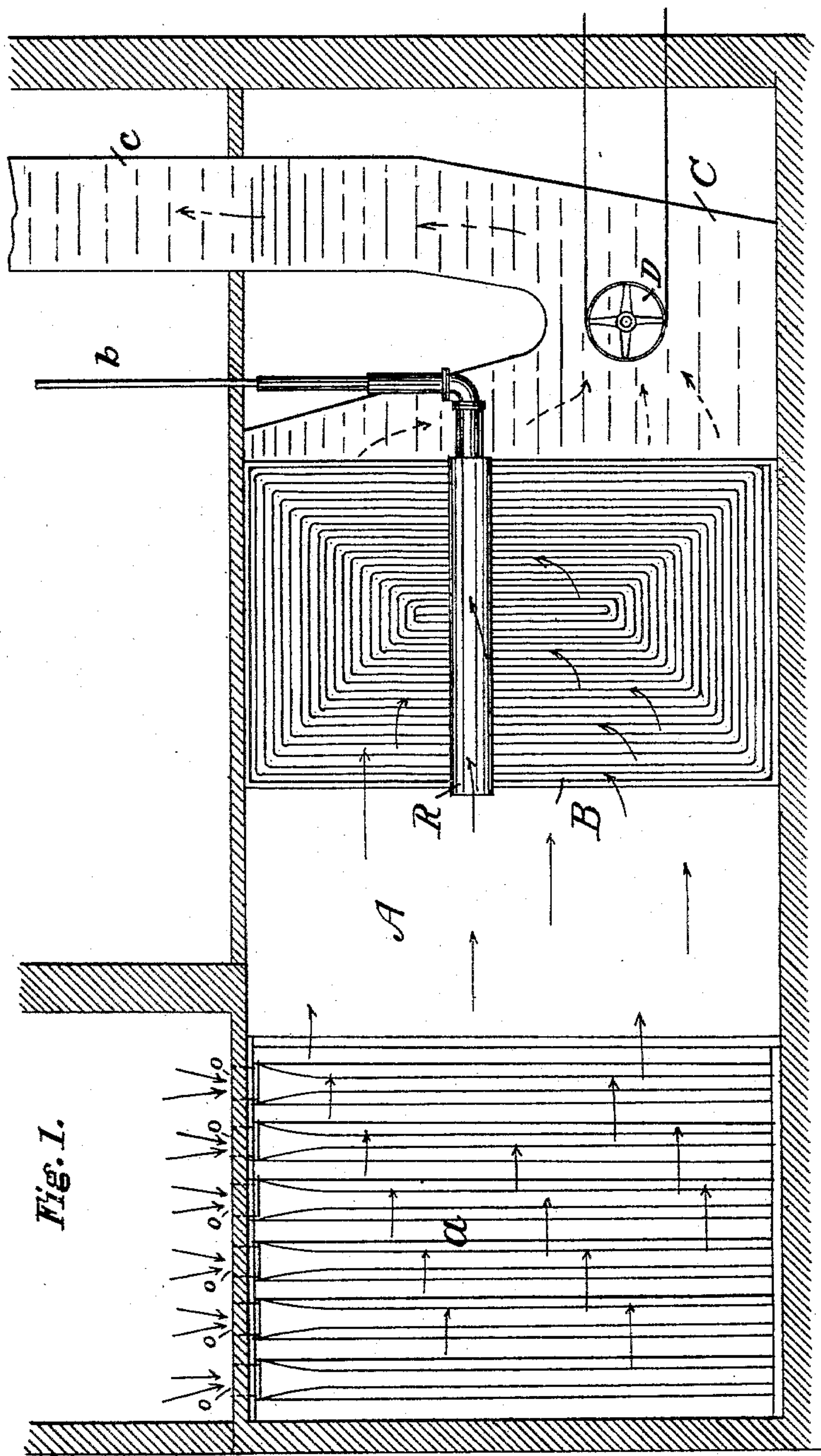


Fig. 1.

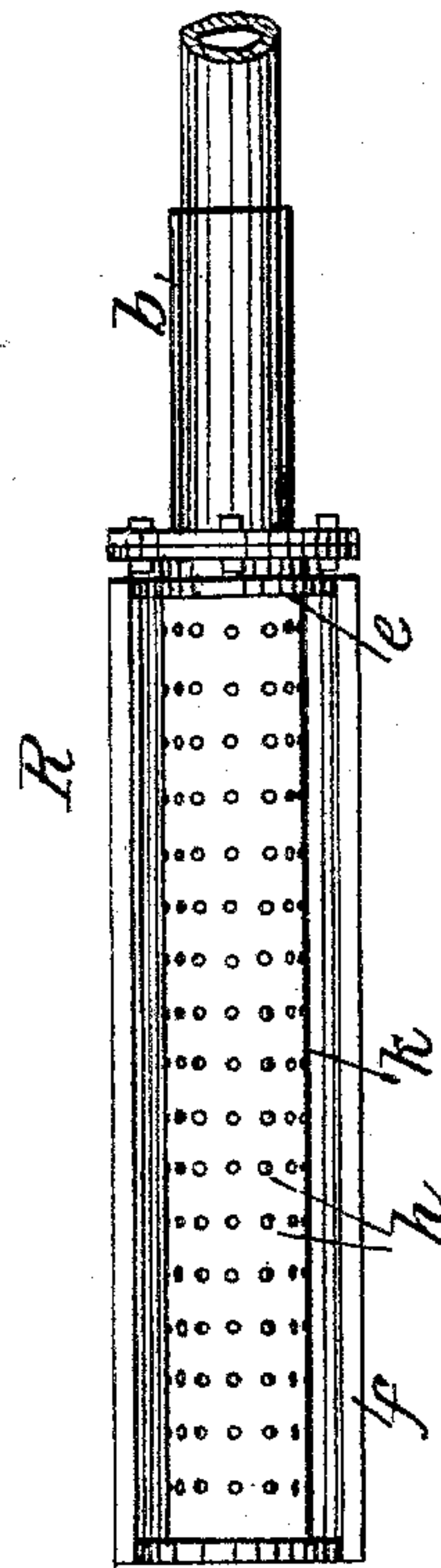


Fig. 2.

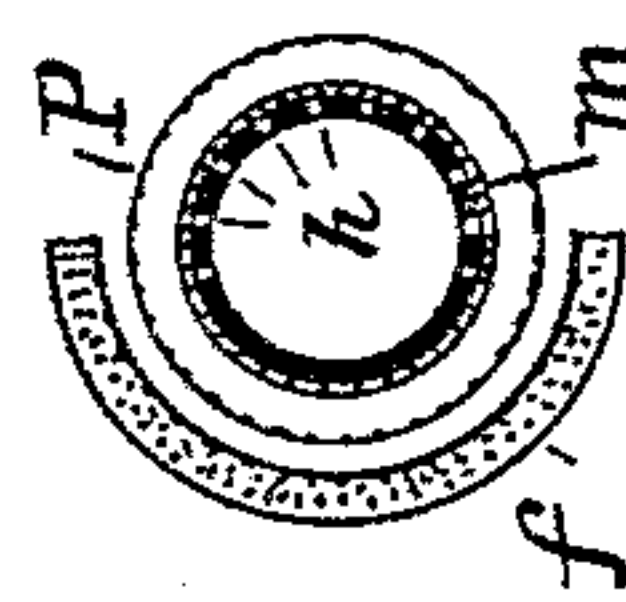


Fig. 4.

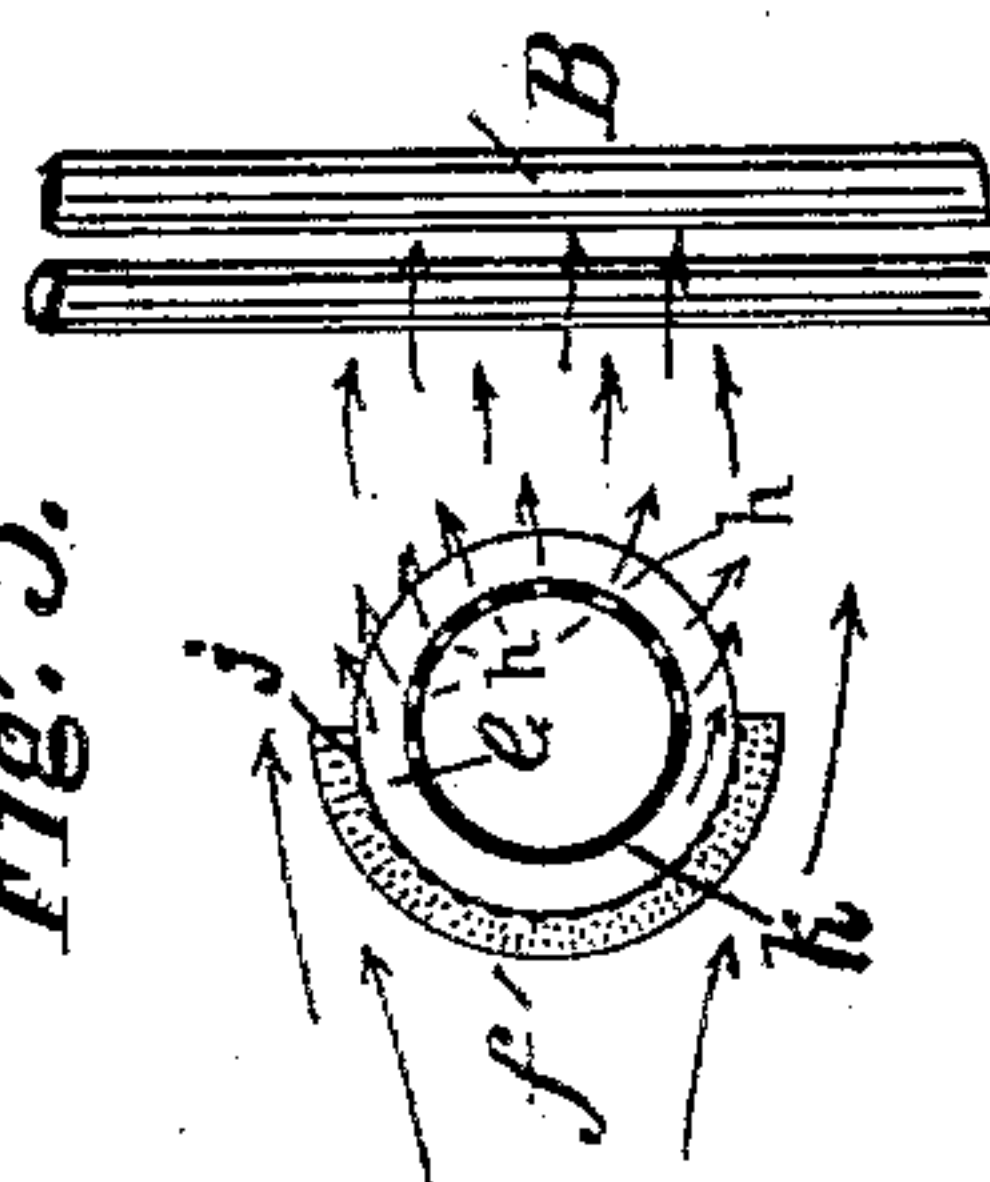


Fig. 3.

Attest.
Joseph A. Gately
George J. Rankin.

Inventor,
Charles J. H. Woodbury
By his attorney Geo. Willis Pierce

UNITED STATES PATENT OFFICE.

CHARLES J. II. WOODBURY, OF LYNN, MASSACHUSETTS.

MEANS FOR HEATING AND VENTILATING BUILDINGS.

SPECIFICATION forming part of Letters Patent No. 589,771, dated September 7, 1897.

Application filed January 28, 1897. Serial No. 620,998. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. II. WOODBURY, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain Improvements in Means for Heating and Ventilating Buildings, of which the following is a specification.

The present invention relates to the heating and ventilation of dwellings, public buildings, halls, &c., by means of heated air, and its special object is to provide means whereby the proper ratio of moisture may be constantly maintained in the air.

It is of course well known that the comfort and healthfulness of the occupants of buildings is materially increased when the artificially-heated air introduced therein has within reasonable limits the same proportion of moisture that is contained in natural air. Ordinarily the heated air in buildings contains a very small percentage of moisture to the cubic foot, and when heated to a summer temperature it is relatively to atmospheric air very dry, and consequently the occupants are rendered uncomfortable by reason of moisture being rapidly evaporated from the skin.

My invention is based upon the fact that the amount of moisture which air can sustain increases very rapidly as the temperature increases; and it consists in the means, substantially as hereinafter described, and pointed out in the claims, for introducing high-pressure steam into the air used for heating and ventilating buildings in what is known as "plenum" system, at a suitable point in the cold-air flue as it approaches the heating-pipes.

The steam is taken from some convenient point, preferably from the induction-pipe which furnishes the supply to the engine which operates the blower employed in the system referred to. The steam passes through a device termed by me a "diffuser," consisting of a single funnel-shaped duct or pipe, or series of pipes, each succeeding pipe of gradually-enlarged diameter, until the area of the cross-section of the smaller end bears approximately the same relation to the area of the cross-section of the larger end that the volume of steam at initial pressure does to

the volume of steam at atmospheric pressure. It is the intention to maintain a uniform velocity of steam from its entrance in the diffuser to its exit therefrom, and this is conveniently done as nearly as may be by employing, preferably, the sizes of pipe in commercial use.

The sides or walls of the last pipe are perforated with a number of holes for the exit of steam which escapes therefrom, and the aggregate area of these holes should be as large as the area of the pipe's cross-section. The object of the perforations, which afford additional enlargement of area for the escape of steam, is twofold, first, that the steam shall not escape at such great velocity as to make annoying noise, and, second, to diminish any tendency to condensation or drip at the point of discharge, where it becomes slightly superheated by the energy of its efflux.

The pipe or pipes forming the diffuser are held in a suitable frame or support and placed in communication with the cold-air flue or with the hot-air shaft, as may be preferred. If in the former place, I may arrange a tube, of thin cotton cloth, around the perforated pipe, and as it becomes distended by the steam readily passing or issuing through the interstices or meshes of the fabric any condensation thereof, as hot water, settles and percolates through the cloth and is drained off.

The diffuser is protected from the direct blast of the cold air by a semicircular shield, in the form of a longitudinal section of half-pipe, made of felt or other non-heat-conducting material, secured to a framework of wire-netting suitably supported.

Of the accompanying drawings, Figure 1 represents a longitudinal section of a plenum system of ventilating and heating in which cold air is drawn into a duct or flue, purified, diffused with steam, heated, and conveyed to the various apartments of a building. Figs. 2 and 3 are respectively a side and a cross section of the steam-diffuser forming a part of the invention. Fig. 4 is a modification of the diffuser. Fig. 5 represents a section on a horizontal line of Fig. 1, taken just below the top wall or ceiling of the horizontal air flue or casing.

A represents the flue, through which the external air is drawn by the blower for the heating and ventilation of the building.

a represents means for filtering or screening external air, and may be of any desired construction.

The means represented at *a* for filtering or screening the air may be of any preferred construction—for instance, such as illustrated in my application, Serial No. 625,716, filed March 2, 1897.

B represents a box or chamber which is an extension of the inlet-flue and contains pipes supplied with steam, among which the air passes and becomes heated and passes by the vertical shaft *c* to the several floors of the building.

D is a blower operated by any suitable means.

b is a steam-pipe connecting with the boiler in the building and to such a part thereof as to take high-pressure steam. The supply-pipe *b* has successive enlargements toward its end and terminates in an enlarged diffuser-pipe *k*, extending across the face of the box of coils B and a short distance therefrom, as shown in Fig. 3.

The pipe *k* constitutes the terminal of the diffuser and is shown in Fig. 2. It is perforated with holes *h*, bored on one side thereof, to discharge the steam in the direction of the air-current, and the aggregate area of the perforations in the diffuser is as large as the area of the cross-section thereof. A uniform velocity of steam is maintained through the feed-pipe from its entrance into the diffuser until its exit therefrom, and the cross-sectional area of the first section of the pipe bears approximately the same relation to the area of the larger end that the volume of steam at initial pressure does to the volume of steam at atmospheric pressure, and this increase in the diameter of the pipe is made by successive enlargements. An increase in the velocity of the steam as it expands is prevented by the increasing accommodation for the steam afforded by the described construction of the pipe.

f is a shield or hood having a base *j*, of wire-netting, over which is bent a thick covering of felt. The shield is secured at each end to wooden rings *e e*, which embrace the diffuser *k* and on the outer side from the heat-coil.

In the operation of the apparatus, the blower being rotated, air is sucked into the openings *o o* of the flue and passes between the pipes of the heat-coil B and up the shaft *c* to the rooms of the building. Dry steam escapes from the diffuser R and mingling with the air is taken into suspension and passes therewith into the shaft *c*. The shield *f* protects the diffuser and prevents it and the steam from being suddenly cooled by the cold air which is rushing toward the heat-coil and, being of felt or other non-conducting material, does not convey the cold to the surface of the diffuser, but acts to insulate the same.

The amount of moisture diffused into the air may be regulated by a throttle-valve in the feed-pipe to the diffuser, and the quantity of moisture may be determined either by the comfort of the occupants of the building in a manner comparable to that in which they would determine upon the most comfortable temperature, or the relative humidity of the air in the rooms may be regulated with precision by means of a wet and dry bulb hygrometer inserted in the heating-pipe C. Owing to the necessarily greater temperature in the heating-flue than in the rooms the standard to be maintained is that of the temperature of the dew-point. For example, if it was desired that the temperature of the rooms should be 70° Fahrenheit and the relative humidity fifty-five (55) per cent. of saturation, this would require a dew-point of 53°. On account of radiation it would be necessary to heat the air in the flue C to a temperature greater than 70°. Assume that it was 90°, then to furnish a dew-point of 53° in a temperature of 90° the wet-bulb thermometer should stand at 67°. The conditions of humidity can be changed to meet this condition by allowing a greater or less quantity of steam to pass into the diffuser by giving more or less opening to the throttle-valve to the diffuser.

The readings of wet and dry bulbs of hygrometers can be obtained from any of the published tables on the subject, and I have extracted from these tables portions applying to the conditions met with in heating buildings, simplifying the methods of management, so that the apparatus is controlled by those in charge of the heating and ventilating system.

Fig. 4 shows a cross-section of a modification of the diffuser in which a cylinder P, composed of a frame of wire-netting covered with cotton cloth, is supported around the pipe *f*. It is larger in diameter than *f*, and is for the purpose of preventing any loud hissing or roaring noises which are sometimes made by the escaping steam. The steam finds its way through the cotton cloth easily and noiselessly.

The diffuser-pipes are preferably covered by non-conducting material *m* on the side in which there are no perforations and may be entirely covered and the perforations extend through them.

Having now described the invention, I claim—

1. In a heating and ventilating system, an air-duct containing a heating-coil, and a steam-diffuser consisting of a perforated pipe in front of said coil and provided with a protecting and insulating shield or hood, on the side away from the coil, to prevent access of cold air to that side of the pipe, as set forth.

2. In a plenum system for heating and ventilating buildings, an air-duct containing means for screening or straining external air, a box of heating-coils, a blower, and a steam-diffuser in front of said coils provided on its

outer face with a protecting and insulating shield, as set forth.

3. The combination in a heating and ventilation system of a box of heat-coils; with a
5 steam-diffuser consisting of a perforated pipe in front of said coils having a protecting and insulating shield or hood of felt attached thereto, as set forth.

4. In a plenum system for heating and ven-
10 tilating buildings means for screening or straining external air, a box of heating-coils connected to a heat-shaft inclosing a blower,

a steam-diffuser in front of said coils provided on its outer face with a protecting and insulating shield, as set forth.

In testimony whereof I have signed my
name to this specification, in the presence of
two subscribing witnesses, this 25th day of
January, 1897. ¹⁵

CHARLES J. H. WOODBURY.

Witnesses:

JEFFRIES WYMAN,

BERNARD W. TRAFFORD.