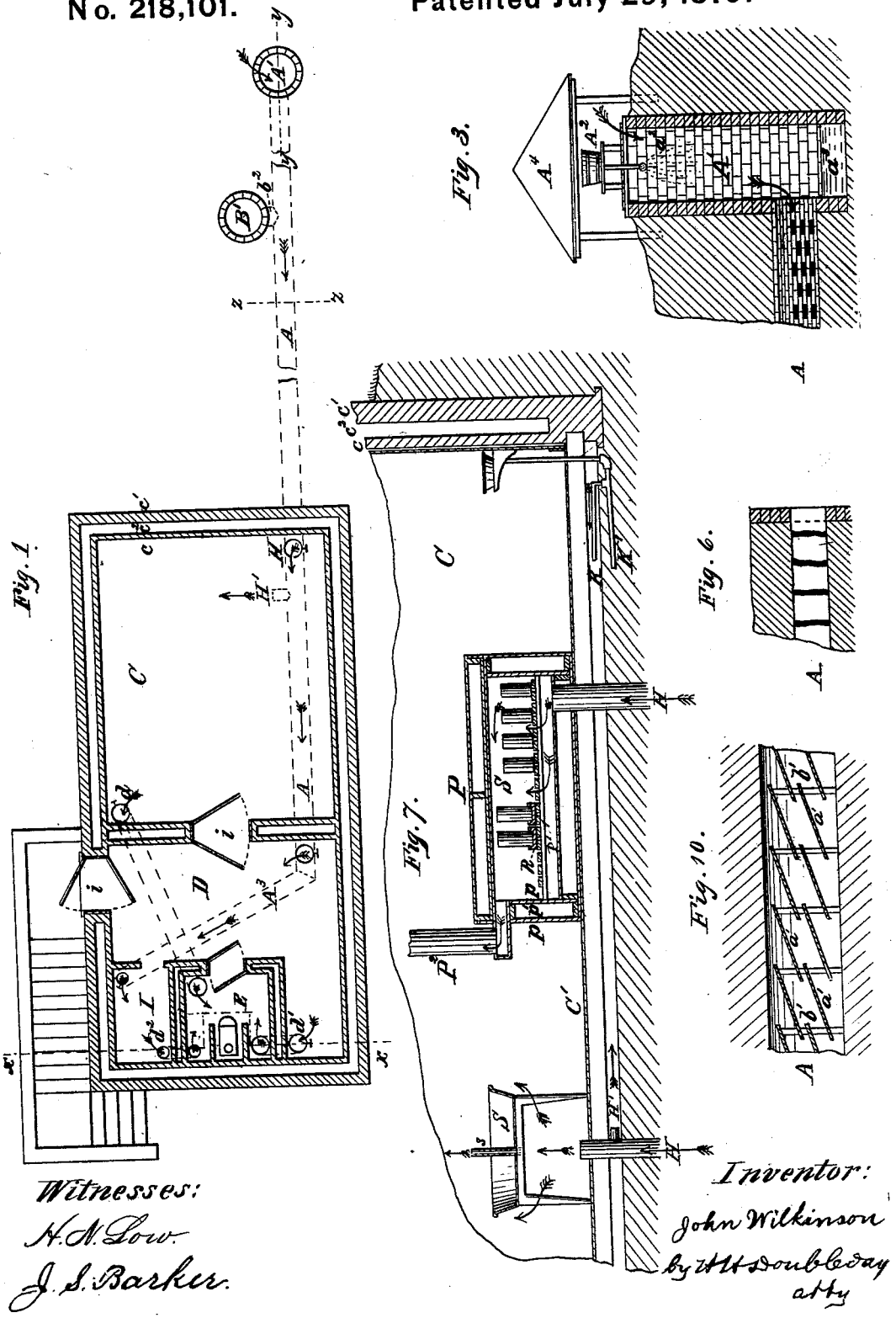
2 Sheets—Sheet 1.

J. WILKINSON.

Tempering and Purifying Air and Ventilating Structures.

No. 218,101. Patented July 29, 1879.



Witnesses:
N. M. Low.
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Inventor:
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2 Sheets—Sheet 2.

J. WILKINSON.

Tempering and Purifying Air and Ventilating Structures

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Fig. 2.

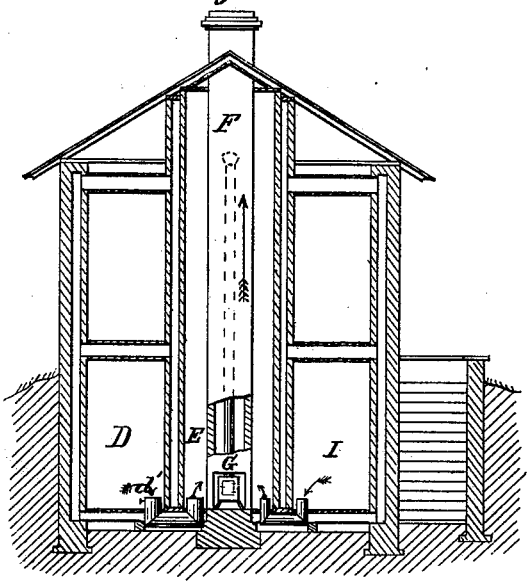


Fig. 3.

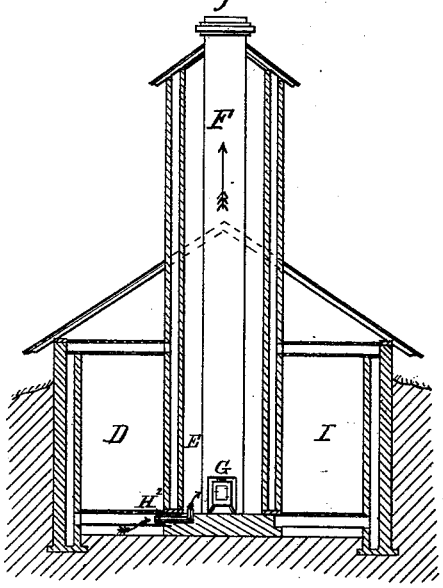


Fig. 4.

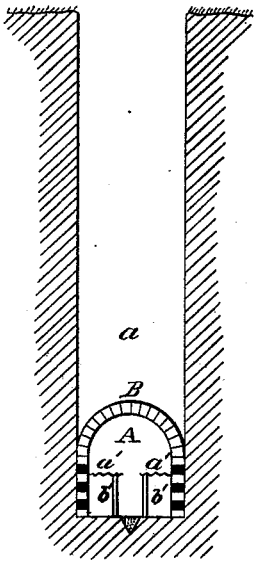


Fig. 5.

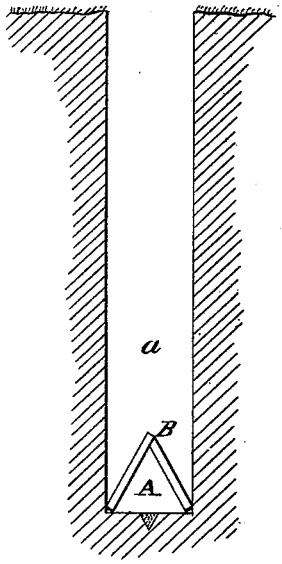
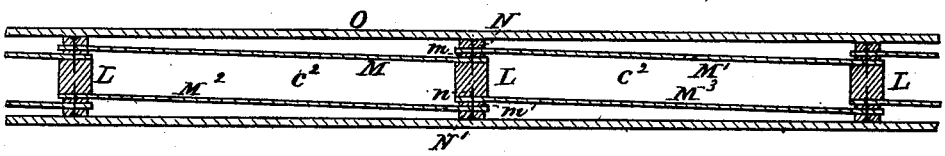


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN WILKINSON, OF HARVARD, ILLINOIS.

IMPROVEMENT IN TEMPERING AND PURIFYING AIR AND VENTILATING STRUCTURES.

Specification forming part of Letters Patent No. **218,101**, dated July 29, 1879; application filed April 7, 1879.

To all whom it may concern:

Be it known that I, JOHN WILKINSON, of the village of Harvard, McHenry county, and State of Illinois, have invented certain new and useful Improvements for Tempering and Purifying Air and for Ventilating Structures of any dimensions or capacity; and I do hereby declare that the following is a clear, full, and exact description thereof, which will enable others skilled in the art to which my invention appertains to make and use the same, reference being had to the accompanying drawings, and to the reference-letters marked thereon, which form a part of this specification.

One part of this invention relates to an improved method for supplying buildings with air of a uniform temperature.

Between the thirty-eighth and forty-fourth degrees of north latitude the temperature of the earth at a depth of from twelve to fourteen feet is uniformly about 50° Fahrenheit throughout the year, and if air from above the surface be transmitted through the earth at that depth it will acquire this temperature. The distance from the surface at which this uniformity begins varies with the latitude of each locality. I have found by experiment that in central Mississippi the distance is from fifteen to twenty feet from the surface. If, at the depth of uniform temperature, a duct be formed through the earth, communicating at one end with the outside air, and at the other with an apartment or building, the air will be drawn into the duct, and, after acquiring the temperature of the surrounding earth, it will be transmitted with said temperature from the duct to the apartment or building.

I have shown how these facts, broadly considered, may be made available for purposes of ventilation in Letters Patent No. 159,055, granted to me; but in the construction thereby patented I employed two ducts, one inclined upward and the other downward relatively to the building to be ventilated, in which case gravitation is depended on to produce a circulation in one direction or the other, according as the outside air is of a higher or lower temperature than the earth; but in the construction hereinafter set forth I employ but a single duct, which may be horizontal, or somewhat inclined upwardly or downwardly, and with which I combine devices adapted to exhaust the air from the building that communicates with the duct. These exhausting devices consist of a shaft or chimney communicating with the apartment to be ventilated, and appliances adapted to expel the air from said shaft or chimney. This shaft or chimney may be located in the apartment to be ventilated, or, when connecting-flues are employed, it may be placed in a contiguous apartment, or even one quite remote. When it is placed in another apartment the exhaust-flues, which connect the ventilated rooms and the chimney, should be as spacious, close, and direct as possible, and should discharge into the chimney, or into a room that I call the "stove-room," which incloses the chimney. The air in this room, which is in direct communication with the exhaust-chimney, should be entirely insulated from air in neighboring apartments and from the outside air, and upon this thorough insulation depends the excellence of the ventilation.

In order to thoroughly insulate a building or apartment I construct it so that it shall be surrounded with spacious and perfectly close chambers of confined air, which are constructed as follows: I place a sheathing of concrete felt within and without the frame of the building or apartment under the siding and under or back of the lath and plastering, when the latter are used. This substance I have found to be a poor conductor of heat, practically water-proof, and air-tight under ordinary circumstances, and, moreover, very cheap. This insulated room opens into, or is in direct communication with, a chimney, which is provided with a stove to heat and expel the air. The air passes into the insulated exhaust-room from the apartments to be ventilated through connecting-ducts. As the air is being exhausted by the devices described it is replaced by air which is caused to enter the building or apartment through a subterranean duct, located on a line below solar influence.

The supply-duct is constructed by first digging a trench of the length and depth required

for the duct, then building on the bottom an arch with brick, tiles, or other suitable materials, and afterward filling the trench with earth.

At the outer end the duct communicates with a shaft, through which the air enters from above the surface, and at the inner end it communicates by suitable pipes with the various apartments to be ventilated. This duct should be sufficiently long to temper the air that is transmitted to the required degree; and in order to have perfect control of the temperature of the air, I provide the supply-duct with several ingress-shafts at different distances from the building to be ventilated, which may be closed or opened interchangeably, and thus the air may be submitted to a longer or shorter tempering action by the earth.

The duct should be of sufficient inner diameter to permit the passage of a man when it is necessary to clean or repair it.

Another part of this invention relates to an improved method of supplying a building or apartment with anhydrated air, and devices for regulating the amount of moisture which the air may bring into such compartment. It consists in providing the building to be supplied with air with an underground supply-duct, through which the air is transmitted, and which is so constructed that the walls condense the moisture carried by the air.

For many purposes it is desirable, and even necessary, that the air supplied to an apartment should have all the moisture removed from it, as in apartments used for drying and similar purposes; but on the other hand it is necessary sometimes that the air supplied should retain some moisture, and also that there should be means of controlling and regulating the amount of moisture in the air that enters an apartment. This latter I attain by providing the supply-duct with several ingress-shafts unequally distant from the exit, whereby the air can be subjected to the anhydrating action a longer or shorter time at will.

The duct is constructed as hereinbefore described; and in order to permit the escape of the condensed moisture, I form in the bottom of the main trench a small supplementary one, and fill it with a hard granular substance, preferably gravel, adapted to receive and remove the water.

Another part of this invention relates to an improved method of disinfecting the air which is supplied to an apartment, and freeing it from deleterious gases and other noxious matter. To this end it consists in constructing the sub-earth supply-duct so that its walls shall consist as much as possible of the natural earth, and in constructing within the duct a series of peculiar shelves or supports, adapted to hold a large amount of natural soil, and bring it in contact with the air that is transmitted.

The natural earth, by being in direct contact with the air, not only greatly assists in tempering the air, but also exerts a decided antiseptic and disinfecting influence, and, in connection with the moisture that is condensed upon it, removes all germs, motes, pollen, dust, and ozone, which latter, as is now well known, plays a large part in the acidifying and fermenting of milk and other perishable matters. The soil which I have found most suitable for these purposes is clay; and if the soil through which the trench is dug is not sufficiently aluminous, I artificially surface the bottom, the walls, and shelves with clay, though any of the well-known deodorizing, disinfecting, and antiseptic earths may be used for the purpose.

Figure 1 is a horizontal section of a building to which are applied the means of carrying out my improved method of ventilation. Fig. 2 is a vertical section on line *x x* of Fig. 1. Fig. 3 is a vertical section on line *y y*, Fig. 1. Fig. 4 is a transverse vertical section of the trench on line *z z* of Fig. 1. Fig. 5 is a modification of Fig. 4. Fig. 6 is a longitudinal section of the trench shown in Fig. 5. Fig. 7 illustrates devices for applying my system of ventilation to the treatment of milk. Fig. 8 is a vertical section of a one-story building. Fig. 9 is a horizontal section of the insulating-walls. Fig. 10 is a horizontal section through the duct and one of the series of shelves.

In the drawings, A represents the supply-duct. It is formed by making a ditch, *a*, of suitable size and depth, and constructing therein an arch or support, B, capable of withstanding the superincumbent weight of earth. This arch or support may be constructed of stones, tiles, or flags, though I prefer to use bricks. When bricks are used they are placed as is shown in Figs. 3 and 4—that is, in such manner as to prevent the earth from falling in, and yet at the same time allow as much as possible of the surface of the soil to be exposed through the wall. This is accomplished by laying the bricks so that their adjacent ends are not in contact, but are as far apart as can be permitted without weakening the wall, thus forming large interstices throughout the duct. When flags or tiles are used they are placed in two lines, their lower ends resting in the corners of the trench and their opposite ends placed together, forming in cross-section substantially an inverted V, as shown in Figs. 5 and 6. The flags are placed in the respective lines, so as to leave wide spaces or interstices between them, for the purposes above mentioned.

The ditch above the walls or arch is filled up as the duct is formed. (See *a*.) The length of the duct and the depth at which it is placed must be determined by the conditions of its locality—two hundred feet long, more or less, and fourteen feet deep, more or less.

The bottom of the ditch serves as the bottom of the duct, it consisting therefore of earth.

If the soil through which the duct is laid is not sufficiently aluminous or clayey, I place a layer of clay or other suitable absorbent on the bottom and in the interstices of the wall. I attach to the side walls of the duct lines of shelves a^1 a^1, preferably made of corrugated

sheet metal, supported upon removable props b^1 b^1. Upon these shelves I place a layer of clay or other suitable absorbing material, and thus secure an additional disinfecting and deodorizing surface.

The shelves are arranged in various planes so that they cause the air to pursue a circuitous or zigzag course as it passes through the duct, and thus tend to bring a greater number of the particles of the air in contact with the earth.

The air is supplied to the duct by means of a vertical shaft, A^1, sunk to or somewhat below the bottom of the duct. For some purposes it may be desirable to extend the shaft above the surface.

When these devices are used to ventilate hospitals or other similar structures, or are used in a malarious region, the ingress-shaft is supplied with means for purifying the air to a greater degree than can be attained by the action of the earth in the duct.

The air, as it passes down the shaft, is subjected to the action of carbolic acid or other disinfectant by causing the acid to fall through the air in a mist or spray, as shown at a^2. It is collected in a vessel or cistern, a^3, in the bottom of the shaft, and returned by pumping or otherwise to the top, where a suitable reservoir, A^2, is placed for holding and supplying it, Fig. 3; or it may be forced upward from the bottom of the shaft in one or more jets, and when so operated there should be a screen or other device adapted to form a spray or mist placed at a proper point to be impinged upon by the jets. The disinfecting liquid may be used in the duct itself, and be operated by devices substantially similar to those described. A covering or roof, A^4, is placed over the mouth of the shaft.

B′, Fig. 1, represents a supplemental ingress-shaft, similar in structure and operation to shaft A^1, but located nearer the building to be ventilated. It communicates with the supply-duct either directly or by a supplemental duct, b^2. The ingress-shafts are supplied with valves, covers, dampers, or other means of closing them to the passage of the air.

It will be seen that when the shaft B′ is open and shaft A^1 closed, the air that passes through duct A will be subjected to the influence of the duct less than when it enters by shaft A^1, and hence that by means of several ingress-shafts the temperature and humidity of the air supplied can be regulated at will.

Referring to Figs. 1, 2, and 7, C D represent chambers or apartments that are to be ventilated.

In order to thoroughly insulate these apartments, I construct their walls substantially as follows: c represents an inner wall, and c^1 an outer wall, between which are formed air-chambers c^2 c^2. These chambers are made spacious and perfectly tight, and are inclosed by non-conducting materials, the degree of the insulation depending upon these matters.

I have found that the walls ordinarily used for insulating are insufficient, in that they are conductors of heat and are not impervious to air.

Referring to Fig. 9, the frame of an apartment or building is represented by the uprights or studding L L L.

M is a sheet of concrete felt, one side of which is placed against the inside of the stud L. The next sheet, M^1, of felt, is placed so as to overlap the sheet M, and a sheet of elastic felt, m, is inserted between the sheets M and M^1. A batten, N, is then secured by means of nails n driven through the batten and the felt into the stud L. A similar sheathing of felt is formed on the outside of the studs L, as shown, at M^2 M^3 m' N′.

If lath and plastering are used, they are secured upon the inside of the sheathing, as shown at O. Outside of the outer sheathing, M^2 M^3, is placed the weather-boarding or other siding.

The air is exhausted from these apartments through pipes d d^1, which, in the constructions shown in Figs. 1 and 2, pass under the floor and open into an exhaust-room or stove-room, E. The walls of this exhaust-room are constructed in a manner similar to that for the apartments described, so that it shall be perfectly insulated, not only from the air outside, but also from the air of the contiguous apartments, and the thorough insulation of this room and the exhaust-shaft, that communicates with it, is one of the essential requisites of my system of ventilation.

F represents the chimney or exhaust-shaft, which is shown to be built up from and to open into the exhaust-room E, which latter extends upward to the highest point practicable, preferably to the top of the shaft, (see Fig. 8,) so that the shaft shall be insulated as fully as possible.

A stove, G, is placed in the room E, at or near the bottom of chimney F, to heat the air in the chimney and expel it therefrom.

The air thus expelled from the chimney is replaced by air from stove-room E, which in turn is replaced by the air from rooms C and D, drawn through the pipes d d^1.

The air which is withdrawn from these apartments is replaced by air supplied by the subterranean air-duct A through feed-pipe H, the supply-duct extending under the apartments or the building that contains them.

I have shown these parts in the positions relative to each other in which I prefer to place them—that is, the subterranean duct A substantially horizontal, the stove-room E within the building to be ventilated, the exhaust-shaft F extending to the bottom of the lowest apartment, and the exhaust-pipes d d^1 situated beneath the floors; but it will be seen that if the shaft F, room E, and apartments C and D are perfectly insulated in the manner described, the circulation of air will be obtained when the parts are in different positions from those shown—that, is the duct A may be inclined up-

ward or downward, the stove-room E and shaft F may be located in a contiguous apartment or building or one quite remote, on a level with or above or below the apartment to be ventilated, and the pipes $d\,d^1$ may pass above, around, or through intervening apartments.

In Figs. 1 and 2, I represents a closet or store-room. The duct is turned as shown at A^3, to convey air to the closet I, whence it is exhausted, as from the other apartments, by a pipe, d^2.

The doorways $i\,i$ are provided with double doors, to prevent changes of temperature when one is passing through them.

It is well known that there accumulate in the spaces between the surface of the earth and the ground-floors of buildings much mold, deleterious gas, and decay. By the means of ventilating which I have described I am enabled to keep in these spaces a body of fresh, pure air.

H^1, Figs. 1 and 7, is a branch pipe, communicating with the feed-pipe H and with the space beneath the floor C^1. H^2, Fig. 8, is an exhaust-pipe, leading from said space to the stove-room E, or the shaft F, and by these means a constant supply of fresh air may be passed beneath the floors from the duct A to the heated shaft.

In dairies, and buildings for similar purposes, waste-conduits are necessary to carry away the refuse fluids, which generally contain grease, coagulated milk, &c., and in these waste-pipes it has been customary to have traps to prevent the escape of gases and odors; but I have found these traps very objectionable, and I am able to carry off said gases and odors by my improved means of ventilating.

K, Fig. 7, represents a pipe communicating with the waste-pipe K′, and entering beneath the floor to the exhaust-room, (or, preferably, to a considerable height up the exhaust-shaft,) where all objectionable air and odors are discharged.

In applying my means of ventilation to milk-rooms and dairies, where milk is placed for preserving and separating the cream, I deliver the air from the sub-earth duct at or near the floor, and generally directly under each vessel containing the milk, as shown in Fig. 7.

If the vessels S are large, I provide them with central flues, *s*, through which the air can pass, which secures uniform cooling of the milk.

I prefer to place the milk-vessels in an insulated chest, and connect the chest with the air-duct. P represents the insulated chest, constructed with double walls $p\,p$ and intervening air-chambers p'. P^1 is a slotted floor, upon which the milk-vessels are placed, permitting a free circulation of air under, around, and over them. The air is exhausted through a flue, P^2, and is supplied by the pipe H, communicating with the sub-earth duct A.

In order to prevent the cooling of the milk at the bottom of the vessel, I provide it with a non-conducting protector, R, which is so placed as to prevent the withdrawal of the heat from that part of the milk which is contiguous to it. This may be made of any non-conducting material, though I prefer to use a pad of the felt of wool.

Instead of the stove G, any desired or well-known air-exhausting devices may be used to expel the air from the shaft F.

What I claim is—

1. A sub-earth air-duct for supplying air to an apartment, constructed substantially as described, with walls partly or entirely consisting of earth.

2. A sub-earth air-duct constructed with walls having open spaces or interstices, substantially as set forth.

3. A sub-earth air-duct having two or more ingresses, substantially as set forth.

4. A sub-earth air-duct provided with walls of absorbing-earth, substantially as set forth.

5. In combination with an apartment, an insulated exhaust-shaft and a sub-earth air-duct, substantially as set forth.

6. The combination, with a room or building to be ventilated and an exhaust-shaft, of an insulated apartment communicating with the shaft and with the apartment, substantially as set forth.

7. As a means for insulating an apartment or building, the combination, with the inner wall and the outer wall, of sheets of felt M M^2 M^1 M^3, and the elastic strips $m\,m'$ between the overlapping sheets, the whole arranged to form tight chambers C C^2, substantially as set forth.

8. In a sub-earth air-duct, the combination of the shelves $a^1\,a^1$, supported at the one side upon the wall of the duct, and at the other by the props $b^1\,b^1$, adapted to support layers of earth in the path of the air currents, substantially as set forth.

9. The exhaustion of gases from sewer and waste pipes by means of the heated exhaust-shaft, for the reasons and in the manner specified and illustrated.

In testimony that I claim the foregoing I have affixed my signature in the presence of two witnesses.

JOHN WILKINSON.

Witnesses:
M. M. TOWNE,
ARCHIBALD DAVIDSON.