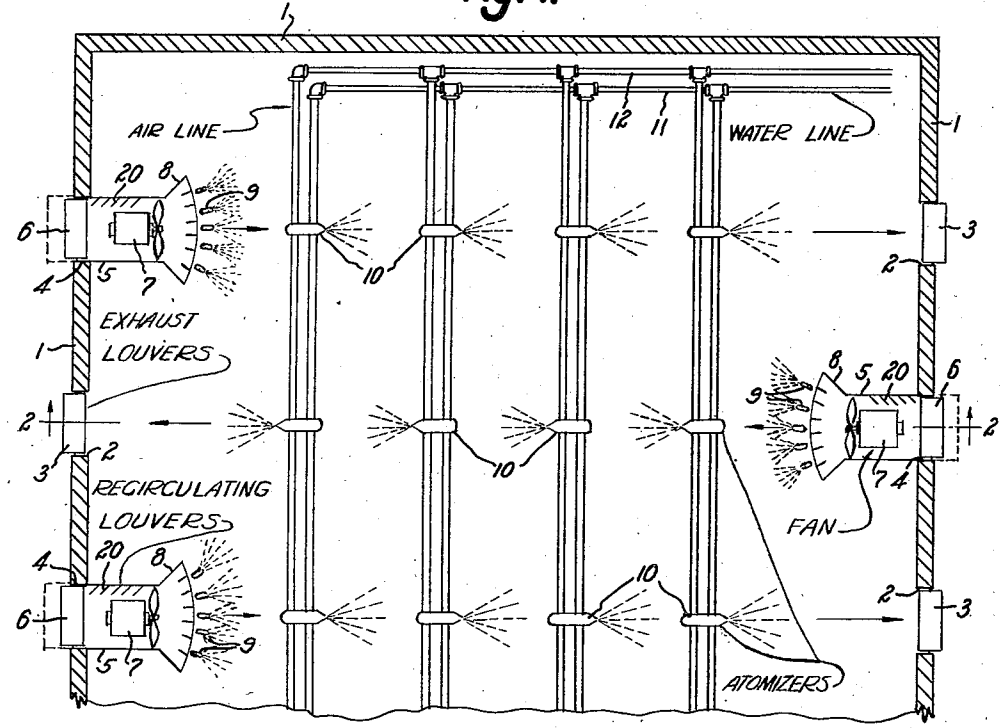
Oct. 5, 1948. A. H. BAHNSON, JR 2,450,571

DUCTLESS SYSTEM

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Fig. 1.



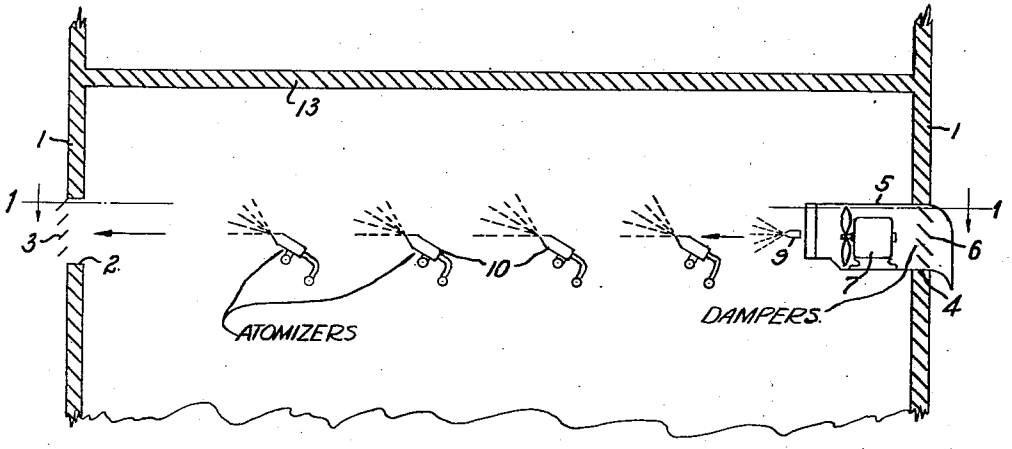


Fig. 2.

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Fig. 3.

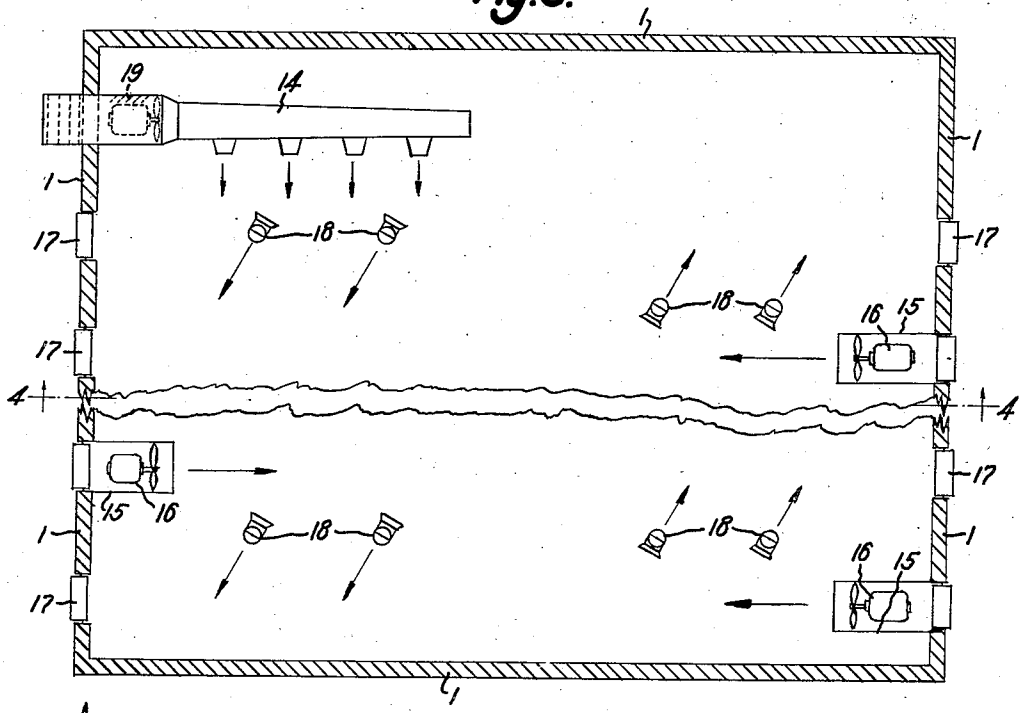


Fig. 4.

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DUCTLESS SYSTEM

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2 Claims. (Cl. 98—30)

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This invention relates to a system of apparatus for ventilating and humidifying the atmosphere of closed spaces or rooms such as textile mill rooms.

As is well known it is desirable in carrying out many factory operations such as those of paper and textile manufacture to maintain the relative humidity of the atmosphere at a predetermined value best suited to the handling of the material. At the same time it is necessary to ventilate the space, that is, to supply fresh air and discharge contaminated air and to control the temperature of the space.

The system most commonly employed in the past for ventilating and humidifying factory rooms is to condition a supply of air with respect to temperature and humidity and bring it into the room and distribute it throughout the room by means of ducts. This system is rather expensive and involves a number of difficulties and disadvantages which are well known.

It has been proposed to ventilate and humidify rooms by a so-called ductless system, that is, by simply bringing fresh air into the room through suitable openings such as the windows by means of blowers or fans and causing the air to circulate in the room and introducing moisture into the air by means of humidifiers at the points of the introduction. The problem of ventilating a room and adjusting the humidity of the atmosphere thereof is not however simply a matter of introducing and discharging the amount of air necessary for securing the desired rate of change and of introducing moisture. There must be a substantially uniform distribution of fresh air and moisture throughout the room. Dead air pockets as well as points of excessive or deficient humidity and strong air currents at the working level must be avoided.

The humidity and temperature of the air introduced into the room may vary considerably. In winter time it must ordinarily be heated and this gives rise to a relatively low humidity requiring the addition of a correspondingly large amount of moisture, the evaporative cooling of which must be taken into account in adjusting the temperature of the room. In summer time the temperature of the air may be and generally is higher than is desired but also its humidity generally is less than desired so that as the humidity is brought up to the desired figure some evaporative cooling may be accomplished. It will be appreciated from the foregoing that in any complete ventilating and humidifying plant means for heating or means for cooling or means

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for both heating and cooling the air will be necessary for year around operation. Such heating and cooling means form no part of my invention which is concerned only with the addition of moisture to the air with incidental cooling thereof due to evaporation of the added water.

In accordance with my invention fresh clean air is brought into the room from an outside source such as the out of doors atmosphere and is passed through the room with the aid of means for atomizing water into the air. The air may be blown into and across the room in a direction to envelop simple atomizers preferably pointed in the general direction of the movement of the air so as to assist its movement or the air may be brought into the room and caused to circulate around the room and humidified by positioning self contained means for atomizing water into a blast of air directed into the path of the circulating air.

A feature of my invention is that the atomizers are distributed about the room at the same level as the current of air which is passed through or circulated in the room, which level is above that of the bulk of the machines and the occupants of the room. In a typical instance the occupants of the room and the bulk of the machinery will occupy say the lower 6 to 10 feet of the height of the room. This is referred to as the working level or zone of the room. The ceiling of the room may be say 15 to 30 feet above the floor. In the event that the ceiling of the room is materially higher than is necessary to provide the working level and a zone immediately above it for the circulation of the humidified air the space may be disregarded as having no bearing upon my invention.

Two examples of my invention are schematically illustrated in the accompanying drawings in which,

Fig. 1 is a fragmentary horizontal sectional plan view on the line 1—1 of Fig. 2 of a room provided with means for passing currents of air across the room and for atomizing water into said currents;

Fig. 2 is a fragmentary vertical sectional elevation on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary horizontal sectional plan on the line 3—3 of Fig. 4 of a room provided with means for circulating air around the room; and

Fig. 4 is a fragmentary vertical sectional elevation on the line 4—4 of Fig. 3.

Referring to the drawings, the side walls 1 of the room are provided with openings or windows 2 fitted with louvers 3. Opposite each opening 2

is an opening or window 4 fitted with a conduit 5 provided with louvers 6 and a fan or blower 7 for drawing a current of air through the louvers 6 and blowing it through the conduit 5 into the room. Conduits 5 may be provided also with louvered openings 20 for drawing air from the room and recirculating it. The inner end of the conduit 5 may be flared at 8 as illustrated to spread the current of air horizontally. In front of each conduit 5 is a row of atomizers 9 all of which discharge their sprays of atomized water into and in the direction of movement of the current of air issuing from the conduit 5. In line with each conduit 5 and the opposite opening 2 is a row of atomizers 10 all pointing in the direction of the current of air. Atomizers 9 and 10 are of the type in which a jet of water, supplied through the water line 11, is atomized and picked up and discharged by a jet of air supplied through the air line 12. Such an atomizer is shown in my U. S. Patent No. 2,311,018. Only a small amount of air is discharged by each atomizer and consequently the tendency of each atomizer to create a current of air is small and might be overcome by the strong current of air created by the fans 7. Consequently the direction of the atomizers 9 and 10 is not critical, that is to say, they might be opposed to the currents of air created by the fans 7 or at right angles or any other angle thereto, but I have found it advantageous to point them generally in the direction of movement of the current of air in which they are located.

Referring to Fig. 2 of the drawing it will be seen that, assuming that the working level of the room is 10 feet high, the air inlet conduits 5, the air outlet openings 2 and the atomizers 9 and 10 are all located at about the 15 foot level and the space between this level and the roof or ceiling is about equal to the space between this level and the working level. As stated above the amount of space above the level of the atomizers is immaterial. In a large factory room there may be a large space, 20 or 30 or more feet high and of flat or pyramidal shape above the level of the atomizers or the roof or ceiling of the room may be flat and only of sufficient height to contain the atomizers above the working level of the room.

As shown in Fig. 2 the atomizers 10 are pointed upwardly at an angle of about 30° to the horizontal but as has been explained above this is not essential since the atomizers have very little effect upon the air currents created by the fans 7.

In the arrangement illustrated in Figs. 1 and 2 it has been assumed that the room is of moderate width say 50 to 75 feet and that the currents of air created by the fans 7 will be sufficiently strong to carry across the room from each inlet 5 to each opposite outlet 2. It is within the scope of my invention however to ventilate a larger room and in the event that the current of air created by each fan will not carry across the room, to have a fan or blower in each outlet 2 directed so as to draw air through the outlet and discharge it outside of the room. It is also within the scope of my invention to interpose additional fans at the same level as the atomizers 10 and in line therewith and directed to assist the movement of air from each inlet 5 to the opposite outlet 2. It is further within the scope of my invention to turn the currents of air created by each fan 7 by means of fans or baffles or both and by a suitable arrangement of outlets so that for instance, a current of air created by a fan might pass across the room and then turn at the opposite wall and pass along one side of the room and pass out of the room through an outlet at the end. Many such arrangements of the air currents will be apparent and need not be illustrated or described in detail. All such arrangements are within the purview of my invention if they embody the essence of my invention as described above which consists in creating a horizontal current of air directly above the working level in the room and atomizing water into said current.

An embodiment of my invention in which the air is circulated in the room and in which its movement is assisted by fans is illustrated in Figs. 3 and 4. In this arrangement the ventilating air is introduced into the room at one end and one side of the room through the duct 14 in a horizontal direction as indicated by the arrows. This duct 14 may of course be replaced by equivalent means for introducing air such as one or more inlets like the ducts 15. Additional air is introduced at points around the room through the louvered ducts 15 by means of fans 16 and air is discharged from the room through louvered outlets 17. Centrifugal atomizers 18 of the type disclosed in U. S. Patent No. 1,966,872 are used to supply atomized water to the air current, each of said atomizers including a fan which is directed in the general direction of the current of air in the room to assist its forward movement. It will be seen that the over all effect of the direction of inlet of the air through the duct 14 and the ducts 15, the movement of air out of the room through the outlets 17 and the direction of the blasts of air created by the fans of the atomizers 18 will be to cause the air to circulate along one side of the room, across the end, back along the other side and back across the other end to the point of beginning. The duct 14 is provided with a louvered opening 19 for drawing air from the room and recirculating it. The ducts 15 also may be similarly provided with recirculating openings (not shown). The apparatus or system shown in Figs. 3 and 4, like that of Figs. 1 and 2 embodies the same feature of creating a current of air, either recirculated or fresh or both, in the room at the level immediately above the working level, regardless of the height of the room and introducing moisture into said current of air. No reservoir of air above the level of said current of air is necessary and if present has no substantial effect on the operation of the system. The ventilation and humidification of the working level results from the intermingling of the air within the working level with the current of air passing overhead, that is to say, there is a constant interchange of air between the current of air and the air in the working level. Some of the air in the current, especially at the lower boundary thereof intermingles with the air in the working level and some of the air in the working level intermingles with the air current and is carried along with it. As a result the air in the working level is constantly renewed and maintained at the desired temperature and humidity without there being created any strong currents of air within the working level, as is the case when the ventilating air is introduced into or withdrawn from or caused to circulate through the working level. The distribution of the means for introducing into and withdrawing air from the room and the distribution of the humidifying means throughout the room with the use of additional means within the room for assisting the movement of the air

such as the humidifiers themselves or fans or both assures an even distribution of the air, an even distribution of moisture and the avoidance of either dead air pockets or excessive movement of the air at localized areas within the room.

The relative proportions of fresh air and recirculated air introduced into the air current and the amount of moisture introduced by the atomizers may be controlled manually or partially or wholly automatically by the use of suitable indicators of temperature, humidity and other characteristics of the air which control the supplies of fresh and recirculated air, moisture, heat or cold, etc. These expedients are not involved in my invention and are therefore not illustrated nor described.

I claim:

1. A system for ventilating and humidifying the atmosphere in a closed space, said space having opposed vertical walls, means in one of said walls immediately above the working zone in said space for introducing a current of air in a horizontal direction toward the opposite wall, means in the opposite wall at the same level for discharging air from said space and means at said level intermediate said walls for atomizing water into said space.

2. A system for ventilating and humidifying the atmosphere in a closed space having parallel vertical walls comprising at least one means in

one wall at the level immediately above the working zone in said space for introducing a current of air in a horizontal direction toward the opposite wall, means in said opposite wall at said level for discharging air from said space, means in said opposite wall at said level for introducing a current of air in a direction parallel to said first current of air and means in said first wall for discharging air from said parallel current, and atomizing means at said level for atomizing water into said parallel currents of air.

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