Nov. 9, 1937. J. McELGIN 2,098,830

APPARATUS FOR THE HEATING OF AIR

Filed Nov. 12, 1935 2 Sheets-Sheet 1

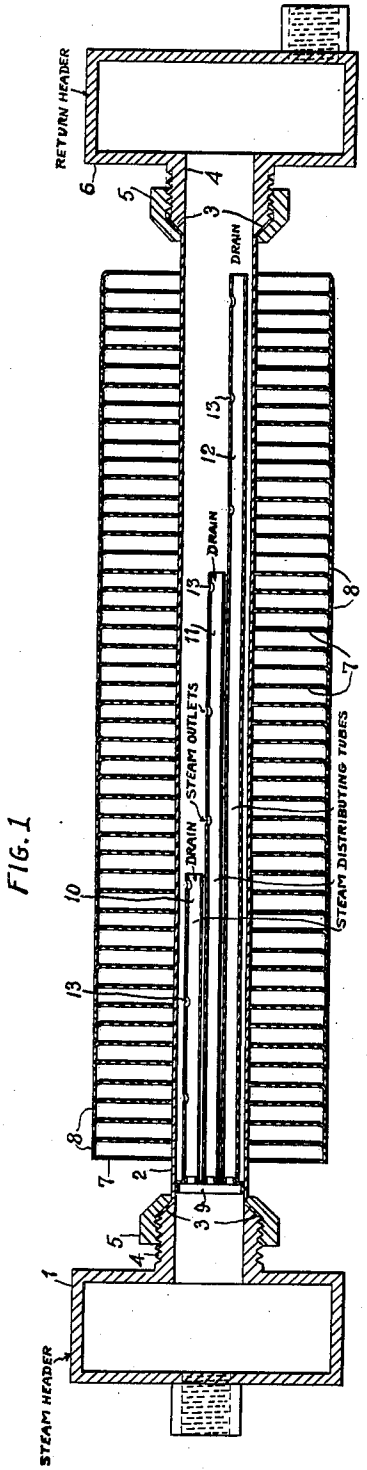


FIG. 1.



FIG. 3.

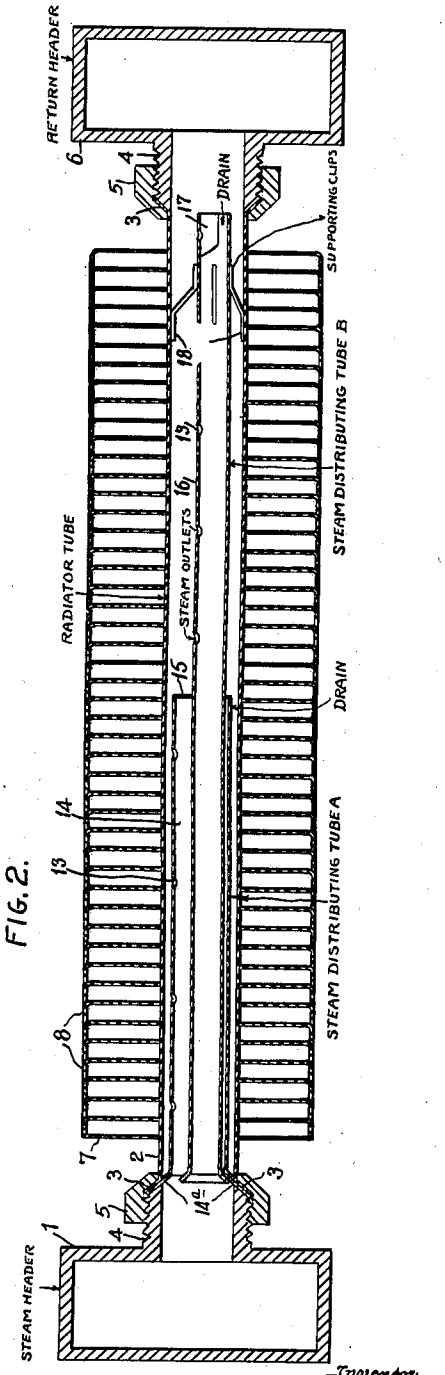


FIG. 2.

Inventor
JOHN McELGIN,
By Touhmin & Touhmin
Attorneys

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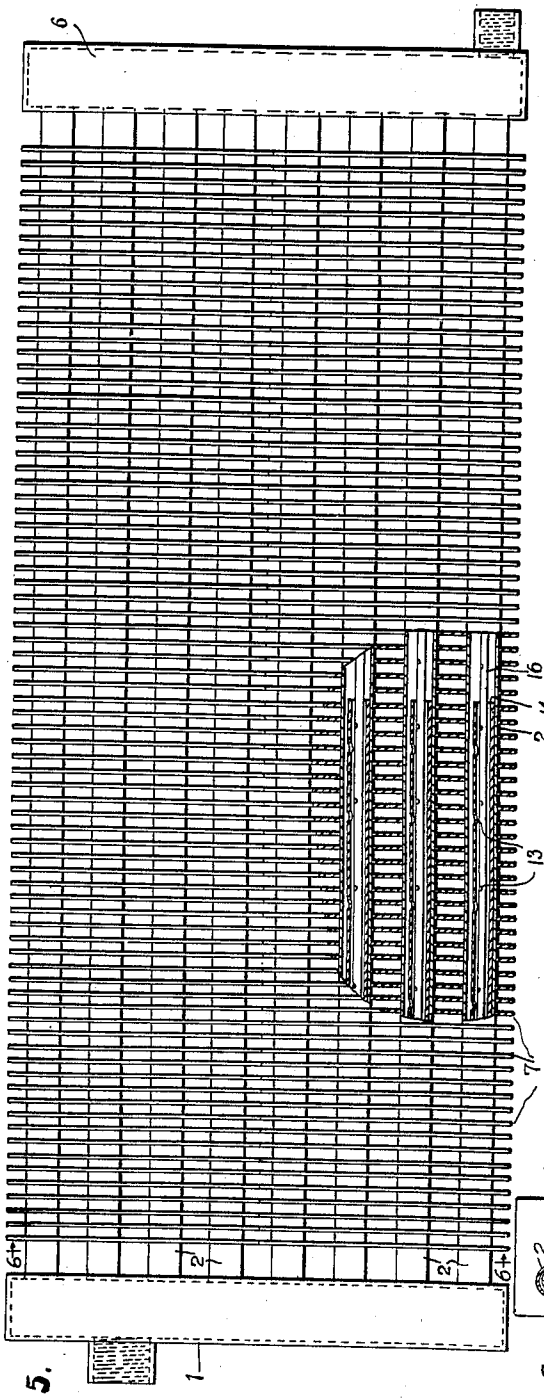


FIG. 5.

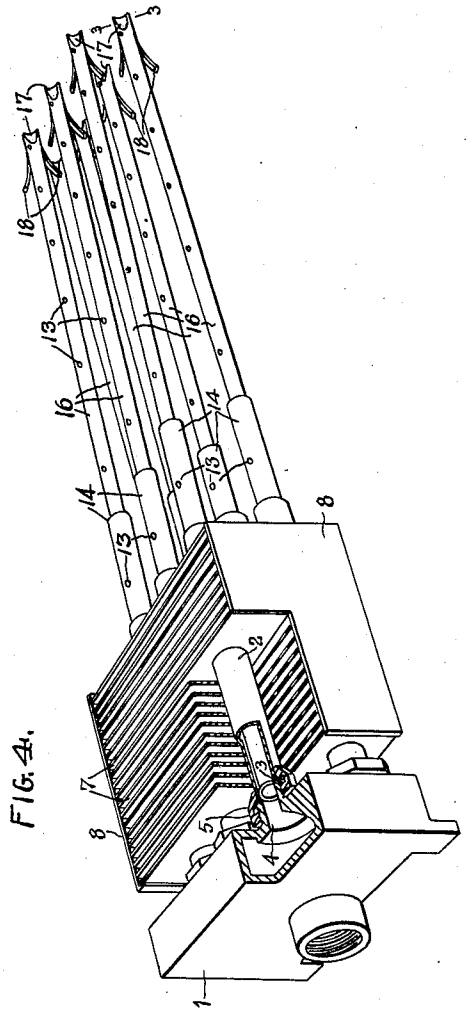


FIG. 4.

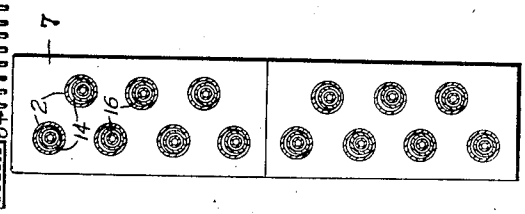


FIG. 6.

Inventor
JOHN McELGIN,
By Taulmin & Taulmin
Attorneys.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR THE HEATING OF AIR

John McElgin, Philadelphia, Pa., assignor to John J. Nesbitt, Inc., Philadelphia, Pa., a corporation of Pennsylvania

Application November 12, 1935, Serial No. 49,364

14 Claims. (Cl. 257—124)

My invention relates to apparatus for the heating of air.

It is the object of the invention to provide an improved apparatus obtaining uniform distribution of steam in blast heating radiators employed in unit ventilators, unit heaters, central fan heating and air conditioning systems.

It is an object to provide a more effective control over the degree of uniformity hitherto obtained in a blast radiator. This result is secured by uniformity heating or tempering air leaving the radiator so that full advantage of the control system of the heating capacity for the radiator by modulating the supply of steam may be obtained.

It is a further object to provide an apparatus for regulating the heat output of the radiator without the necessity of by-passing unheated air around the radiator, while at the same time securing a uniform discharge temperature instead of distinct streams of hot and cold air.

It is a further object to thereby dispense with the space allotted to a by-pass chamber. By the arrangement of the instant invention, the volume of air handled remains the same at all times, thus eliminating the inevitable variable volume which is obtained when dampers are used in connection with by-pass systems in view of fan characteristics.

It is an object to eliminate the existing system of employing one or more banks of blast coils, the steam flow to which is regulated by a supply valve. Such an arrangement also suffers from hot and cold air streams when the supply is modulated. For instance, the air stream at the steam end of the coil in this prior art structure is heated, whereas at the return end there may be no heat at all, thereby incurring the danger of breakage in freezing weather. This prior art arrangement has resulted in separating the blast radiators into two or more sections that are brought into action successively as the outside temperature falls. This is unsatisfactory since it results in a step action that prevents continuous, smooth control.

The present invention, by the use of steam distributing tubes of the nature set forth and described herein, eliminates these defects of the prior art. It provides a uniform discharge temperature. The steam supply may be modulated in sub-freezing weather without the danger of forming ice in the radiator tubes at the return end. The control is continuous over the full capacity of the radiator in that no distinct steps in heating capacity are made. The functions of heating and tempering are combined in a single piece of apparatus, thus saving in valve and installation costs and in the size of the apparatus.

When applied to such equipment as unit ventilators and unit heaters, the present invention avoids the stratification of air into hot and cold streams, providing more uniform heating. The same advantages occur when the radiator of this invention is used in connection with central systems.

Particularly it is the object of this invention to provide an apparatus distributing steam to various portions of a radiator by providing within the radiator a plurality of inner steam tubes of various lengths which connect to the main supply header in a manner similar to a plenum duct system. Each steam carrying channel is individual from the other channels employed and furnishes steam only to that portion of the radiator which is selected for that purpose. The flow of steam entering each of the separate channels is controlled partially by the resistance of the tube, the number of holes drilled in it, the location of the holes, the size of the holes and by the orifice size at the entry into each steam distributing tube.

It is a further object of this invention to so arrange the apparatus that once the entry orifices are properly sized, the quantity of steam entering each of the separate steam distributing channels remains the same as that entering the other channels. This condition cannot be obtained with a single distributing tube in long radiators.

Furthermore, a single distributing tube lacks the uniformity of distribution, as it is affected considerably by the demand due to varying velocities within the tube.

It is an object of the instant invention to supply each tube from the main supply header, thus permitting an unchanging balance to be obtained between the volume of steam entering each of the channels.

It is a further object of the invention to use fins on the tube of any desired form, although I prefer to use fins having turned-over ends to thereby form an air passageway through which the air flows over the tubes between the fins. The size and shape of the fins are immaterial.

Referring to the drawings, Figure 1 is a diagrammatic view in section showing one form of multiple steam distribution tubes.

Figure 2 is a similar view showing diagrammatically other forms of steam distribution tubes.

Figure 3 is a section on the line 3—3 of Figure 4

showing the crimped restricted ends of the tubes.

Figure 4 is a perspective of a cast iron header, the concentric tubes such as in Figure 2, from which have been removed some of the plates on the tubes to disclose the positioning fingers on the ends of the tubes, the holes in the tubes, and the crimped ends thereof.

Figure 5 is a side elevation of a typical radiator partially broken away and partially in section.

Figure 6 is a section on the line 6—6 of Figure 5.

Referring to the drawings in detail, 1 is a steam header, preferably of cast iron. 2 designates the main tube of copper having flanges 3, which are retained upon the nipples 4 by the screw-threaded flange nuts 5 mounted upon the nipples 4 of the header 1. A similar construction of flanges, nipples and nuts is provided on the return header 6. Mounted on the tube 2 is a plurality of copper fins 7 of any desired configuration, thickness, shape or size, but preferably of the proportions indicated on the drawings. There may be provided, optionally, turned-over ends 8 in order to close the space on either side between the plates 7 to form a defined air passageway.

Referring to the specific vanes as shown in Figure 1, a perforated plate 9 is inserted adjacent the inlet end of the tube 2. There is mounted in this plate a plurality of steam distribution tubes, of which there may be any number, depending upon the size of the tube 2. These steam distribution tubes are designated respectively 10, 11 and 12, and they are progressively longer in length, one with respect to the other, in the order named. These tubes are provided with apertures 13. The ends of the tubes may be crimped, as more fully shown in Figure 4. The apertures 13 are preferably arranged on one side of the tubes while the other side is continuous, serving to act as a drain for condensate, which drains out the ends of the tubes.

In Figure 1 the distribution tubes are shown of the same size with the same size inlet orifices. By designing the number of apertures 13, the relative sizes of the tubes, the location of the apertures in the tubes and the proportions of the tubes to one another and to the main tube 2, an even distribution of steam can be effected throughout the length of the tube so that a uniform modulated temperature of the air can be secured that is constant from end to end of the tube 2 to prevent hot and cold streaks and the by-passing of cold air.

In the form shown in Figure 2, I have arranged a plurality of tubes of successively greater lengths arranged one within another. While I have only shown the main tube and two inner steam distribution tubes, yet any number of such tubes can be employed, depending upon the size and other arrangements as they may be varied in the actual installation.

In the simple construction shown in Figure 2, the shorter, outermost steam distribution tube 14 has its outer end closed as at 15 where it engages the inner tube 16 which projects beyond it.

The inner end of the tube 14 is provided with a flange 14a which inter-engages with the flange 3 of the main tube 2 so that both of these flanges, 3 and 14a, can be clamped upon the common nipple 4 by the common clamping nut 5.

The free end of the tube 16 is crimped as at 17. This free end is also supported by fingers 18 which engage the surface of the tube 16 and the interior of the main tube 2. Each of the tubes 14 and 16 is provided with the apertures 13. The same conditions apply as to the location and arrangement of the apertures as heretofore explained.

It will be understood that this radiator can be made of any materials, such as aluminum, copper, iron or the like, but as a matter of practice I have found that a very successful and satisfactory radiator is one having cast iron headers such as 1 and 6, copper main tubes, fins and distribution tubes, and copper clamping nuts 5.

By using the radiator of the instant invention, the air enters the room or subsequent apparatus in uniformly heated condition regardless of the quantity of preheating required. Thus the combining of the several tempering coils formerly required into a single radiator gives a continuous control of the temperature of the leaving air that permits close regulation of the dew-point temperature, regardless of the outside weather conditions.

It will be understood that I desire to comprehend within my invention such modifications as may be clearly embraced within the claims and scope of my invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a radiator, spaced headers, an interconnecting main tube, and a plurality of interiorly disposed, steam distribution tubes in the main tube having their outlets disposed at different locations within said main tube.

2. In a radiator, spaced headers, an interconnecting main tube, and a plurality of interiorly disposed, steam distribution tubes in the main tube having their outlets disposed at different locations within said main tube, said distribution tubes having perforations spaced therealong.

3. In a radiator, spaced headers, an interconnecting main tube, and a plurality of interiorly disposed, steam distribution tubes in the main tube having their outlets disposed at different locations within said main tube, said distribution tubes having perforations spaced therealong, said perforations being arranged in groups whereby the perforations in one tube will be grouped apart from the perforations in another tube.

4. In a radiator, spaced headers, an interconnecting main tube, and a plurality of interiorly disposed, steam distribution tubes in the main tube, said distribution tubes being of different length.

5. In a radiator, spaced headers, an interconnecting main tube, and a plurality of interiorly disposed, steam distribution tubes in the main tube, said distribution tubes being of different length and each of said tubes having a plurality of spaced perforations.

6. In a radiator, spaced headers, an interconnecting main tube, and a plurality of interiorly disposed, steam distribution tubes in the main tube, said distribution tubes being of different length and each of said tubes having a plurality of spaced perforations, said perforations being so arranged in each tube that steam supplied therethrough will be delivered to a different part of the main tube from each of the interiorly disposed tubes.

7. In combination, in a radiator, of spaced headers, interconnecting main tubes, and a plurality of interiorly disposed, perforated distribution tubes of different length having uniform entry orifices to each tube, said perforations in each tube being arranged to supply steam to different portions of the interior of the main tube.

8. In combination, in a radiator, of spaced headers, interconnecting main tubes, a plurality of interiorly disposed, perforated distribution tubes of different length having uniform entry orifices to each tube, said perforations in each tube being arranged to supply steam to different portions of the interior of the main tube, and means to restrict the exit of steam from the end of at least one of said interiorly disposed, steam distribution tubes.

9. In combination, in a radiator, of spaced headers, interconnecting main tubes connecting said headers, a plurality of steam distribution tubes of different length having spaced perforations in each tube located within the main tube, and means for positioning said steam distribution tubes to supply from the supply header predetermined amounts of steam thereto, said tubes being arranged one within another.

10. In combination, in a radiator, of spaced headers, interconnecting main tubes connected to said headers, a telescopically arranged, interiorly disposed, distribution tube located within each main tube and interlocked on the supply header with the end of the main tube mounted on the supply header, and a second interiorly disposed, steam distribution tube mounted within the main tube of greater length than the first mentioned steam distribution tube, also adapted to receive steam from the steam supply header.

11. In a radiator, spaced headers, interconnecting main tubes detachably connected thereto, and a plurality of perforated steam distribution tubes arranged one within another in each main tube, said distribution tubes progressively decreasing in length from the steam supply side of the radiator to the return side, the outer ends of said distribution tubes other than the longest tube having means thereon forming a closed connection with the next adjacent tube.

12. In a radiator, spaced headers, interconnecting main tubes detachably connected thereto, and a plurality of perforated steam distribution tubes mounted within each main tube progressively decreasing in length from the steam supply side of the radiator to the return side, the perforations in said tubes being so arranged that the perforations in one tube are located in a different part of the main tube than the perforations in another steam distribution tube.

13. In a radiator, spaced headers, interconnecting main tubes detachably connected thereto, a plurality of perforated steam distribution tubes mounted within each main tube progressively decreasing in length from the steam supply side of the radiator to the return side, the perforations in said tubes being so arranged that the perforations in one tube are located in a different part of the main tube than the perforations in another steam distribution tube, and means on at least one of said steam distribution tubes for restricting the end thereof.

14. In a radiator, spaced headers, interconnecting main tubes, and a plurality of perforated steam distribution tubes arranged one within another and of progressively greater length as the steam distribution tubes decrease in diameter.

15. In a radiator, spaced headers, interconnecting main tubes, and a plurality of perforated steam distribution tubes arranged one within another and of progressively greater length as the steam distribution tubes decrease in diameter, the smaller the tube the greater its length, and the closer to the return header end of the main tube that that steam distribution tube supplies steam.

JOHN McELGIN.