Jan. 27, 1953

L. H. FRITZBERG

2,626,783

HEAT EXCHANGER

Filed Oct. 26, 1949

FIG. 1

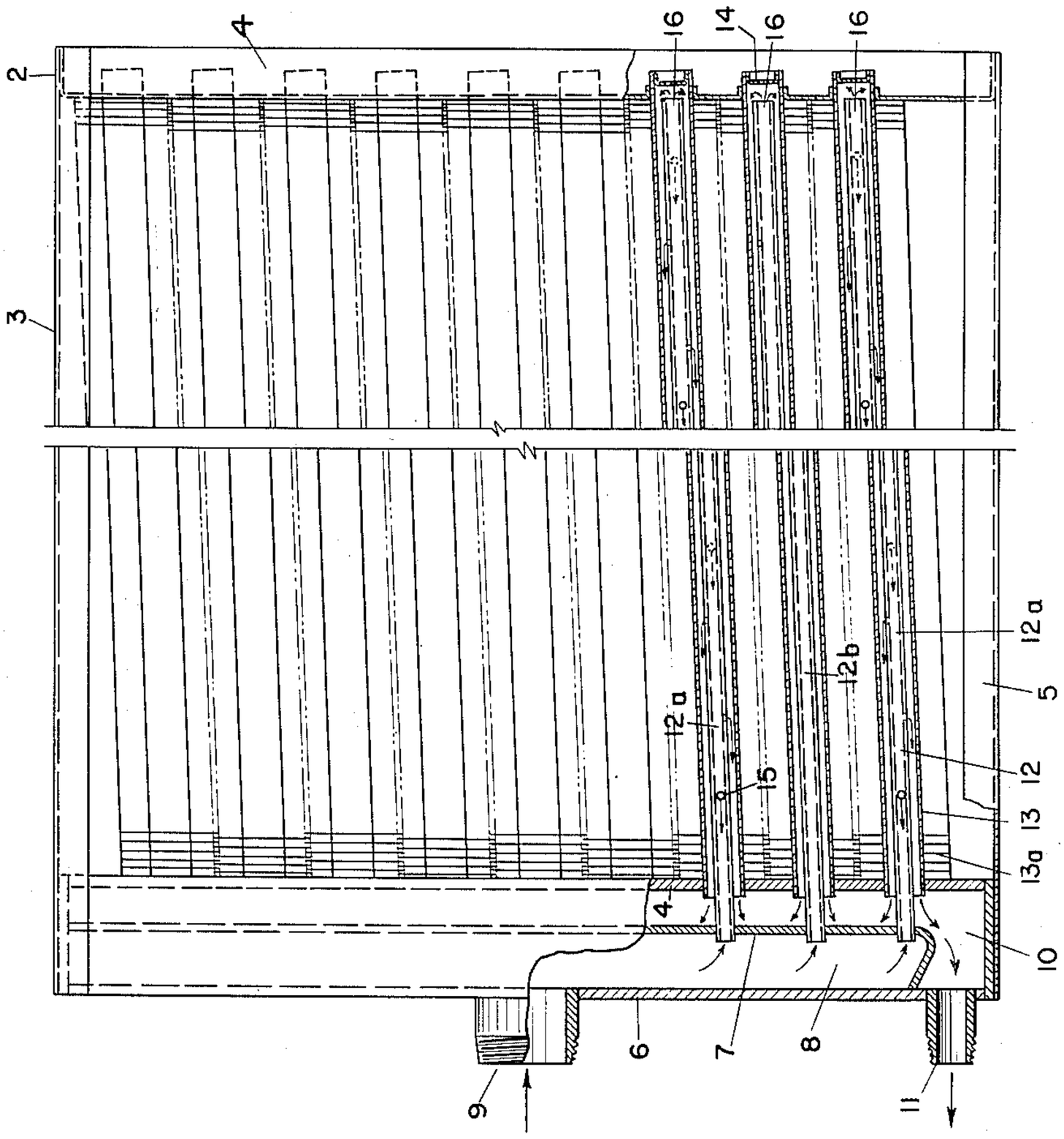


FIG. 2

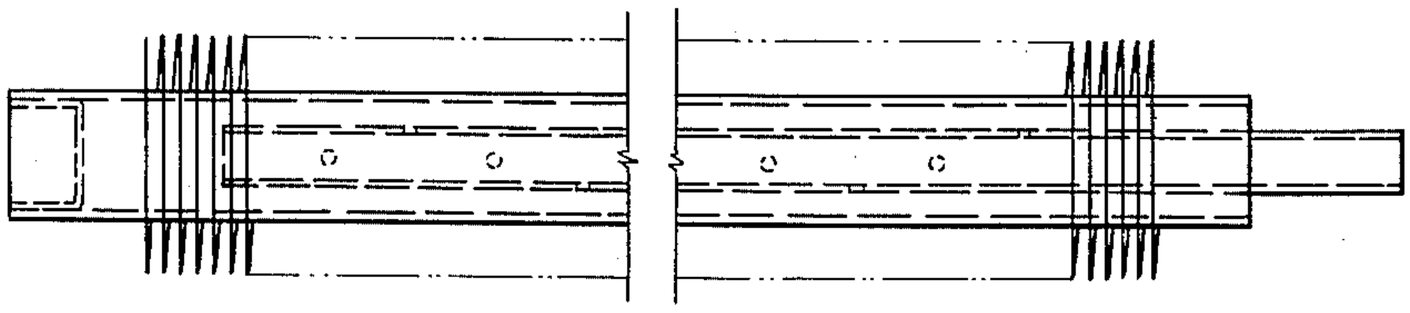


FIG. 3

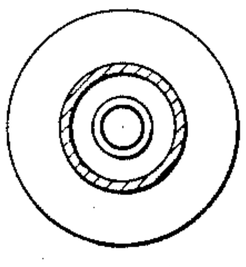
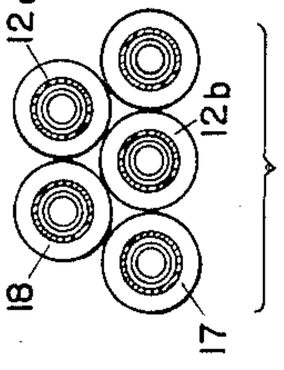


FIG. 4



INVENTOR.

Laurence H. Fritzberg

BY

Herman Reis

Patented Jan. 27, 1953

2,626,783

UNITED STATES PATENT OFFICE

2,626,783

HEAT EXCHANGER

Lawrence H. Fritzberg, Syracuse, N. Y., assignor to Aerofin Corporation, Syracuse, N. Y., a corporation of New Jersey

Application October 26, 1949, Serial No. 123,650

7 Claims. (Cl. 257—146)

1

This invention relates to heating apparatus adapted to be installed in duct-work or the like comprising a part of an air conditioning or ventilating system and, more particularly, to a device for heating air or the like by heat exchange with steam or similar fluid in which the supply of heating fluid may be reduced while maintaining supply of a reduced quantity of fluid to both ends of the device to assure that all portions of the air stream contacting the device will be tempered substantially uniformly thereby eliminating the possibility of freezing condensate at one end of the device under conditions of throttled steam supply.

Heretofore, when steam supply to heating apparatus employed in duct-work of an air conditioning system has been throttled one end of the heat exchanger is hot but the other is cold. This is disadvantageous for the air stream passing through the exchanger is not tempered substantially uniformly which may result in stratification of the air stream.

The chief object of the present invention is to provide a heating device in which both ends of the device are heated substantially equally under conditions of reduced steam supply.

An object of the invention is to provide a heating device in which the air stream passing through the device is tempered substantially uniformly even under conditions of reduced steam supply.

A further object is to provide heating apparatus in which the steam supply may be throttled without danger of freezing condensate at one end of the apparatus by contact with the cold incoming stream of air passing through the apparatus.

This invention relates to heating apparatus and comprises in combination a supply header, means for supplying steam to the inlet of the header, a return header for removing steam and condensate from the apparatus, steam distributing tubes connected to the supply header, return tubes surrounding the distributing tubes and connected to the return header, said return tubes being closed at their ends remote from the return header, some of the steam distributing tubes having orifices therein spaced substantially longitudinally of the tube and having open ends for the passage of steam into the return tubes, other distributing tubes having open ends only for passage of steam into the return tubes whereby heating is provided on both ends of the apparatus under conditions of reduced steam supply to the distributing tubes thereby providing substantially uniform heating of an air stream passing through the apparatus.

2

The attached drawing illustrates a preferred embodiment of the invention, in which

Fig. 1 is a view partly in elevation and partly in section of a heating apparatus embodying the invention;

Fig. 2 is a fragmentary view of cooperating distributing and return tubes;

Fig. 3 is a sectional view of the tubes shown in Figure 2; and

Fig. 4 is a fragmentary view of a modified form of the invention.

Referring to the drawing, there is shown heating apparatus comprising a rectangular casing structure 2 including a top wall 3, end walls 4 and a bottom wall 5. Preferably, the casing is designed for placement in an air duct or the like so that the top and bottom walls are substantially horizontal, air flowing through the casing in a substantially horizontal direction.

A header structure 6 is mounted within the casing adjacent end wall 4. The header structure 6 includes a partition 7 separating the structure into an inlet portion 8 having inlet 9 connected to a source of supply of steam or other heating medium such as a boiler and an outlet portion 10 having an outlet 11 connected to a drain or boiler return for disposal of condensate.

A plurality of steam distributing tubes 12 extend outward from inlet portion 8 through partition 7, each tube 12 being placed within a return tube 13 which is connected to outlet portion 10. Each of the return tubes 13 is closed at its end opposite its connection to the header by a plug 14 or other means. Each tube 13 may be provided with fins 13*a* if desired to promote heat transfer.

The distributing tubes 12 extend substantially throughout the length of the return tubes 13 and are preferably concentric therewith. Tubes 12 may be held in spaced relation to tubes 13 by any desired means. The tubes 13 are disposed approximately horizontally above each other but are inclined downward toward the outlet portion 10 at a slight angle to permit gravity flow of condensate to the outlet portion 10.

Some of tubes 12 designated as 12*a* are provided with orifices 15 spaced longitudinally thereof and open ends 16 opposite the connections to the inlet portion 8, such orifices and open ends serving to deliver steam or other heating medium from within the tubes 12 into the annular spaces between such tubes and the outer tubes 13. Other of tubes 12 designated as 12*b* are not provided with such orifices but possess only the open ends 16 to supply steam to the annular spaces be-

tween tubes 12 and 13. It will be understood, of course, if desired, the ends of tubes 12*b* may be closed and one or more orifices provided close to the end the purpose being to assure that steam reaches such end of the heating apparatus. It will be noted, refer to Figure 1, that tubes 12*a* and 12*b* are arranged alternately in the structure. Under conditions in which the supply of steam to the tubes 12 is throttled or decreased to reduce the heating effect on the air passing through the heating apparatus, such alternate arrangement of tubes 12*a* and 12*b* assures that both ends of the heating apparatus heat air passing therethrough substantially uniformly. If such structure were not provided and the pressure at which steam is supplied were reduced, the far end of the apparatus would be inactive with the result that cold air passing through such section of the apparatus would not be heated permitting stratification of layers of heated and cold air. In addition, the provision of heating at the far end of the apparatus even when steam supply is throttled assures that condensate at such end of the apparatus does not freeze.

In Figure 4, I have illustrated a modification of the invention in which a coil housing at least two horizontal rows is provided. In this form of the invention, one row 17 may be provided with tubes 12*b* while a second row 18 may be provided with tubes 12*a*, the remainder of the tube structure constructed as described above.

With the present invention, substantially uniform heating of air passing through the apparatus may be obtained even when the steam supply is reduced. The present invention assures heating of both ends of the apparatus when the supply of steam to the device is throttled. So doing, eliminates the possibility that stratification of layers of heated and cold air may ensue and assures that freezing of condensate at one end of the apparatus does not occur when the supply of steam is reduced. Such advantages are obtained without increase in the cost of the apparatus and may afford a slight reduction in labor costs of the assembly.

While I have described a preferred embodiment of my invention, it will be understood my invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In heating apparatus containing a passage for an air stream to be heated, the combination of a supply header, means for supplying heating fluid to the inlet of the header, a return header for removing condensate, distributing tubes for the heating fluid in communication with the supply header and extending completely across the air passage in the heating apparatus, return tubes, each return tube surrounding a distributing tube and being connected to the return header, said return tubes being closed at their ends remote from the return header, some of the distributing tubes having orifices therein spaced substantially longitudinally thereof and open ends for passage of heating fluid into the surrounding return tubes, other of said distributing tubes having at least one orifice substantially at the opposite ends only for passage of heating fluid into the surrounding return tubes.

2. Apparatus according to claim 1 in which the distributing tubes having longitudinally spaced orifices and the distributing tubes having orifices substantially at the opposite ends only are arranged alternately in the structure.

3. Apparatus according to claim 2 in which the lowest distributing tube has orifices therein spaced longitudinally thereof and an open end for passage of heating fluid into the return tube.

4. In heating apparatus containing a passage for an air stream to be heated, the combination of a supply header, means for supplying steam to the inlet of the header, a return header for removing condensate and steam, steam distributing tubes in communication with the supply header and extending completely across the air passage in the heating apparatus, return tubes, each return tube surrounding a distributing tube, said return tubes being closed at their ends remote from the return header, some of the distributing tubes having orifices therein spaced substantially longitudinally thereof and open ends for passage of steam into the surrounding return tubes, other of the distributing tubes having open ends only for passage of steam into the surrounding return tubes, said distributing tubes having open ends only being placed alternately in the structure with distributing tubes having orifices therein.

5. In heating apparatus containing a passage for an air stream to be heated, the combination of a header structure, a partition in the header forming inlet and outlet chambers, means for supplying steam to the inlet chamber and for removing steam and condensate from the outlet chamber, steam distributing tubes extending from the inlet chamber through said partition and extending completely across the air passage in the heating apparatus, return tubes, each return tube surrounding a distributing tube and being connected to the outlet chamber, the return tubes being closed at their ends remote from the outlet chamber and being inclined at an angle to promote gravity flow of condensate to the outlet chamber, some of the distributing tubes having orifices therein spaced substantially longitudinally thereof and open ends for passage of steam into the annular spaces between the distributing tubes and the return tubes, other of the distributing tubes having open ends only for passage of steam into the annular spaces between the distributing tubes and the surrounding return tubes.

6. Apparatus according to claim 5 characterized by the fact that distributing tubes having open ends only are placed alternately with the distributing tubes having orifices therein.

7. Apparatus according to claim 5 in which the structure includes at least two rows of distributing tubes, tubes in one row having open ends only and tubes in a second row having orifices therein.

LAWRENCE H. FRITZBERG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,837,442	Jackson	Dec. 22, 1931
2,098,830	McElgin	Nov. 9, 1937
2,229,032	Ashley	Jan. 21, 1941
2,499,608	Rink	Mar. 7, 1950