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1,607,172

C. S. SAGE

RADIATOR

Filed June 10, 1924

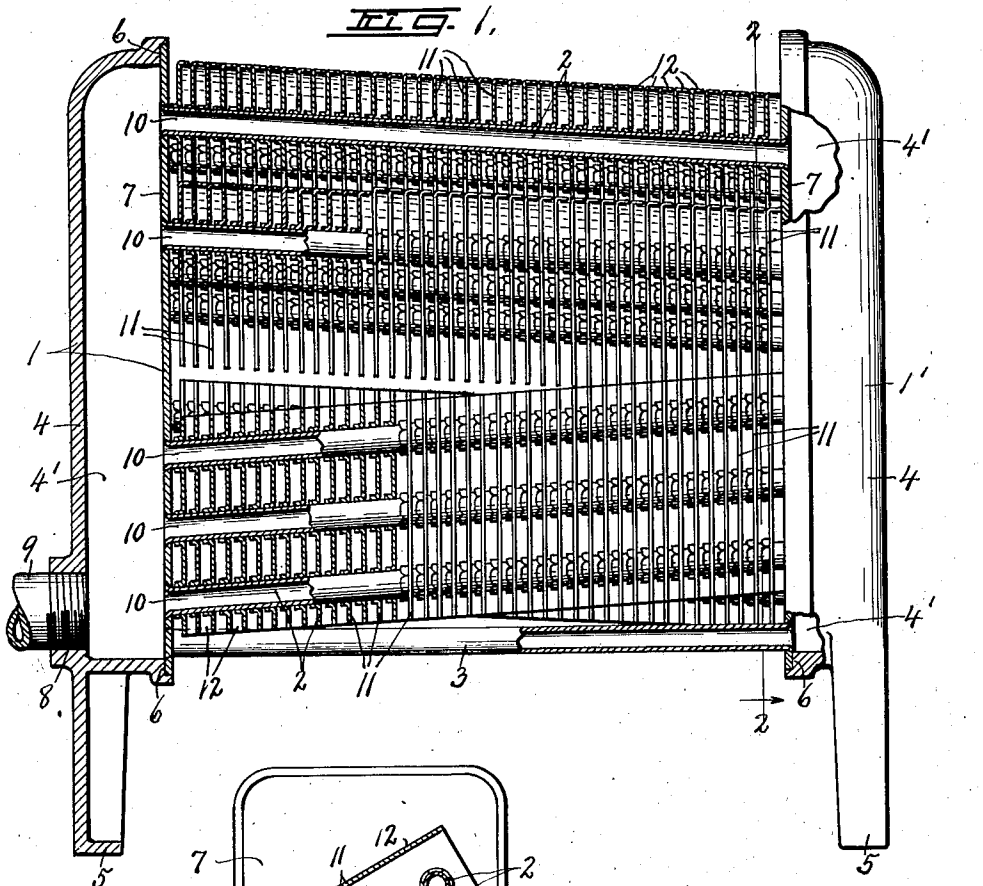


FIG. 2.

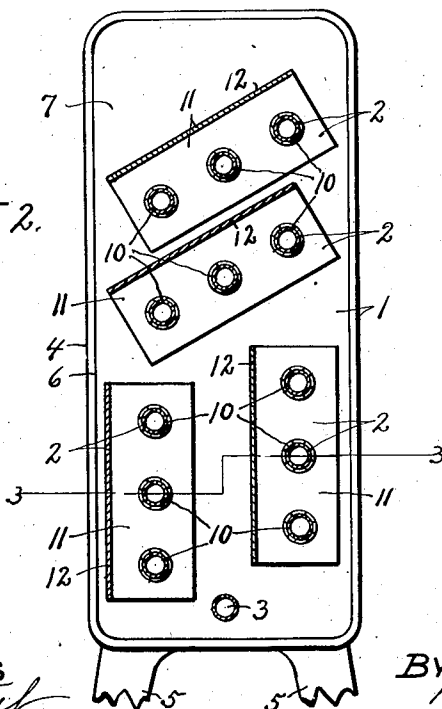
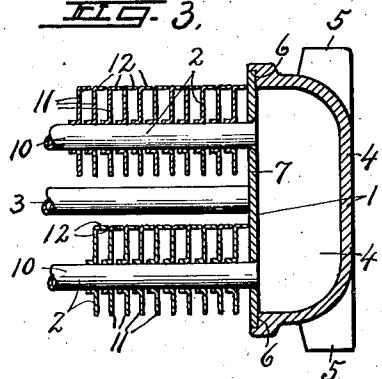


FIG. 3.



WITNESS
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UNITED STATES PATENT OFFICE.

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RADIATOR.

Application filed June 10, 1924. Serial No. 719,073.

This invention relates to a heat transfer apparatus of the class set forth in my pending applications, Serial No. 448,051, filed Feb. 26, 1921, and Serial No. 636,077, filed May 2, 1923, (application No. 448,051 has matured into patent No. 1,516,893, issued Nov. 25, 1924), except that it is used more particularly with what is commonly known as "one pipe" steam heating systems in which the water of condensation is allowed to flow back through the same pipe which supplies the steam.

In apparatus of this character, the steam is admitted to one of a pair of spaced heads or manifolds which are connected by a system of spaced tubes to permit the flow of steam and water condensation from one manifold to the other thereby constituting what is commonly known as a "radiator" by which a part of the heat imparted to the manifolds and tubes is transferred or radiated into the room in which the apparatus is located for heating purposes.

It is well known that relatively thin sheet metal tubes having a high degree of heat conductivity afford a more rapid and therefore, more economical and efficient transfer of heat than cast metal tubes which are necessarily of much greater thickness.

It is also well known that applying thin sheet metal plates having a high degree of heat conductivity to the conducting tubes for the heating agent, greatly increases the rapidity of heat transfer from the heated tubes to the surrounding air.

Furthermore, it is found that in radiators of this type the inclination of the tubes from a horizontal plane not only provides a freer passage for the steam from one manifold to the other, but also allows a free flow of the water of condensation between the manifolds and prevents trapping of air and water in the tubes thus rendering the one pipe system of the highest degree of efficiency.

Again, it is well known that heated air tends to rise in vertical paths from the heat radiating elements, and the main object of my present invention is to utilize this law of gravity in connection with the agents previously set forth in not only permitting the free natural flow of the heated air up-

wardly in vertical paths from the lowermost heating element of the radiator, but also to direct this upflow through relatively narrow vertical channels formed by relatively thin partition plates having a high degree of heat conductivity contacting with the heating tubes and arranged in parallel vertical planes so as to provide a combined heat transfer area of extremely large capacity in a radiator unit of comparatively small size.

Another object is to construct and arrange these heat transfer plates in such manner as to increase their radiating area without increasing the size of the radiator and to direct the upflow of the heated air needed to give the most efficient results.

Other objects and uses relating to specific parts of the apparatus will be brought out in the following description.

In the drawings:—

Figure 1 is a side elevation, partly in section, of a house heating radiator embodying the various features of my invention.

Figure 2 is a transverse vertical sectional view taken in the plane of line 2—2, Figure 1.

Figure 3 is a horizontal sectional view through one side of the radiator taken in the plane of line 3—3, Figure 2.

As illustrated, this apparatus comprises a pair of similar upright end heads or manifolds —1— and —1'— arranged in longitudinally spaced relation and connected by a series of, in this instance, four heat transfer units —2— and a connecting tube —3— for the flow of water of condensation from one manifold to the other.

Each manifold preferably comprises a chambered main body —4— having pendant extensions or legs —5— adapted to rest upon the floor of the room in which the apparatus is located or such apparatus may be otherwise supported, if desired.

The chambered members —4— are arranged with their open sides facing each other and are provided with marginal recesses —6— for receiving the marginal edges of a pair of sheet metal plates —7— in which the adjacent ends of the heat transfer unit —2— are supported, the marginal edges of said plates —7— being welded or otherwise permanently secured to the inner

faces of the main bodies —4— to form rigid parts thereof.

The outer wall of one of the manifolds —4— is provided near the lower end of its chamber as —4'— with an inlet opening —8— in which is secured a pipe —9— adapted to be connected to any suitable source of steam supply, although it is evident that other heating agents may be employed, if desired.

The opposite manifold —4— is also provided with a chamber —4'— which is connected near its lower end to the corresponding end of the first-named chamber by means of the tube —3— which serves to conduct water of condensation from one chamber to the other so that it may finally pass out through the lower part of the steam supply conduit —9— without interfering with the flow of steam to the adjacent manifold —4—.

The heating units —2— are similar in that each comprises a series of, in this instance, three thin sheet metal tubes —10— and a relatively greater number of thin sheet metal plates —11— supported by the tubes of that unit in parallel spaced relation transversely thereof.

The tubes —10— and plates —11— are made of thin metal having a high degree of heat conductivity, such for example, as copper, brass or tin so as to afford a rapid transfer of the heat from the steam or water in the tubes to the surrounding atmosphere for heating purposes.

The tubes —10— of each heat transfer unit —2— are arranged in parallel spaced relation lengthwise of the radiator and have their opposite ends permanently and rigidly secured in suitable openings in the adjacent plates —7— so as to form liquid-tight joints therewith and to establish communication between the heads therethrough.

The ends of the tubes may be secured in the plates —7— by swaging, welding or any other suitable fastening means.

The tubes of each unit are preferably disposed in inclined planes to facilitate the flow of steam from one manifold to the other and also to enable the water of condensation to easily gravitate from one manifold to the other along the bottoms thereof without interfering with the flow of steam therethrough thereby preventing the trapping of air and water of condensation in any part of the steam circulating system.

The tube —3— connecting the lower ends of the chambers —4'— also serves to carry the water of condensation from one manifold to the other and thereby to permit its escape along the bottom of the steam supply pipe —9— while the steam is flowing through the upper part thereof.

The inclination of the tubes —2— also permits any water of condensation accumu-

lating therein, to flow back into one or the other of the manifolds —4— and if flowing into the manifold opposite the steam inlet, it returns through the conductor —3— to the steam inlet —9—.

Two of the heat-interchanging units —2— are connected to and between the lower portions of the manifolds —1— and are disposed side by side in transverse vertical planes and therefore, the tubes of both sets will be disposed in parallel vertical planes but are inclined longitudinally in opposite directions.

The plates —11— of each of said units are provided with registering apertures through which the tubes extend and are also provided with flanges surrounding the apertures and in contact with the tubes for transferring heat therefrom to the plates which are preferably arranged in parallel vertical planes and in uniformly spaced relation lengthwise of the tubes to form vertical air cells through which the air to be heated may easily travel under its own gravity as it takes up the heat from the plates.

These plates may be made of thin sheets of copper, brass or other suitable material having high degree of heat conductivity and by reason of their thickness, a relatively large number of them may be placed side by side upon the tubes thereby producing a combined relatively large heat radiating area within a comparatively small space which together with their high heat, conductivity provides for a rapid circulation of the air to be heated from bottom to top during its natural upward flow with a minimum resistance.

It is now apparent that cold air coming in contact with the two lower sets of plates —11— is heated thereby and of course, tends to expand in all directions, but in order that it may be directed upwardly and forwardly, the rear edges of the plates of both sets are provided with flanges —12— offset in the same direction and preferably at right angles to the main bodies of the plates through which the tubes pass, the lengthwise width of the flanges being approximately equal to the spaces between the main bodies thereof so as to form baffle walls at the rear of the cells or spaces for deflecting heated air upwardly and forwardly through the open upper ends and front sides of the cells.

The upper two heat transfer units —2— are disposed one above the other, directly over the upper ends of the lower units previously described, and are preferably arranged in diagonal or inclined planes so that each row of tubes will extend transversely of or from front to rear of the radiator heads or manifold —1—.

In other words, each of these upper units inclines forwardly and upwardly from the

rear directly over the upper ends of the lower perpendicular units and the upper rear edges of the plates —11— of both units are offset laterally in the same direction from the main bodies to form flanges —12— of substantially the same width as the spaces between the main bodies of the plates so as to form baffle members for deflecting the heated air rising from the lower units and from between the upper units forwardly and upwardly into the room in which the radiator is located.

It will be observed that even though the tubes of the several heat transfer units are arranged in inclined planes, the plates thereof are disposed in vertical planes and therefore, form vertical channels or cells through which the heated air may readily pass, but is directed in its upward flow by the flanges —12— into the room and in the direction desired.

These flanges in addition to their function as baffle plates for directing the flow of the heated air, also greatly increase the heat-radiating area of the radiator as a whole, while the vertical channels between the plates of the several units permits the flow of the air across and in contact with both faces of all the plates with a minimum amount of resistance and thereby assures a maximum heat transfer from the steam passing through the tubes to the surrounding air, all of which enables the radiator to be made relatively small, compact and easily portable while still retaining a proportionately large heat-radiating area.

I claim:

1. In a heat transfer apparatus, hollow upright manifolds, means for introducing a heating agent into one of said manifolds, a heat-transfer unit including a tube connecting said manifolds and disposed in a longitudinally inclined plane, and sheet metal plates contacting with the tube and disposed in spaced parallel vertical planes, and means for introducing a heating agent into one of the manifolds, said plates having flanges projecting laterally from corresponding lengthwise edges across the intervening spaces.

2. In a heat transfer apparatus, hollow upright manifolds a heat transfer unit having a series of tubes connecting said manifolds and disposed in parallel longitudinally inclined planes one above the other, said unit having a series of sheet metal plates extending transversely of and around the tubes and disposed in spaced parallel vertical planes, said plates being provided with vertical flanges projecting across the intervening spaces.

3. In a heat-transfer apparatus, a pair of hollow upright end heads, and a heat-transfer unit connected to and between said heads and inclined longitudinally and transversely, said unit having a series of plates disposed in spaced parallel vertical planes, and provided with flanges projecting across the intervening spaces.

In witness whereof I have hereunto set my hand this 3d day of June, 1924.

CHARLES S. SAGE.