Jan. 4, 1949. G. R. GOLDTHWAITE 2,458,159

HEAT EXCHANGER

Filed Nov. 26, 1946 2 Sheets-Sheet 1

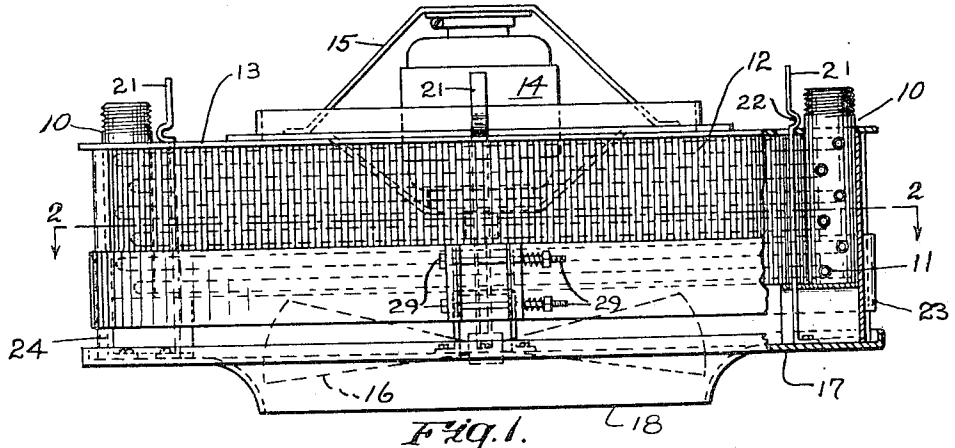

Fig. 1.

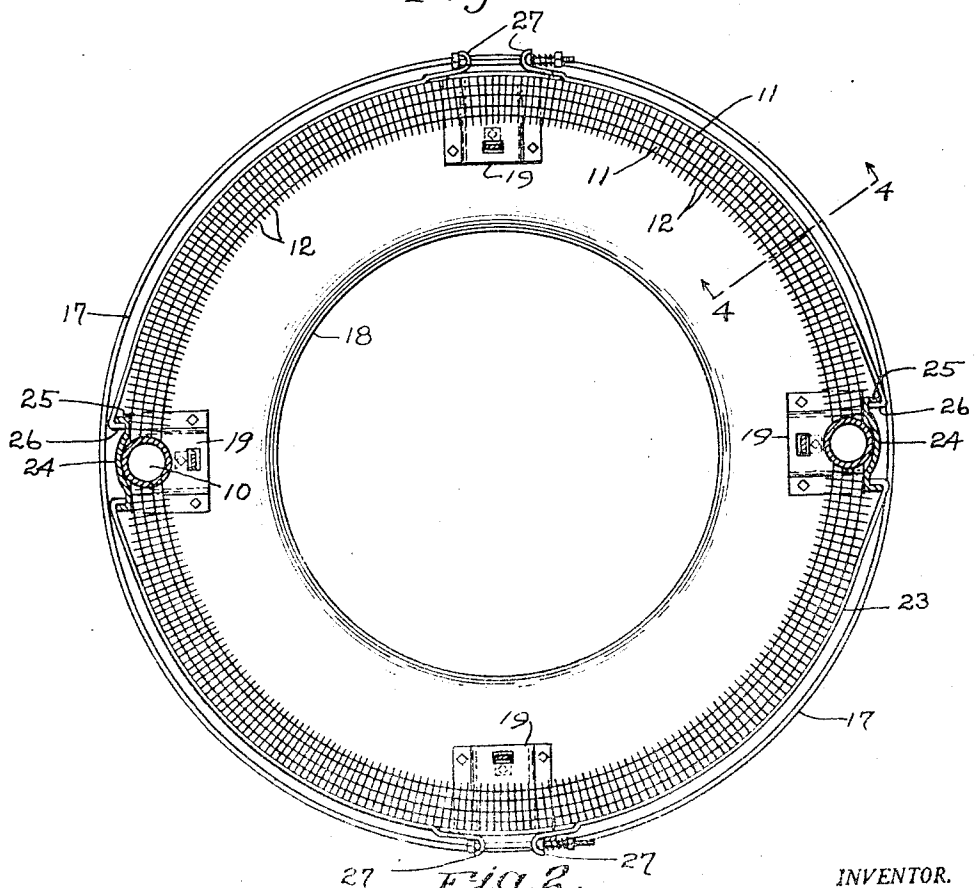

Fig. 2.

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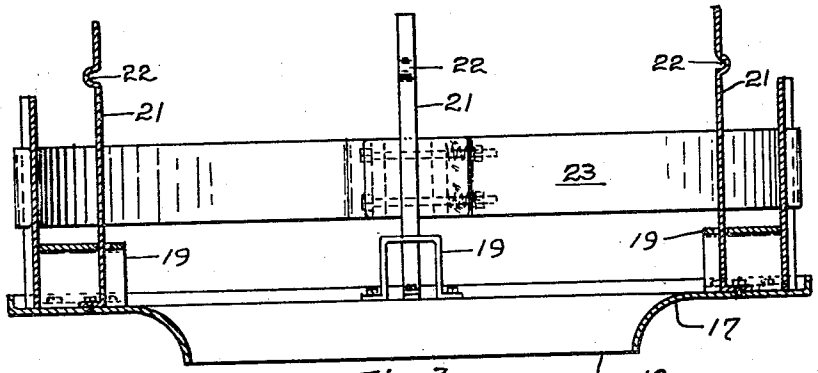

Fig. 3.

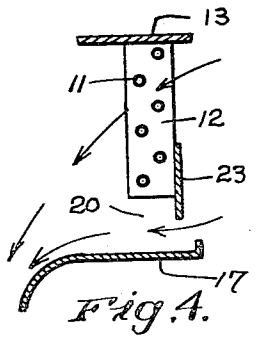

Fig. 4.

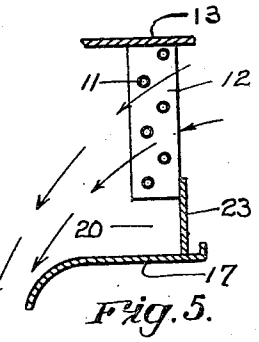

Fig. 5.

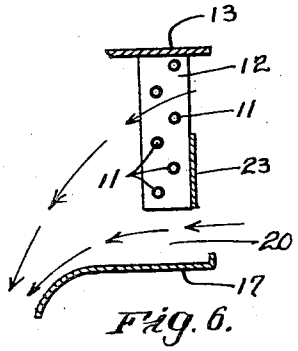

Fig. 6.

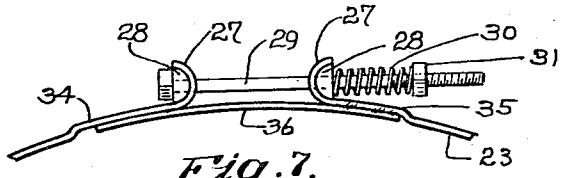

Fig. 7.

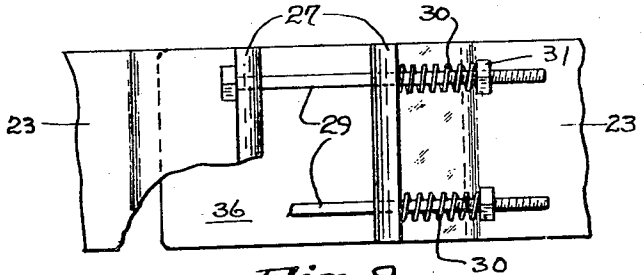

Fig. 8.

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Patented Jan. 4, 1949 2,458,159

UNITED STATES PATENT OFFICE

2,458,159

HEAT EXCHANGER

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Application November 26, 1946, Serial No. 712,355

5 Claims. (Cl. 257—137)

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This invention relates to heat exchangers, and relates more particularly to air heaters which include fans for blowing heated air into the space to be heated.

Air heaters known generally as unit heaters and as down blast heaters are widely used for heating factories, warehouses and other industrial buildings. They usually consist of annular or rectangular finned tube heating coils with propeller fans for drawing air through the coils and for blowing the heated air into the space to be heated. The heaters are ordinarily mounted above the space to be heated, and supplied with steam from a high pressure steam line.

Since different unit heaters may be located at different heights; may be supplied with steam under different pressures, and may have different heating loads, it is necessary to adjust the heat output of an individual heater so that it will supply the precise quantity of heat desired from it. Adjustment of the speed of the fans of the units, and of steam valves in the high pressure steam lines has not proved satisfactory. The most satisfactory method of operating a unit heater and of adjusting its heat output to suit its location and load, is to operate the fan at constant speed; to supply a constant volume of steam to the heater, and to vary its heat output by by-passing sufficient unheated air around the heating coil and into the fan so that the mixed air stream delivered by the fan has the desired temperature. My U. S. Patent No. 2,295,991 discloses a unit heater fitted with dampers adapted to be adjusted by a thermostat for varying the volume of air by-passed around an air heating unit and supplied with the heated air into the fan of the unit.

In many locations, the load on a unit heater is constant as is the pressure of the steam supply. It is not necessary, therefore, to use a relatively expensive thermostatic control. A by-pass damper can be set to a position providing the correct mixture of heated and unheated air, and left at that position.

This invention is a heat exchange unit having a by-pass passage and having a simple, easily adjusted and inexpensive by-pass damper therefor.

A feature of the invention is that circular heat exchange coils have extended surface, heat exchange fins thereon, the outer tips of which terminate in the outer surface of a cylinder and form the bearing surface for a cylindrical damper which is slidable on the fins to close off variable surfaces thereof from contact with air drawn

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into the fan of the unit, or across an air by-pass passage for varying the volume of air by-passed around the fins.

Another feature of the invention is that the by-pass damper is so constructed as to expand and contract in accordance with the expansion and contraction of the heat exchange fins on which it is supported.

An object of the invention is to adjust the temperature of the air supplied by a heat exchange unit, by by-passing air around the heat exchanger of the unit, and by varying the proportions of by-passed to treated air.

A more definite object of the invention is to provide in a heat exchanger, an air by-pass passage and a simple, inexpensive damper therefor.

The invention will now be described with reference to the drawing, of which:

Fig. 1 is a side elevation with a broken away portion, of an air heater embodying this invention;

Fig. 2 is a sectional view along the lines 2—2 of Fig. 1;

Fig. 3 is a sectional view through the lower portion of the heater with the heating surface and fan removed;

Fig. 4 is a sectional view along the lines 4—4 of Fig. 2 and shows the damper part way across the by-pass passage;

Fig. 5 is a view similar to Fig. 4 but with the damper adjusted to close off the by-pass passage;

Fig. 6 is a view similar to Figs. 4 and 5 but with the damper out of the by-pass passage;

Fig. 7 is an enlarged plan view of one of the spring connections at the ends of the damper, and

Fig. 8 is a side elevation with a broken away portion, of the damper end connection of Fig. 7.

The embodiment of the invention illustrated by the drawings includes the steam supply and return headers 10 having the usual circular openings in which the ends of the semi circular tubes 11 are fitted. The conventional, radial fins 12 are fitted around the tubes 11 and are so constructed and arranged that the outer surfaces of their outer ends lie on the surface of a cylinder.

The plate 13 extends across the upper surfaces of the fins 12 and closes off the upper surface of the heat exchange surfaces from air passage into the upper end of the unit. The upper ends of the headers 10 extend through the plate 13 which has a central indented portion for receiving the electric motor 14, the motor being supported by the support 15 from the plate 12.

The propeller fan 16 is supported on the lower

end of the rotary shaft of the motor 14, and the unit has a plate 17 extending across the lower portion of the unit, and having a central outlet 18 just below the fan 16, forming the air outlet of the unit.

The brackets 19 are bolted to the lower plate 17 and serve as seats for the lower surfaces of the fins 12, supporting the weight of the heat exchange surfaces upon the plate 17. The brackets 19 also space the lower surfaces of the fins 12 from the plate 17 forming the air by-pass passage 20 into the fan 16. The supports 21 are bolted at their lower ends to the plate 17 and extend through openings in the brackets 19 and in the upper plate 13 and serve to support the unit from a structure overhead the space to be heated. The supports 21 have the crimped portions 22 which press against the upper surface of the plate 13 holding it in position when the unit is assembled.

The cylindrical damper 23 is made up of four sections as best illustrated by Fig. 2. The curved damper supports 24 have their lower ends bolted to the plate 17 and extend along the outer surfaces of the headers 10 in contact with same. The supports 24 have the outwardly extending ends 25 into which the inwardly extending ends 26 of the damper sections are hooked and held.

The semi-circular ends 27 of the damper sections have the semi-circular bars 28 fitted therein, the damper ends 27 and the bars 28 having the bolts 29 extending therethrough. The heads of the bolts contact the flat surfaces of the bars at one side of the center of the heater, and the springs 30 on the bolts between the bars and the nuts 31 on the bolts, contact the flat surfaces of the bars on the other side of the center of the heater. As the nuts 31 are screwed up on the bolts 29, against the springs 30, the corresponding curved ends 27 of the damper are pulled together tightening the contact of the damper on the outer surfaces of the fins 12 which provide a bearing surface for the damper. The bars 28 prevent the straightening out of the curved damper ends 27 which would take place if the bolt heads and springs contacted them directly.

The damper has the cylindrical end portions 34 and 35 adjacent the curved ends 27, which have a greater diameter than the remainder of the damper, and the curved damper plates 35 attached to the damper portions 35 are fitted against the inner sides of the portions 34 and 35, and prevent air leakage between the curved ends 27.

The springs 30 permit the damper to fit snugly on the outer surface of the fin during expansion and contraction thereof caused by the heating and cooling respectively, of the heat exchange surfaces.

By unscrewing the nuts 31 on the bolts 29, the tightness of the damper against the outer surfaces of the fins 12 can be loosened so that the damper can be slidably placed by hand to close off the by-pass passage 20 as illustrated by Fig. 5; to completely uncover the by-pass passage as illustrated by Fig. 6, or to partially close off the by-pass passage as illustrated by Fig. 4. The damper can, of course, be adjusted to any position between the extreme positions illustrated by Figs. 5 and 6.

When the damper is slidably adjusted as described, its inwardly extending ends 26 slide against the outwardly extending ends 25 of the damper supports 24. The supports 24 also prevent leakage of air through the damper adjacent the headers 10.

In operation, when the motor 14 rotates the fan 16, the latter draws air over the surfaces of the fins 12 which add heat to the air. When the damper is in the position illustrated by Fig. 5 of the drawing where there is no by-pass, the unit delivers maximum heat for the prevailing steam pressure. When the damper is adjusted to the position illustrated by Fig. 6 of the drawing, a large portion of the heat exchange surface is shut off, and the by-pass passage is completely open. This results in a substantial reduction in the temperature of the air delivered through the outlet 18, due both to the reduction in heating surface and to the mixture of a large volume of unheated, by-pass air with the heated air. The damper can readily be adjusted to the position providing the heat desired, following which the nuts 31 can be screwed up on the bolts 29 for maintaining the damper secured in that position.

While one embodiment of the invention has been described for the purpose of illustration, it should be understood that the invention is not limited to the exact apparatus and arrangement of apparatus illustrated, as modifications thereof may be suggested by those skilled in the art without departure from the essence of the invention.

What is claimed is:

1. In a heat exchanger having a propeller fan and heat exchange tubes extending in a circular path centrally around the axis of the fan on the air inlet side thereof, said tubes having radially extending fins thereon the outer ends of which lie on the surface of a cylinder coaxial with said tubes, said exchanger having a wall spaced from said fins and providing a circumferentially extending inlet passage into the inlet of said fan, said fan being arranged to draw air between said fins and through said passage, the combination of a cylindrical damper constricted on said outer ends of said fins and slidable thereon across said passage, and means for varying the diameter of said damper for varying its contact pressure against said outer ends of said fins.

2. Apparatus as claimed in claim 1 in which the diameter varying means includes resilient means whereby the damper can expand and contract with the expansion and contraction of the fins without binding.

3. In a heat exchanger having a propeller fan, semi-circular heat exchange tubes extending centrally around the axis of the fan on the air inlet side thereof, and fluid supply and return headers into which said tubes connect, said headers extending along lines parallel to said axis, said tubes having radially extending fins thereon, the outer ends of which lie on a cylinder coaxial with said tubes, said exchanger having a wall spaced from said fins and providing a circumferentially extending air passage into the inlet of said fan, said fan being arranged to draw air between said fins and through said passage, the combination of damper supports extending across said passage and alongside said headers, and a pair of semi-cylindrical dampers contacting said outer ends of said fins and having ends slidably supported by said supports whereby the damper can be slidably positioned across said passage.

4. Apparatus as claimed in claim 3 in which the damper includes resilient means whereby it

can expand and contract with the expansion and contraction of the fins.

5. Apparatus as claimed in claim 3 in which the damper has other ends which are interconnected by resilient means permitting expansion and contraction of the damper with expansion and contraction of the fins, and in which the resilient means includes means providing expansion of the damper whereby it can be moved by hand slidably on said fin ends and across said passage.

GEORGE R. GOLDTHWAITE.

REFERENCES CITED

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

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Number	Name	Date
2,295,991	Goldthwaite	Sept. 15, 1942