DAMPER FOR MARINE HEATER

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Application June 18, 1956, Serial No. 591,831

2 Claims. (Cl. 257—6)

The present invention relates in general to rotary regenerative air preheaters, and more particularly to an improved damper arrangement that is adapted to regulate the by-passing of one or both fluids that are directed through the preheater.

A rotary regenerative air preheater essentially comprises a rotor that carries heat transfer material that is first contacted by hot gases to absorb heat therefrom and is then moved to position in an air stream to impart heat thereto. In the operation of such heat exchange apparatus it is frequently desirable, if not necessary, to bypass part of the stream of air around the heat exchange material of the rotor. Such a condition may arise for example, when there is danger that the heat transfer material may be cooled by excessive air flow to a temperature that might permit the condensation of moisture and the attendant corrosion of the preheater assembly, this condition commonly occurring during periods of low boiler load such as are especially common in marine applications.

The present invention contemplates the provision of by-pass dampers for both the gas and air passageways of a rotary regenerative air preheater. A further provision of this invention is that the dampers which regulate fluid flow through by-pass passageways are linked to dampers controlling fluid flow through the main fluid passageways whereby closure of the main fluid passageways automatically effects opening of the by-pass passageways therefor, and opening of the main fluid passageways automatically effects closure of the corresponding fluid by-pass. Still further, the installation of the by-pass dampers in the previously unavailable housing structure is a feature of the invention.

The invention will be best understood upon consideration of the following detailed description of an illustrative embodiment thereof when read in conjunction with the accompanying drawings in which:

Figure 1 is a sectional elevation of a rotary regenerative type air preheater embodying correlated main fluid and by-pass dampers in accordance with the present invention.

Figure 2 is a top view plan of the disclosed device.

In Figure 1 the numeral 10 designates a cylindrical rotor comprising a shell 12 connected by radially extending partitions 14 to a rotor post 15, which is driven by a motor 16 acting through suitable reduction gearing housed therewith. The rotor 10 is enclosed in a box-like housing 18 which is provided with end plates 20, 21 that are formed with circumferentially spaced apertures 22, 23 for the flow of streams of hot gas and cooler air to be heated to and through the rotor. Conventionally the rotor 10 carries a mass of heat absorbing material 28 which usually comprises a series of metallic plates spaced apart to form vertical passageways through the rotor. Circumferential seals 30 affixed to the edges of the rotor shell 12 and radial seals affixed to the end edges of the radial partitions 14 maintain the fluids in their respective passageways.

In accordance with the present invention plates 24 are positioned diagonally across the corners of rectangular housing 18 to provide air passages 25 and gas passageways 27 through which fluid may flow in a direction generally parallel to the rotor axis so as to by-pass the main fluid passageway. A series of butterfly type dampers 36 extend across the main air duct to permit closure thereof while axially aligned dampers 38 cooperate to permit opening of the by-pass passageways 25.

Damper plates 38 which are mounted upon the ends of shafts 32 at right angles to the main dampers 36 are arranged to terminate adjacent the plate 24 at one side and the housing 18 at the other. When similarly disposed in a plane normal to the flow of air through air by-pass passageway 25, the dampers 38 collectively comprise a triangular construction completely closing the passageway.

Each shaft 32 is provided with a crank arm 42 positioned at one end thereof outside the rotor housing 18 by which an actuator (not illustrated) may rotate the dampers to any predetermined position.

On the opposite or gas side of the rotor by-pass passageways 27 are each controlled by triangular dampers 29 while the main gas passageway through the rotor of the preheater remains uncontrolled. Dampers 36 and 38 are mounted for movement about their longitudinal axes on a series of parallel shafts 32 which have their ends pivotally supported by the rotor housing 18 in a plane normal to the rotor axis. The longitudinal edges 39 of the dampers 36 and 38 are arranged to overlap in a manner that effectively precludes fluid flow therethrough, but since the dampers 36 are positioned at right angles to dampers 38 they become inversely acting whereby movement of dampers 36 into a position permitting edges 39 to abut positions dampers 38 in a wide open position while movement of actuators 42 but ninety degrees closes dampers 38 and opens dampers 36.

The gas by-pass passageways 27 are controlled by individual dampers 29 pivotable about a single shaft 31 supported by the plate 24 and housing 18. The main gas passageway through apertures 23 is itself free from control means whereby the only control of gas flow may be achieved through closure of the by-pass dampers 29.

In operation under full load conditions which require a maximum amount of preheated air the damper valves 36 are rotated to a wide open position while the inversely acting damper valves 38 are tightly closed to force all available air through the rotor and the heat exchange material carried thereby. Under conditions of partial or low boiler load when the demand for preheated air is reduced and the passage of excess air through the rotor would reduce the temperature of the heat exchange material below the dew-point, the dampers 36 are moved to a partially closed position while the inversely acting dampers 38 are partially opened to permit a quantity of air to by-pass the rotor.

Dampers 29 are maintained normally closed. However, during periods of excess power demand when economy or efficiency of operation is of secondary importance the resistance of the gas side of the rotor may be partially relieved by opening the dampers 29 to permit gas flow therethrough.

While this invention has been described with reference to the embodiment having interconnected main and by-pass dampers operable by a common operator it should be considered within the scope of this invention to mount the main and by-pass dampers separately subject to individual control, and it should be evident that other changes could be effected without departing from the spirit of the invention. It is therefore intended that all matter contained in the above description or illustrated
in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an air preheater having a cylindrical rotor divided by radial partitions into a plurality of sector shaped compartments carrying a mass of heat exchange material, and a stationary housing having a rectangular section surrounding the rotor and provided with end plates formed with circumferentially spaced openings for the separated flow of air and gas to and through the rotor; partitions extending diagonally across the corners of the rectangular housing to provide passageways for fluid to by-pass the rotor; and damper means supported by the rotor housing adapted to control the flow of air through the rotor and adjacent by-pass passageways.

2. In an air preheater having a cylindrical rotor divided by radial partitions into a plurality of sector shaped compartments carrying a mass of heat exchange material, and a stationary housing including a rectangular section surrounding the rotor with end plates formed with circumferentially spaced openings arranged to provide air and gas passageways to and through the rotor; diagonal partitions extending across the corners of the rectangular housing to provide passageways for the by-pass of air and gas around the rotor, axially aligned damper means extending across the air opening in the housing and the adjacent air by-pass passageways to control the flow of air therethrough, said damper means mounted on a plurality of parallel damper shafts rotatably supported by the rotor housing.

3. An air preheater as defined in claim 2 wherein the damper means adapted to control the air opening in the housing is displaced substantially ninety degrees from the plane of the axially aligned damper means controlling the air by-pass openings whereby rotation of the axially aligned dampers about their longitudinal axes will simultaneously open one and close the other.

4. An air preheater as defined in claim 3 having individually operable damper means in the gas by-pass passageways adapted to control the flow of gas therethrough.

5. In an air preheater having a cylindrical rotor divided by radial partitions into a plurality of sector shaped compartments carrying a mass of heat exchange material, and a stationary housing including a rectangular section surrounding the rotor with end plates formed with circumferentially spaced openings arranged to provide main air and gas passageways to and through the rotor; diagonal partitions extending across the corners of the rectangular housing to provide passageways for the by-pass of air around the rotor; main damper means extending across the main air passageway to control the flow of air therethrough; and by-pass damper means including individually operable controls adapted to regulate fluid flow therethrough said by-pass passageways.

6. An air preheater having a cylindrical rotor divided by radial partitions into a plurality of sector shaped compartments carrying a mass of heat exchange material, and a stationary housing having a rectangular section surrounding the rotor and provided with end plates formed with circumferentially spaced openings for the spaced flow of air and gas through the rotor; partitions positioned diagonally across the corners of the rectangular housing to provide passageways for the by-pass of fluid around the rotor; and damper means extending across the air opening and its adjacent by-pass passageways adapted to simultaneously and inversely control the flow of air therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

1,737,189 Haber .................... Nov. 26, 1929
2,407,284 Kennedy .................. Sept. 10, 1946
2,578,783 Cruise .................... Dec. 18, 1951
2,699,106 Hoyer ..................... Jan. 11, 1955

FOREIGN PATENTS

587,035 Great Britain ................. Apr. 11, 1947