June 11, 1957 C. F. STARK 2,795,400

HEAT TRANSFER ELEMENTS FOR ROTARY REGENERATIVE HEATERS

Filed July 22, 1954

Fig. 1

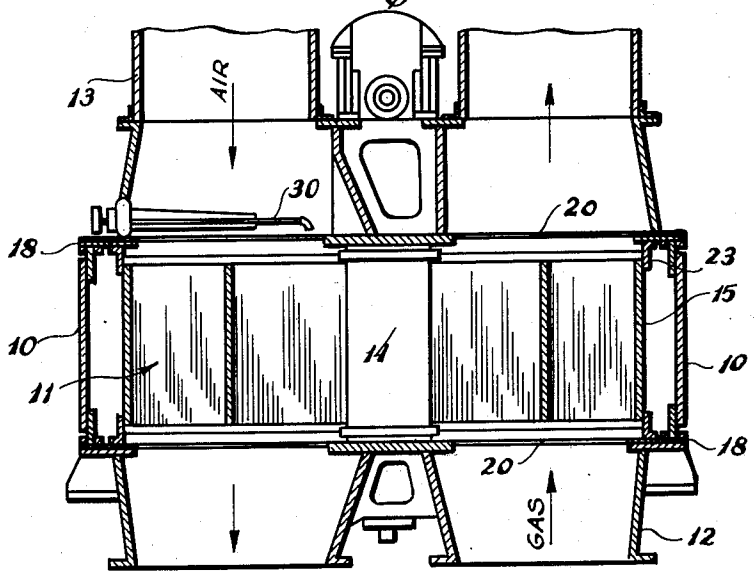


Fig. 3

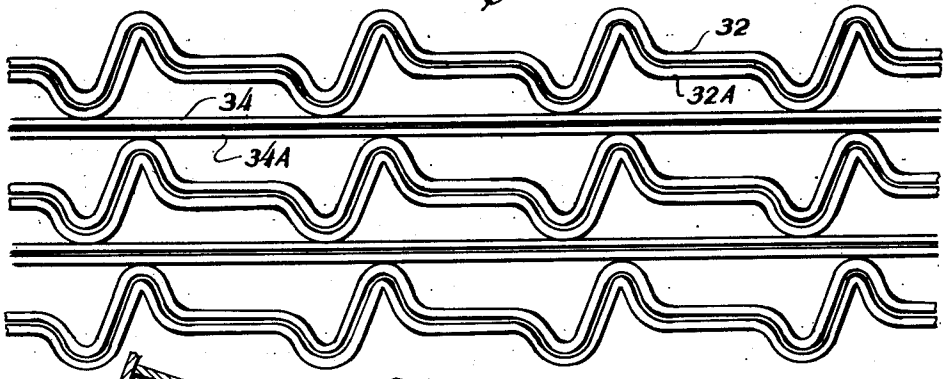
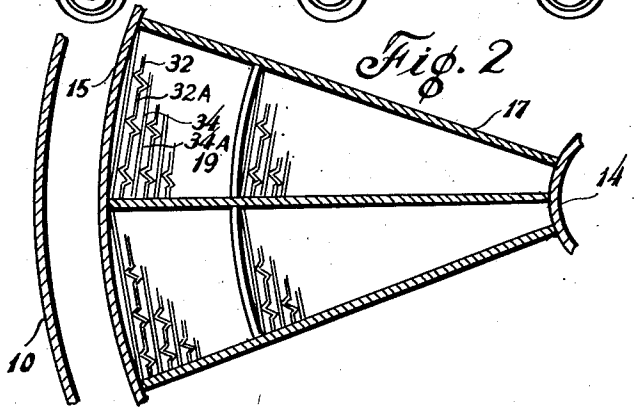


Fig. 2



INVENTOR.
Conrad F. Stark
BY James J. Whigden

United States Patent Office 2,795,400
Patented June 11, 1957

2,795,400

HEAT TRANSFER ELEMENTS FOR ROTARY REGENERATIVE HEATERS

Conrad F. Stark, Wellsville, N. Y., assignor to The Air Preheater Corporation, New York, N. Y., a corporation of New York

Application July 22, 1954, Serial No. 445,135

6 Claims. (Cl. 257—1)

The present invention relates in general to heat transfer apparatus of the rotary regenerative type; it relates particularly to an improved arrangement of heat transfer elements within such an apparatus to promote continuous trouble free operation thereof.

A rotary regenerative heater of the type under consideration has a cylindrical rotor divided into compartments in which are supported spaced metallic heat transfer plates which as the rotor turns are first exposed to a stream of heating gases and then disposed in the air passage to impart the heat absorbed from the gases to the air. A difficulty sometimes encountered in the operation of regenerative type heaters is the fouling of the heat exchanger surfaces by fly ash or other products of combustion which, with the use of certain fuels and under certain combustion conditions, may become so serious that resistance to flow through the spaces between the heat transfer plates is increased to the point where it limits the operational capacity of the heater and eventually necessitates curtailment of operation.

Heretofore, it has been customary to provide soot blowers which deliver air or steam under pressure to the tightly packed heating elements or plates to dislodge the deposits and carry them away leaving a relatively clean body of heating elements. However, it is frequently the case that the amassed deposits are satisfactorily removed from the edges of the elements adjacent the soot blower while portions thereof more remote from the soot blowers receive insufficient cleaning fluid to effect an efficient cleaning operation.

According to the present invention, it is therefore proposed to provide pairs of mating heating elements relatively loosely packed within the respective compartments of the rotor so that when they are subjected to a fluid jet from an air or steam soot blower, the plates will attain a natural vibration causing the plates to be rapped together with great rapidity so as to effectively dislodge deposits over the entire surface of each heating element including portions thereof which are remote from the concentrated soot blower jet and which would otherwise receive little or no cleaning action from a conventional soot blower.

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

Figure 1 is a sectional elevation of a rotary regenerative air preheater;

Figure 2 is a plan view of a portion of a rotor carrying pairs of heat exchanger elements arranged according to this invention; and

Figure 3 is a plan view on a greatly enlarged scale of a section of Figure 2 and illustrates the pair of the heat transfer plates or elements according to this invention.

As is illustrated in the drawing, the regenerative air preheater which contains the heat transfer plates of this invention, comprises a housing **10** enclosing a rotor **11** containing metallic heat transfer plates **32** and **32A** (Figures 2 and 3) which are moved first into contact with gases entering through the duct **12** for absorbing heat therefrom, and then into contact with air entering through duct **13** to preheat the air, the rotor being turned by a motor (not shown) connected to a rotor post **14**. The rotor **11** comprises a cylindrical shell **15** connected by radially extending partitions or diaphragms **17** to the rotor post **14** which serve to subdivide the rotor into a plurality of wedge or sector shaped compartments **19**. Sector plates **18** at the ends of the casing **10** at opposite ends of the rotor **11** are formed with alined openings as at **20** for passing heating gases and air through the rotor. The flow of gas and air between sides of the rotor and the housing **10** is prevented by circumferential seals **23** carried on the edge rims of the rotor shell **15**.

The heat transfer plates **32**, **32A** are undulated, or corrugated, and similarly formed so that each of a pair of plates nests with the other. Thus a pair of plates presents a double thickness of metal constituting a heat absorbing mass but is subjected to corrosive action of flue gases on only two faces, rather than four, since the plates though loosely packed of a pair are in substantial contact and even if slightly separated would present a very narrow passage for gas flow compared with the flow areas at the sides of each pair of plates.

The cleaning means for this apparatus comprises a cleaning nozzle **30** disposed in the air passage opposite the heat transfer plates for directing jets of cleaning fluid upon them as they pass slowly beneath the nozzle while the latter is moved from the rim of the rotor towards the center and then returned to the rim. Steam, air or other cleaning fluid is supplied to the cleaning nozzle from any suitable pressurized source of supply not here shown. After leaving the cleaning nozzle, the blast or jet of cleaning fluid is directed upon the end edge portions of the loosely packed heating elements **32** and **32A** and the spaced divider plates **34**. As the jet of cleaning fluid strikes the end portion of the body of heating elements, turbulence in the fluid stream is at once set up causing the loosely mounted heating elements to rapidly vibrate with the fluid stream so as to jar loose fly ash and other deposits adhering to the entire surface thereof, thereby giving assistance to the direct fluid blast emanating from the cleaning fluid jet. In this manner the fly ash and other products of combustion are readily removed from the entire surface of each heating element to thereby maintain a relatively clean heat exchanger at a correspondingly high degree of operating efficiency.

What I claim is:

1. In a rotary regenerative heater having a cylindrical housing formed with parallel passages for heat exchange between gaseous fluids, a rotor in said housing carrying heat transfer elements into the passage for hot gas to absorb heat therefrom and then into the passage for fluid to be heated to impart heat thereto, said heat transfer elements comprising; a series of nesting pairs of similarly formed heat transfer elements having adjacent pairs of heat transfer elements separated by plane metallic plates, said plates and nested elements being loosely contained in the rotor to permit a limited lateral vibration thereof.

2. In a rotary regenerative heater having a cylindrical housing formed with parallel passages for heat exchange between gaseous fluids, a cylindrical rotor in said housing for carrying heat transfer plates into the gas passage to absorb heat from the gases passing therethrough and then to the air passage to impart heat to the air passing therethrough and radially extending partitions dividing said rotor into a plurality of sector shaped compartments; a series of nesting pairs of heat exchanger plates in each compartment, pairs of which are loosely arranged in nesting relation in alternation with plane dividing plates; and a cleaning means mounted on the housing for movement

transversely of the rotor to direct a stream of cleaning fluid onto the end faces of said heating elements thereby causing them to vibrate sufficiently to jar loose any deposits clinging thereto.

3. In a rotary regnerative heater having a cylindrical housing formed with parallel passages for heat exchange between gaseous fluids, a cylindrical rotor in said housing for carrying heat transfer plates into the hot gas passage to absorb heat therefrom and then into the air passage to impart heat thereto, and radially extending partitions dividing said rotor into a plurality of sector shaped compartments; a series of mating pairs of heat transfer elements, pairs of which are loosely arranged in alternation with a plurality of plane divider sheets; and a cleaning nozzle mounted on said housing for movement transversely of the rotor to direct cleaning fluid onto the heat transfer elements, the fluid stream from said nozzle causing the heat transfer elements to vibrate sufficiently to jar loose products of combustion clinging thereto.

4. In a rotary regenerative heat exchanger having a cylindrical housing formed with parallel passages for the exchange of heat between fluids flowing therethrough; a cylindrical rotor carrying heat transfer plates into the hot gas passage to impart heat thereto and radially extending partitions dividing the rotor into a plurality of

sector shaped compartments; a series of mating pairs of formed heat transfer elements, pairs of which are loosely arranged in alternation with a plurality of plane divider sheets; a cleaning nozzle mounted on said housing for movement transversely of the rotor to direct cleaning fluid onto the heat transfer elements carried thereby, said nozzle simultaneously subjecting the heat transfer element to a vibrating motion and to a flow of cleaning fluid.

5. A rotary regenerative heat exchanger as defined in claim 4 wherein the flow of cleaning fluid from the cleaning device subjects the heat transfer element to a simultaneous rapping and purging action.

6. A rotary regenerative heat exchanger as defined in claim 4 wherein the flow of cleaning fluid from the cleaning device simultaneously subjects a portion of the heat transfer element to a purging and rapping action.

References Cited in the file of this patent

UNITED STATES PATENTS

2,122,176	Herbeck	June 28, 1938
2,183,936	Karlsson et al.	Dec. 19, 1939
2,372,997	Yerrick et al.	Apr. 3, 1945
2,379,506	Yerrick et al.	July 3, 1945