United States Patent [19]

Mahoney

[11] **3,906,606**

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[54] **ERECTION PROCEDURE FOR VERTICAL SHAFT AIR PREHEATERS**

[75] Inventor: **Robert Emmett Mahoney,** Wellsville, N.Y.

[73] Assignee: **The Air Preheater Company, Inc.,** Wellsville, N.Y.

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[21] Appl. No.: **505,421**

[52] **U.S. Cl.** ..... **29/157.3 R;** 29/429; 29/469; 113/118 R; 165/9

[51] **Int. Cl.²** **B21D 53/02;** B23P 15/26

[58] **Field of Search** ..... 29/157.3 R, 157.3 D, 156.8 CF, 29/429, 469; 113/118 R, 118 D; 165/9, 10

[56] **References Cited**

UNITED STATES PATENTS

253,743	2/1882	Mensing	29/429 UX
3,267,562	8/1966	Chiang et al	29/469 X
3,710,850	1/1973	Kurschner et al.	165/9
3,710,851	1/1973	Finnemore	165/9
3,861,013	1/1975	Kurschner et al	29/157.3 R

FOREIGN PATENTS OR APPLICATIONS

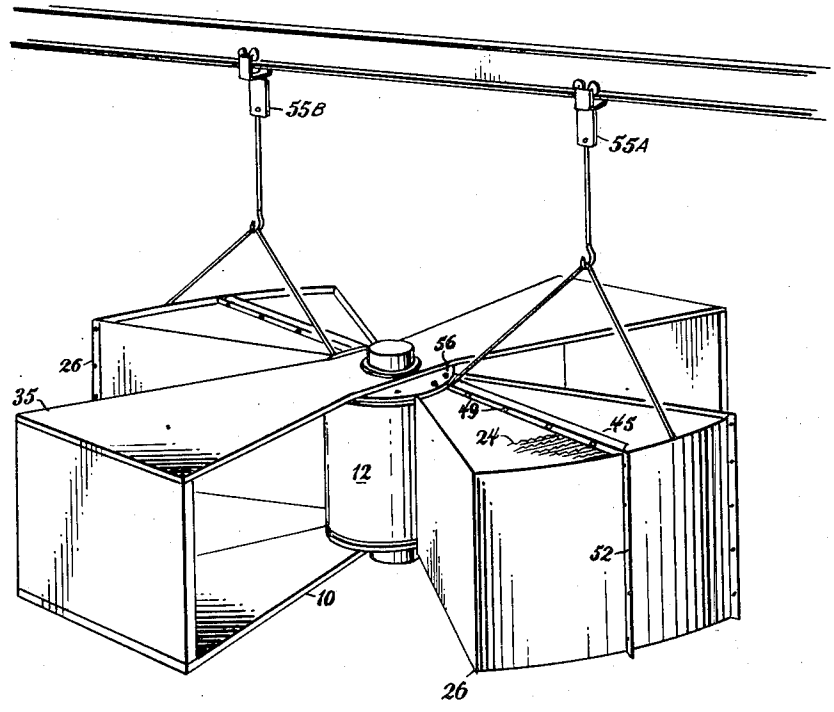
29,411	1971	Japan	29/156.8 CF

Primary Examiner—C. W. Lanham
Assistant Examiner—D. C. Reiley, III
Attorney, Agent, or Firm—Wayne H. Lang

[57] **ABSTRACT**

The method of manufacturing a rotor for a vertical shaft air preheater that rotates about a vertical axis between streams of hot gas and cool air. The rotor comprises a series of independent compartments that each contain a mass of heat absorbent element. The rotor is constructed by simultaneously securing to a rotor post two similar sector shaped compartments disposed at 180° to each other about the rotor post and by continuing to attach additional pairs of similar sector shaped compartments to opposite sides of thr rotor post until the compartments define a rotor. During construction there is at all times a substantially balanced assembly. The compartments are pivotally attached to the rotor post and joined together at their outer extremeties to form a composite assembly that extends around the rotor post.

6 Claims, 2 Drawing Figures



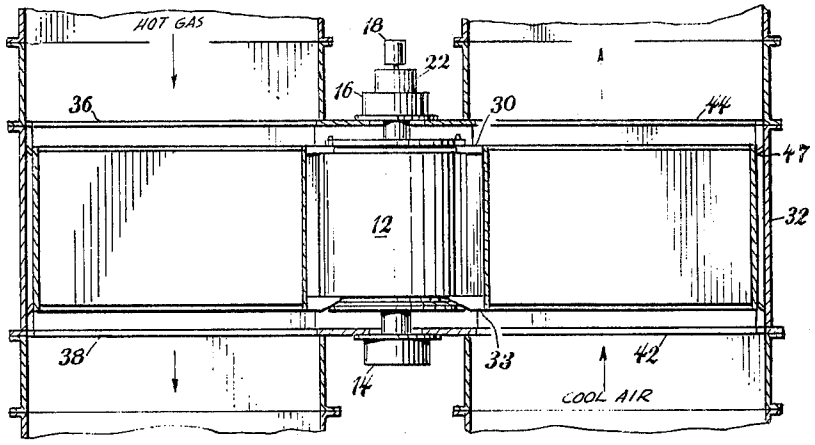

HOT GAS
18
22
16
36
30
44
47
12
32
38
33
42
14
COOL AIR

Fig. 1

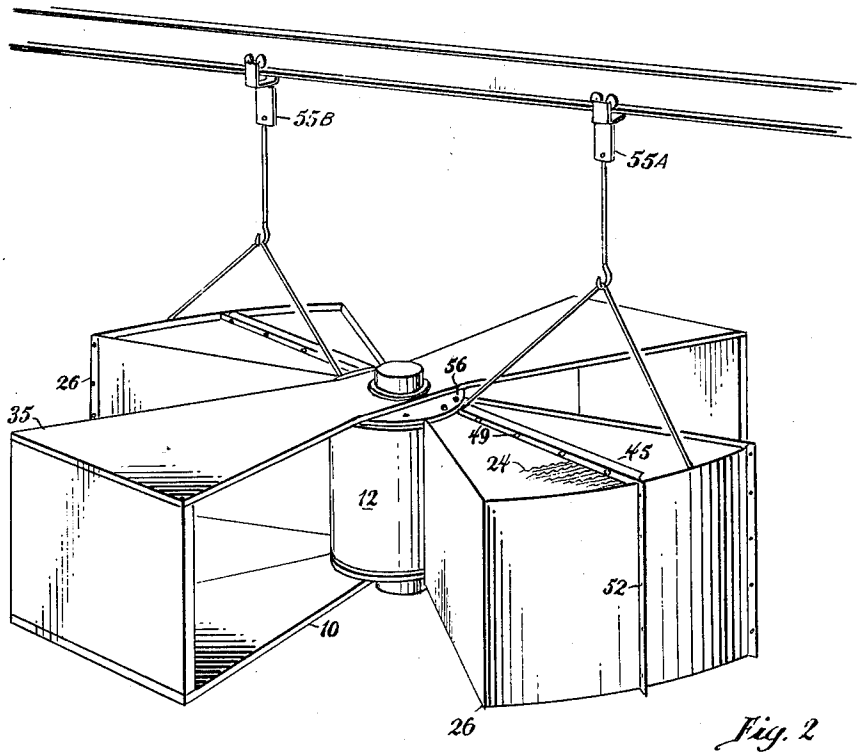

55B
55A
26
56
35
49
45
24
12
52
10
26

Fig. 2

ERECTION PROCEDURE FOR VERTICAL SHAFT AIR PREHEATERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a rotary regenerative air preheater and has particular relation to an arrangement by which compartments or baskets that carry a mass of heat absorbent element are assembled around a rotary shaft that in turn is disposed about a vertical axis. The rotary shaft and the assembly of element baskets are combined into a unit that operates as an integral body but one in which the several parts thereof are independent and free to thermally expand and contract.

2. Description of Prior Art

Rotary regenerative air preheaters are customarily made of individual parts that are assembled and then connected together by a system of welded joints in the manner defined by U.S. Pat. No. **3,267,562** of Chiang. An air preheater constructed in this manner is initially strong, but when subjected to repeated heating and cooling as may attend normal service operations, a differential of expansion occurs between the several parts and a substantial stress is accordingly concentrated in the welded joints therebetween with a resulting cracking or breaking of the welded joints so that the serviceability of the air preheater is materially impaired.

In U.S. Pat. No. **3,710,850** of Kurschner, et al, a rotary regenerative heat exchanger is disclosed wherein independent but similar compartments of heat absorbent element are pivotally attached to a central rotor post that is supported on bearings at the ends thereof for rotation about a horizontal axis. While suitable for "horizontal" type air preheaters that inherently assume a state of balance during construction thereof, such arrangements have never proved practical for air preheaters of the "vertical" type because the great weight of the constituent elements causes problems of rotor imbalance when during assembly the elements thereof are progressively attached to a central rotor post.

SUMMARY OF THE INVENTION

In accordance with the present invention, I therefore provide a procedure whereby an air preheater comprising a series of similar sector shaped compartments may be assembled about the periphery of a vertically disposed central rotor post. The assembly procedure defined is adapted to permit the gradual assembly of heavy compartments without attendant problems of imbalance, and it is moreover designed to provide a vertical shafted composite rotor of integral parts that are pivotally joined together whereby they are free to expand and contract as dictated by thermal change and not subject to cracking and breaking of welds as associated with continuous expansion and contraction of elements that are joined together by welding.

BRIEF DESCRIPTION OF THE DRAWING

The nature of the invention and its novel features will be more fully understood from the following description and shown in the accompanying drawings in which:

FIG. **1** is a sectional view of an air preheater made generally according to the present invention, and

FIG. **2** is a preferred embodiment of the invention as contained in a perspective view of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The arrangement of the drawing shows a rotary regenerative heat exchanger with a vertically disposed rotor post **12** having a support bearing **14** at the lower end thereof and a guide bearing **16** at the upper end thereof on transverse support structure **35.** The rotor assembly comprising a series of sector shaped compartments **26** is pivotally attached to the rotor post at upper and lower connections **30** and **33,** and it is rotated about its vertical axis by a drive motor **18** that is connected through suitable reduction gearing **22** to the rotor post **12.** A mass of permeable heat absorbent material **24** contained in the independent sector shaped compartments **26** is adapted to absorb heat from hot fluid and then give it up to cooler fluid as it flows therethrough.

The compartments **26** are open at opposite ends thereof to permit the countercurrent flow of hot gas and cooler air and they are secured to the rotor post **12** by pivotal linkage **30 - 33** which permits limited relative movement between the compartments and the rotor post **12** as may be brought about by thermal expansion and contraction.

The assembled compartments are surrounded by a rotor housing **32** having openings **36, 38, 42** and **44** opposite ends of the rotor for the inlet and outlet of the hot gas and cooler air.

To preclude the leakage of fluid through the space between the rotor and the rotor housing, radial sealing means **45** in the form of elongate leaves are inserted between the end edges of the composite rotor compartments and held by bolts **49** while circumferential seals **47** at the peripheral edge of the rotor are adapted to bridge the space between the rotor and the surrounding rotor housing in accordance with standard practice.

Pivotal couplings **30 – 33** are attached independently to rotor post **12** to support each compartment in a manner that permits a limited amount of relative movement therebetween as is necessary to accommodate normal variations. The radial outer ends of the sectorial rotor compartments **26** are bolted together as at **52** to comprise an integral rotor mass that extends as an annular body around the rotor post.

Inasmuch as the rotor is built up progressively from independent modules or components that may themselves weigh up to **50** tons, a great imbalance of forces is experienced during assembly thereof whenever the construction procedure reaches a stage that requires attaching one or more units to the side of an already balanced rotor post. This invention accordingly defines an erection procedure that is adapted to minimize the imbalance of forces that will accompany the assembly of a modular design air preheater wherein independent rotor compartments are added progressively to a vertical rotor post.

In accordance with this invention, a support bearing **14** is first connected to suitable structure such as a horizontal beam **10** capable of supporting the entire air preheater. One end of the rotor post **12** is vertically supported in the support bearing **14** and the opposite end of the vertically disposed rotor post is supported against lateral movement by a guide bearing **16** that is itself carried by a support beam or other structure **35** having a predetermined strength sufficient to preclude lateral movement thereof when loaded unevenly as by

an element compartment **26** that may be temporarily positioned at one side of the rotor post.

A rotor compartment **26** containing a mass of heat absorbent element **24** is then moved by an overhead hoist or other lifting means shown schematically at **55A** into position laterally adjacent the rotor post **12** and is attahced thereto by pins **56** in accordance with standard porcedure. Without releasing its support of the first compartment, a second hoist **55B** is adapted to lift a second compartment **26** to the rotor post at a point that is removed **180°** from the first compartment. Both compartments **26** are attached to the rotor post by means of a standard pivotal attachment that includes a lower compression fitting **33** and the upper tension fitting **30.** Inasmuch as the rotor compartments supported on opposite sides of the rotor post together with the central rotor post now present at a symmetrical assembly, such assembly provides a balanced load bearing vertically downward upon the support bearing **14** with no lateral forces being exerted upon the axially spaced guide bearing. Therefore both hoists **55** may be immediately removed and made ready to simultaneously lift another pair of element compartments into position at opposite sides of the rotor post.

Additional rotor compartments **26** are then lifted into position adjacent opposite compartments **26** that are already attached to the rotor post, and they are pivotally secured in the same manner as those already attached thereto so that there is at all times a balanced assembly. After the compartments **26** are pivotally connected to the rotor post, the hoists **55A** and **55B** are removed and the compartments are secured loosely by bolts **52** to an adjacent basket so they are free to adjust themselves to a slight repositioning of the rotor compartments.

Subsequent compartments **26** are progressively attached to opposite sides of the rotor post **12** and to adjacent compartments until an annular assembly of compartments extends completely around the rotor post, all of which are held to the rotor post by a pivotal connection **56** and to one another by bolts **52.**

After the rotor has been completely assembled each loose connection **52** between baskets is progressively tightened so that the rotor assumes a permanent annular configuration concentric with the rotor post and having radial sealing means **45** positioned between edges of adjacent baskets wherein circumferential seals **47** are adapted to bridge the spacing between the rotor and a surrounding rotor housing.

Instead of hoists **55** being used to hold the compartments **26** until pairs thereof are secured to opposite sides of the rotor post, the compartments may be lifted into position adjacent the rotor post and supported temporarily on compression type supports on the underside thereof until the compartments are secured to the rotor post. When a pair of compartments are secured opposite sides of the rotor post, the supports therefor may be removed and replaced in such a position that additional compartments may be supported thereby until the rotor is complete.

This and other analagous steps may be utilized without departing from the spirit of the invention. It is therefore intended that other modifications and variations may be made without departing from the intent of the invention and that the details of the invention are to be limited only by the scope of the appended claims.

I claim:

1. The method of manufacturing a rotor for a vertical shaft rotary regenerative air preheater comprising the steps of supporting one end of a vertical rotor post in a rotatable support bearing, positioning the opposite end of said rotor post in a guide bearing that precludes lateral movement of the rotor post, positioning a sector shaped element compartment radially adjacent the rotor post and attaching it thereto while substantially simultaneously attaching a similar element compartment to the rotor post **180°** removed from the first rotor compartment so that there is at all times a substantially balanced assembly, and continuing to attach similar sector shaped compartments to opposite sides of said rotor post until the combined assembly of compartments comprises a composite rotor that extends concentrically around the rotor post.

2. The method of manufacturing a rotor for a rotary regenerative air preheater as defined in claim **1** further including the step of pivotally attaching each compartment to the rotor post.

3. The method of manufacturing a rotor for a rotary regenerative air preheater as defined in claim **1** wherein two sector shaped compartments are positioned simultaneously at alternate sides of the rotor post after a single compartment has been initially attached to each of opposite sides of the rotor post.

4. The method of manufacturing a rotor for a rotary regenerative air preheater as defined in claim **1** including the step of temporarily supporting each compartment on compression type supports on the underside thereof until a similar compartment is attached to the rotor post in a position removed substantionally **180°** therefrom.

5. The method of manufacturing a rotor for a regenerative air preheater as defined in claim **4** including the step of removing the means supporting diametrically opposite compartments from the rotor post before attaching additional compartments thereto.

6. The method of manufacturing a rotor for a regenerative air preheater as defined in claim **1** including the step of providing means supporting each rotor compartment adjacent the rotor post with its radius substantially normal to the axis of the rotor post.

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