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ROTARY HEATER WASHER CONTROL SYSTEM

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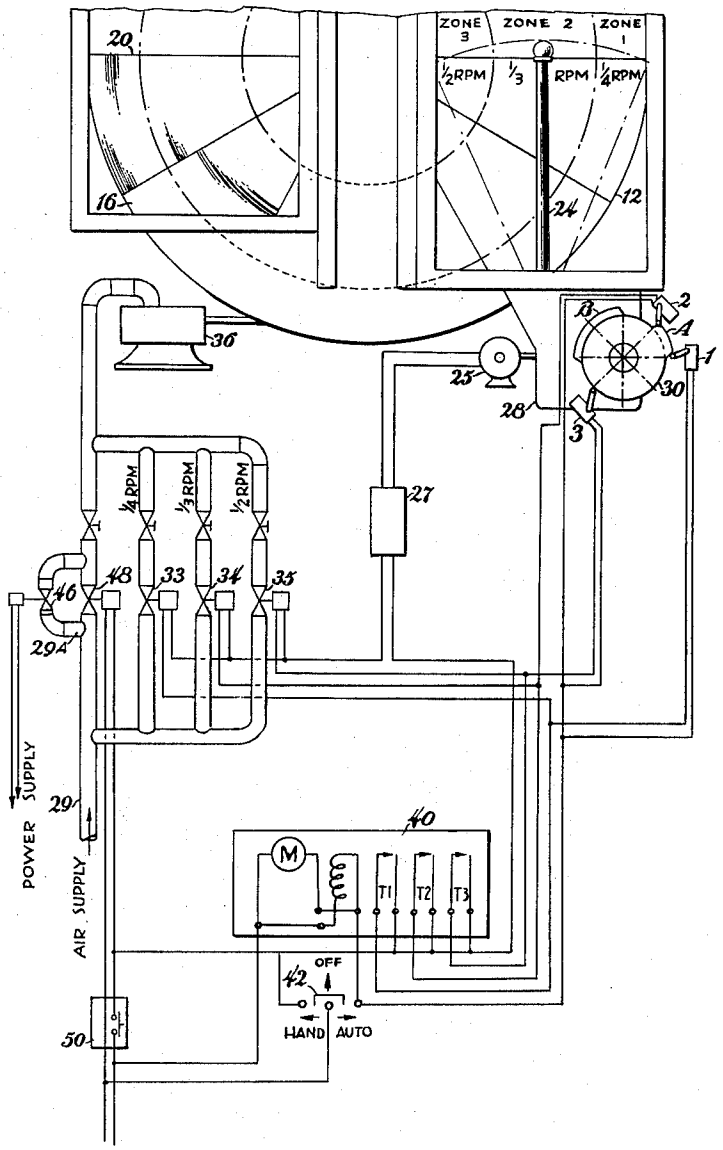

INVENTORS
Lloyd D. Grames
Arthur Wilbur Black
BY
Wayne H. Lang
AGENT

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ROTARY HEATER WASHER CONTROL SYSTEM

Lloyd D. Grames and Arthur Wilbur Black, Wellsville, N. Y., assignors to The Air Preheater Corporation, New York, N. Y., a corporation of New York

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The present invention relates to heat transfer apparatus of the rotary regenerative type and more particularly to an improved control system for such an apparatus which synchronizes radial movement of a soot blower cleaning arm with variable rotary movement of the rotor of said apparatus.

In rotary heat exchangers the heat transfer surface usually consists of spaced metallic plates mounted in a rotor which turns to dispose the plates first in the path of gases to absorb heat therefrom and then positions the plates in an air stream to impart heat thereto. Soot and other deposits entrained in the gases accumulate on the heat transfer plates and it becomes desirable, if not necessary, to clean them periodically so that the efficiency of the heater may be maintained at its highest level.

Since soot and other products of combustion evenly accumulate on all the heating surfaces positioned in the rotor, it is evident that such surfaces must be subjected to a thorough cleaning action to remove the deposits therefrom. Consequently, jets of steam, air or water are commonly played on the heating surface of the revolving rotor to remove such accumulated deposits and thereby present a comparatively clean surface to the passing gas and air streams.

It is a main object of this invention to provide means for subjecting all heat exchange surfaces of the rotor to similar amounts of cleaning action by synchronizing radial movement of the cleaning arm with rotational movement of the rotor. By so doing, all the heating elements or plates of the rotor lying between its centrally lying rotor post and its peripheral outer edge receive substantially equivalent amounts of cleaning action irrespective of their relative distance from the center of the rotor.

For all rotary heaters, and especially for the larger sizes of air preheaters of the type herein described, it is extremely difficult to vary the rate of radial movement of the cleaning arm sufficiently to compensate for the great variation in the linear speeds of said rotating heating elements in locations from the inner to the outer portion of the rotor. In the present invention, provision is made for means correlating radial movement of the soot blower cleaning arm with means varying the rotational speed of the rotor so that all portions of the rotor may be subject to like amounts of cleaning action. The exact manner by which this proposed correlation is effected may be more clearly understood by reference to the following specification and the accompanying drawings in which:

The single figure in the drawing is a diagrammatic view of a zoned rotary air preheater and cleaning device together with the controls necessary to correlate movement of the preheater and cleaning device.

Referring more particularly to the drawing, numeral **12** indicates the rotor of a rotary regenerative type air preheater which is divided into the usual sector shaped compartments **16** by radial diaphragms **20**. As the rotor turns on its axis, a pivoted cleaning arm **24** carrying a fluid dispensing means at its distal or radially outer end

intermittently moves generally radially over the rotor so as to subject each portion of said rotor to a fluid stream emanating from the dispensing means moving in an arcuate path.

The cleaning arm **24** is mounted on the rotating hub **30** of the cleaning device **28** which is only diagrammatically shown. The hub **30** is slowly rotated in a clockwise direction about its axis by a motor **25** controlled by timing mechanism **40** acting through magnetic motor starter **27**.

Positioned around hub **30** are a plurality of cams A and B which, sequentially contact switches **1**, **2**, and **3** as the hub rotates to effect closure of connecting electrical circuits which energize solenoid valves **33**, **34** and **35**. These valves in turn regulate flow of compressed air through supply line **29** of the auxiliary air motor **36** which is coupled to drive the preheater rotor **12** during predetermined periods of operation. The cam A on hub **30** of the cleaning device **28** and the switches **1** and **3** are positioned around said hub in a plane perpendicular to its axis, and cam B with its cooperating switch **2** is positioned in a plane spaced from cam A. Furthermore, cam B is substantially twice the length of cam A, and is angularly spaced therefrom so that when cam A rotates past switch **1**, cam B immediately contacts switch **2**, and when cam B rotates past switch **2**, cam A immediately comes into contact with switch **3**.

The repeat cycle timer **40** is a standard electrical timing device which includes a plurality of timer switches **1**, **2** and **3** together with a timer motor "M." The motor "M" of the timer becomes operative when the selector switch **42** is moved to the "auto" position. The nature of the timer is such that each of the timer switches T1, T2 and T3 may be given a predetermined setting, so that when properly actuated, each switch will periodically cycle between an "open" and a "closed" position. By way of example, switch **1** of timer **40** may be set to open four minutes and close for ten seconds, switch **2** may be set to open three minutes and close for ten seconds, while switch **3** may be set to open for two minutes and close for ten seconds. It is to be understood that this timing sequence and duration is given by way of example only, and not by way of limitation.

When in operation, the "open-closed" sequence of any switch T1, T2 and T3 in the timer will be repeated as long as a cam on shaft **30** is in actuating engagement with a cooperating switch. For example, when the cleaning device motor **25** rotates hub **30** so that cam A contacts switch **1** a circuit is closed and switch T1 of the timer **40** commences to open and close at the predetermined intervals. During periods of closure, the starter **27** is energized allowing motor **25** to turn the cleaning device **28** sufficiently to allow nozzle carrying arm **24** to move radially a short distance. This distance may be varied but it is determined by the approximate radial span of a group of heating elements actively subjected to the action of fluid emanating from the dispensing means during a single pass.

So long as cam A is in contact with switch **1**, the correspondingly numbered switch T1 of timer **40** continues to repeat its predetermined "on-off" cycle and a connecting circuit to solenoid operated valve **33** is closed causing the valve to remain open and thus permit compressed air to flow to air motor **36** in sufficient quantity to maintain a rotor speed of one complete revolution during the same interval switch T1 of timer **40** remains open. At the end of this prescribed period, switch T1 of timer **40** automatically closes so as to close the circuit to starter **27** and in turn energize the motor **25** turning the hub **30** of cleaning device **28** slightly so as to again move the arm **24** radially inward.

After cam A has rotated past switch 1 the circuits to the solenoid valve 33 and to switch T1 of timer 40 are opened so that these members become inoperative. Cam B however is arranged to immediately contact the adjacent switch 2 so as to complete the circuit to switch T2 of timer 40 and to solenoid valve 34 in the air supply line. Valve 34 then opens to allow sufficient air to motor 36 to increase its speed of rotation to a predetermined rate, given by way of example as ⅓ R. P. M.

Switch T2 of timer 40 then becomes operative and the predetermined "on-off" sequence again commences. Since the rotor now makes one complete revolution in but three minutes, switch 2 of the timer is set to close every three minutes for a short interval during which interval the starter 27 energizes motor 25 to actuate the cleaning device. When the cleaning device is actuated the hub 30 and its integral cams are rotated slightly and cleaning arm 24 is again moved radially inward its prescribed distance. As is evident from the drawing, cam B is substantially larger than cam A, thereby contact between cam B and its cooperating switch 2 is maintained for a relatively long period and the solenoid valve 34 and the switch 2 of timer 40 are maintained operative while arm 24 is traversing zone 2 of the rotor.

After cam B has rotated past switch 2, cam A contacts switch 3 thereby completing a circuit to solenoid valve 35 and to switch T3 of timer 40. Consequently, air is supplied to air motor 36 sufficient to increase the rotational speed of rotor 16 to ½ R. P. M., and switch T3 of timer 40 now closes every two minutes to energize starter 27 for motor 25. This "off-on" condition again continues until hub 30 carrying cam B has rotated past its cooperating switch 3 and the radially moving arm 24 has moved past the innermost segment of zone 3.

After the cam A has rotated past switch 3 the heating elements of the entire rotor will have been subjected to cleaning action of the cleaning device 24, and they will have been exposed to substantially the same amount of cleaning action irrespective of their radial distance from the rotor post. As a result of this arrangement, the heating elements of a rotor so cleaned are maintained at a uniformly clean condition as they consistently operate at or near peak efficiency.

Solenoid operated valve 46 is an emergency valve in air supply by-pass 29A which remains closed when its solenoid operator remains energized, but on power failure opens to allow a full air flow to air motor 36. Solenoid valve 48 in the air supply line parallel to 29A remains closed normally, but by completing the circuit at manually operated switch 50 this valve opens to allow a full flow of air to motor 36. Selector switch 42 enables an operator to selectively energize the cleaning system either automatically or manually. The "off" position of said switch 42 isolates the entire system from the electric power supply.

The electric power supply and the compressed air supply used in operating the system herein disclosed may be taken from any convenient source, however such sources of supply comprise no part of this invention.

While this invention has been described with reference to the embodiment shown in the drawing, it is evident that many changes could be made without departing from the scope of the invention, and it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What we claim is:

1. A cleaning arrangement for a rotary regenerative air preheater or the like having a cylindrical rotor carrying regenerative heat transfer material first through a gas passage to absorb heat therefrom and then through an air passage to impart heat to air passing therethrough; a variable speed drive mechanism provided to move the rotor about its axis; a cleaning device pivotally mounted adjacent the rotor and having an end thereof free to move across the rotor in response to motor driving means; a timing mechanism periodically interrupting the means driving said cleaning device; and means regulating the power supply to said variable speed motor in response to the changing position of said cleaning device.

2. A cleaning system for a rotary regenerative air preheater as defined in claim 1 wherein said means regulating the variable speed motor comprises a cam operated control means.

3. A cleaning system for a rotary regenerative air preheater as defined in claim 1 wherein said timing mechanism is periodically actuated by a plurality of cam operated switches.

4. A cleaning system for a rotary regenerative air preheater as defined in claim 1 wherein the timing mechanism and the regulating means for the variable speed motor are simultaneously actuated by a common cam operator.

5. A cleaning arrangement as defined in claim 1 wherein the means regulating the power supply to the variable speed motor is energized by a selector switch cooperating with said cleaning device.

6. A cleaning arrangement as defined in claim 5 wherein the selector switch is energized in response to camming means integral with said cleaning device.

7. A cleaning arrangement for a rotary regenerative air preheater or the like having a cylindrical rotor carrying regenerative heat transfer material first through a gas passage to absorb heat from gas passing therethrough and then through an air passage to impart heat to the air passing therethrough; a pneumatically operated driving mechanism adapted to drive the rotor about its axis; a cleaning device adjacent the rotor having an end thereof free to move across an end of the rotor in response to motor driving means; a timing mechanism periodically interrupting the means driving said cleaning device; and means regulating the flow of pneumatic operating fluid to said rotor driving mechanism.

References Cited in the file of this patent

UNITED STATES PATENTS

2,069,574	Bowers	Feb. 2, 1937
2,204,532	Erbguth et al.	June 11, 1940
2,379,506	Yerrick et al.	July 3, 1945
2,592,705	Jewell et al.	Apr. 15, 1952
2,624,352	Illian	Jan. 6, 1953

FOREIGN PATENTS

462,857	Great Britain	Mar. 17, 1937