Feb. 18, 1941. H. Y. HALL 2,232,000

CLEANER

Filed March 31, 1939 2 Sheets-Sheet 1

Fig. 1.

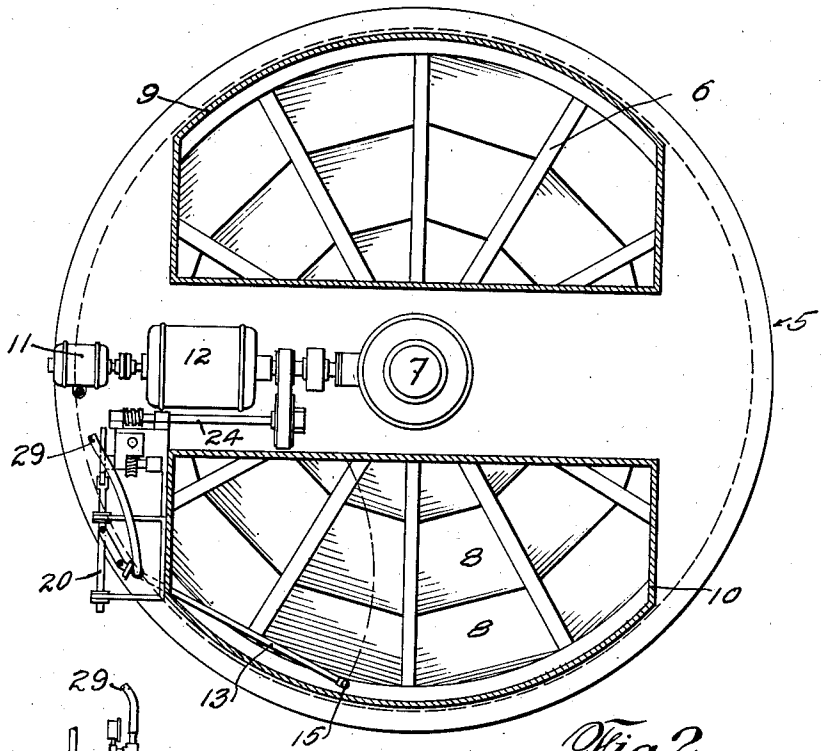

Fig. 2.

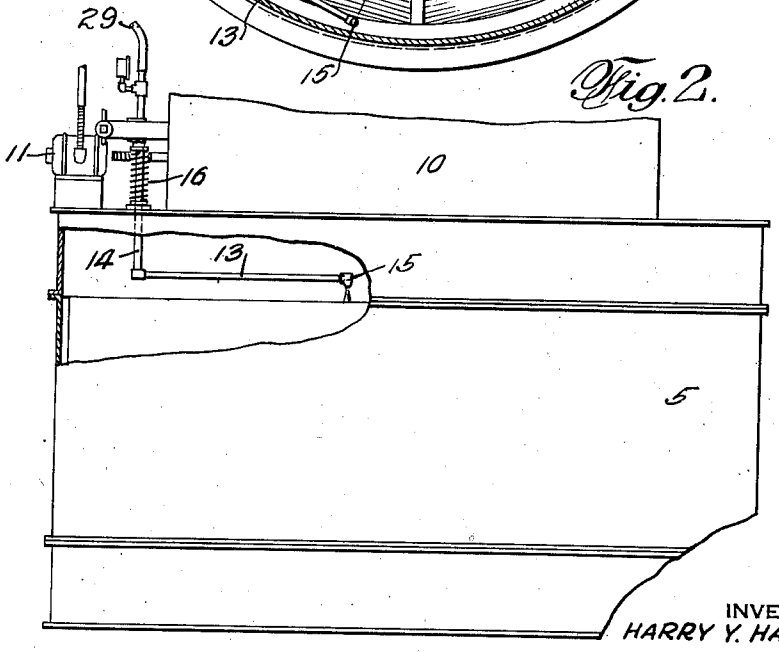

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Fig. 3.

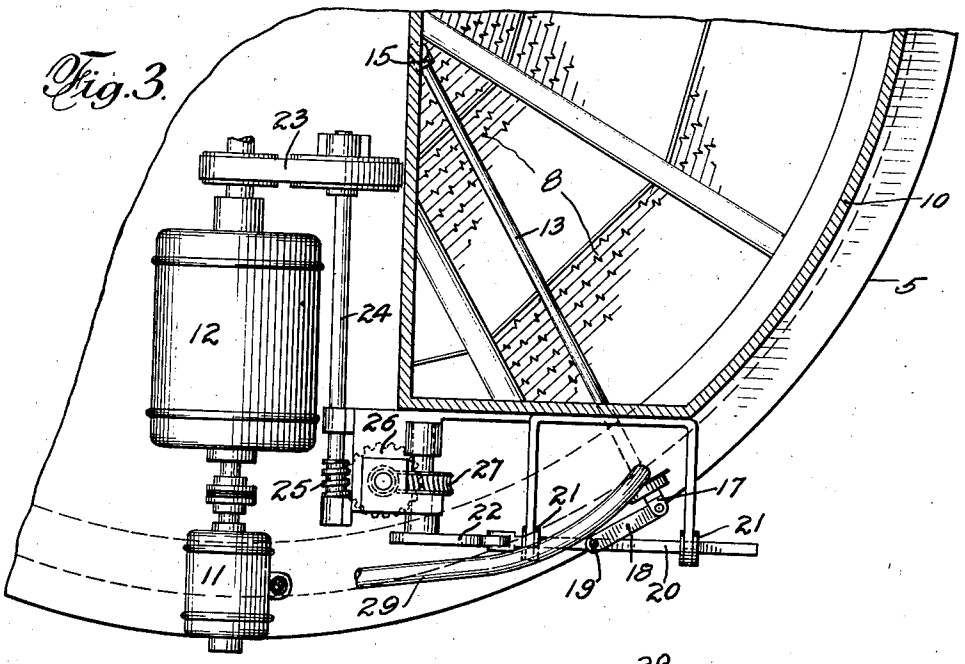
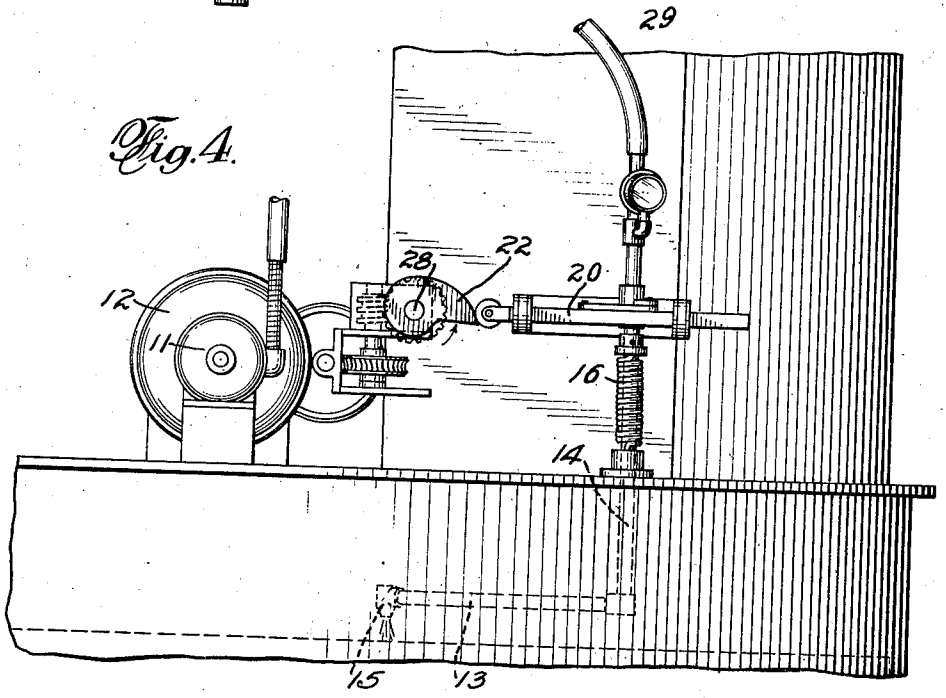


Fig. 4.



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Patented Feb. 18, 1941 2,232,000

UNITED STATES PATENT OFFICE

2,232,000

CLEANER

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Application March 31, 1939, Serial No. 265,178

3 Claims. (Cl. 257—1)

My invention relates to apparatus for cleaning or maintaining clean the cells of an air preheater.

In preheaters of the regenerative type, hot furnace gases are passed through one section of the preheater so as to heat the material defining cells in the preheater, after which the cells are usually rotated into position so as to permit the flow of air to be heated through the previously heated cells so as to abstract heat therefrom and heat the air which is usually used for combustion purposes. The fly ash carried by the hot furnace gases tends to deposit within the cells, thus obstructing the flow of both gases and air and necessitating frequent cleaning. Water jets have been used for the purpose of cleaning the cells and steam soot-blowers have been employed. However, the steam tends to have a corrosive effect on the cells and ducts and often causes the fly ash to be plastered quite securely within the cells, thus to some extent defeating the purpose of the soot-blowers. Such cleaning methods usually require a shut-down of the preheater.

I have devised a novel apparatus for maintaining the cells of an air preheater clean, which apparatus is not subject to the disadvantages heretofore noted and others.

It is the general object of the invention, therefore, to provide an improved apparatus for maintaining the cells of an air preheater clean.

It is another object to provide an improved apparatus for constantly maintaining the cells of an air preheater clean without the necessity for shutting down the air preheater.

Another object is to provide an improved apparatus for maintaining the cells of an air preheater clean and without injurious effects on the heater or the ducts.

Other objects and various features of novelty and invention will be hereinafter pointed out or will become apparent to those skilled in the art.

In the drawings which show, for illustrative purposes only, a preferred form of the apparatus—

Fig. 1 is a top plan view of a regenerative type of air preheater illustrating improved cleaning means, the gas and air ducts being shown in section;

Fig. 2 is a view in side elevation of the parts shown in Fig. 1, parts being broken away;

Fig. 3 is an enlarged, fragmentary top plan view of the heater shown in Figs. 1 and 2; and

Fig. 4 is a view in side elevation of the parts shown in Fig. 3.

The invention will be described as embodied in a so called "Ljungstrom" preheater. Such a heater comprises a casing 5, in which there is a rotor 6 carried by a vertical shaft 7 in the casing. The rotor is of generally cellular construction and comprises a large number of individual vertical cells 8 not unlike the cells of an automobile radiator. The casing is provided with gas and air ducts, the gas outlet duct being shown at 9 and the air inlet duct at 10. Between the cells beneath the two ducts are sealing members (not shown) for preventing the mingling of the gas and air flowing through the respective ducts.

In the form illustrated a lower duct conducts hot products of combustion or furnaces gases upwardly through the heater so that the cells 8 become heated. The cellular rotor is continuously rotated as by means of the motor 11, reduction gear 12 and bevel or other gearing (not shown) for driving the shaft 7. The heated cells are thus transferred to the air duct space and in this case air is directed downwardly through the heater, that is, in a direction opposite to the flow of hot gases through the cells. During the passage of the products of combustion through the preheater fly ash is deposited in the small cells and if not removed will cause a clogging of the heater. It has been found that the fly ash deposits to the greatest extent at the gas outlet side of the cells, that is, in the tops of the cells as shown in the drawings. My invention, as indicated, relates to means for removing the fly ash deposits from the cells before the deposits become sufficiently extensive as to cause a substantial lowering of the efficiency of the heater or a complete shut-down.

My improved apparatus broadly consists in means for jetting the deposited fly ash from the cells with a jet of air preferably directed in the same direction as the flow of air through the cells and simultaneously therewith. The jet preferably traverses the entire cell structure as from the outside of the heater generally towards the axis thereof, so that all the cells will be jetted during the rotation of the cellular rotor.

In the drawings I have illustrated an improved form of mechanism. In the form shown a jet pipe 13 is movably carried by the casing as by being secured to a vertical pipe 14, journaled in the top of the heater casing. The jet pipe 13 carries a nozzle 15 spaced a short distance, say, a few inches above the tops of the cells of the preheater, so as to direct a jet of air downwardly and forcibly through the cells. In one commercial installation I have employed with success a one-quarter inch nozzle of such form as to maintain considerable concentration of the air jet. The jet arm 13 is urged to, say, its outward position, as shown in Fig. 1, by suitable means such as a torsion spring 16 surrounding the journal pipe 14. The journal pipe 14 may have a projecting arm 17 thereon, pivotally connected to a connecting rod 18, which is itself pivotally connected by a pivot pin 19 to a bar 20, slidable in guides 21—21 which are supported from the casing. The torsion spring in the form shown urges the arm 13 to its outermost position and consequently urges the bar 20 towards the left as viewed in Figs. 3 and 4. The jet arm 13 is caused to swing generally radially in-

wardly in order to cause the air jet to traverse the entire cellular structure by suitable means, such as a cam 22, which may be slowly operated by reduction gearing beyond the reduction gear 12. In the form illustrated such reduction gearing may comprise sprockets or pulleys with a chain or belt 23 trained thereover for driving the shaft 24. The shaft 24 may drive a worm 25, which in turn drives the worm wheel 26. The worm wheel shaft in turn carries a worm which drives a worm wheel 27 upon the shaft 28 on which the cam 22 is mounted. The cam 22, as will be seen, is shaped to cause the jet arm 13 to be traversed quite slowly across the cells at the outer side of the heater and to cause the jet to be traversed more quickly as the jet arm approaches the center of the heater. The cam is furthermore formed so that when the jet has completely traversed the heater the jet arm 13 will be quickly moved to its outermost position, all as will be understood from the drawings. Other means, of course, may be employed for actuating the jet arm.

When the device is in operation the cellular rotor operates at a slow speed, say, 3 R. P. M. Such speed under normal conditions gives sufficient time for the heat to be taken up from the products of combustion and to be transferred to the air flowing through the air duct. Air under quite a substantial pressure, say, 100 pounds, is conducted to the air jet, as from the air hose 29. The reduction gearing and cam arrangement are such that the jet arm will be swung so as to cause the air jet of high pressure air to be traversed completely across the heater in, say, twenty minutes. Under ordinary conditions such speed of traverse will permit the cellular rotor to turn 60 revolutions during one traversing motion of the air jet. Under some conditions the air jet may be caused to traverse more slowly and under other conditions at a higher rate, all depending upon the quantity and character of the fly ash being deposited.

It will be seen that the high pressure air jet is directed upon the fly ash deposits where such deposits are the most dense, that is, at the top, when the products of combustion have been caused to flow upwardly as in the present case. The high pressure air jet dislodges the loose fly ash and causes the same to flow downwardly with the air through the heater. The high pressure air being of the same character as the air being heated in no wise dilutes or otherwise affects the same, nor does the air jet, being of the same character as the air flowing through the heater, serve to add any difficulties in the way of increasing corrosion of the heater parts or of the ducts, nor is the cost of maintenance of those parts increased by reason of my improved method and apparatus.

In the preferred form the jetting is carried out continuously, that is to say, while the heater is in operation the cleaner is also operating. It is to be understood, however, that the operation of the cleaner may be intermittent. Furthermore, it is to be understood that I do not wish to be limited to the air pressure noted, nor to details of construction.

My improved apparatus will maintain a preheater in a clean, workable condition indefinitely. The cost of operation is slight and costly shutdowns for cleaning are rendered unnecessary.

While the invention has been described in considerable detail and a preferred form of apparatus illustrated, it is to be understood that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

I claim:

1. In a device of the character indicated, a regenerative heater including a casing, a regenerative heater cell unit rotatable about an upright axis in said casing, a hot gas duct for said casing for conducting hot gases through said cell unit, an air heater duct for said casing for conducting air through said cell unit to be heated, a cleaning jet arm mounted for swinging about an upright axis and of a length to traverse said cell unit in a generally radial direction from the outside to the inside, nozzle means on said jet arm and positioned adjacent said cell unit and in said air duct, means for conducting air under pressure to said jet arm and nozzle to jet accumulations of foreign matter from said cell unit and common means for rotating said cell unit and swinging said jet arm to cause said nozzle to move generally radially over said cell unit, said means for swinging said jet arm including means for swinging the same more rapidly when said nozzle is traversing the radially inward portion of said cell unit than when traversing the radially outward portion thereof.

2. In a device of the character indicated, a regenerative heater including a casing, a regenerative heater cell unit rotatable about an upright axis in said casing, a hot gas duct for said casing for conducting hot gases through said cell unit, an air heater duct for said casing for conducting air through said cell unit to be heated, a cleaning jet arm mounted for swinging about an upright axis and of a length to traverse said cell unit in a generally radial direction from the outside to the inside, nozzle means on said jet arm and positioned adjacent said cell unit, means for conducting cleaning fluid under pressure to said jet arm and nozzle to jet accumulations of foreign matter from said cell unit, and means for automatically swinging said arm and jet nozzle to cause the latter to move over said cell unit while said cell unit is rotating, said last mentioned means including means for swinging said jet arm more rapidly when said nozzle is traversing the radially inward portion of said cell unit than when traversing the radially outward portion thereof.

3. In a device of the character indicated, a regenerative heater including a casing, a regenerative heater cell unit rotatable about an upright axis in said casing, a hot gas duct for said casing for conducting hot gases through said cell unit, an air heater duct for said casing for conducting air through said cell unit to be heated, a cleaning jet arm mounted for swinging about an upright axis and of a length to traverse said cell unit in a generally radial direction from the outside to the inside, nozzle means on said jet arm and positioned adjacent said cell unit and in said air duct, means for conducting air under pressure to said jet arm and nozzle to jet accumulations of foreign matter from said cell unit, and means for automatically swinging said jet arm and nozzle means slowly across said cell unit and quickly returning said jet arm and nozzle means while said cell unit is rotating.

HARRY Y. HALL.