July 3, 1945. W. D. YERRICK ET AL 2,379,506

ROTOR OPERATED WASHING NOZZLE

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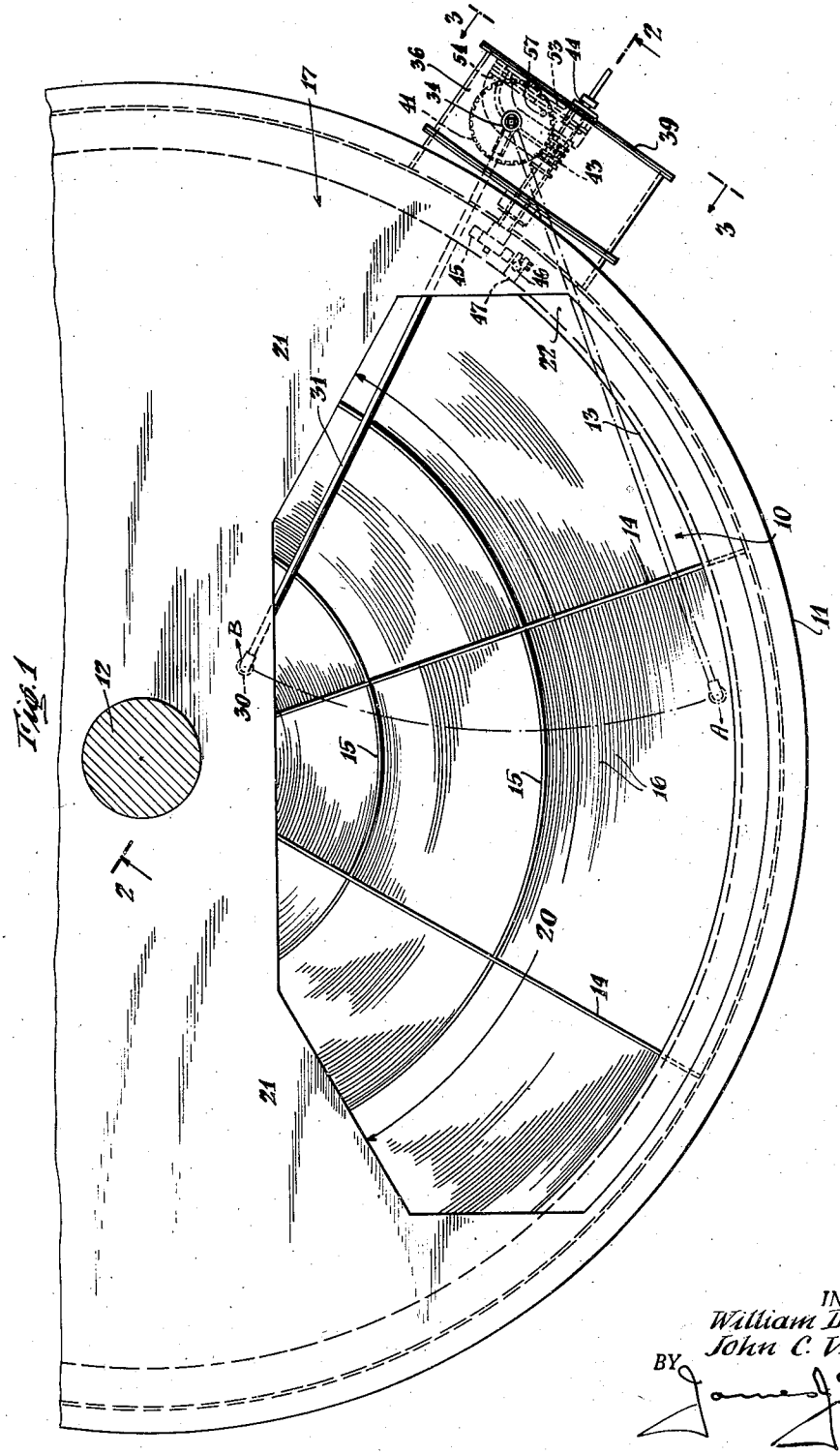


Fig. 1

INVENTORS
William D. Yerrick
John C. Vickland
BY
ATTORNEY

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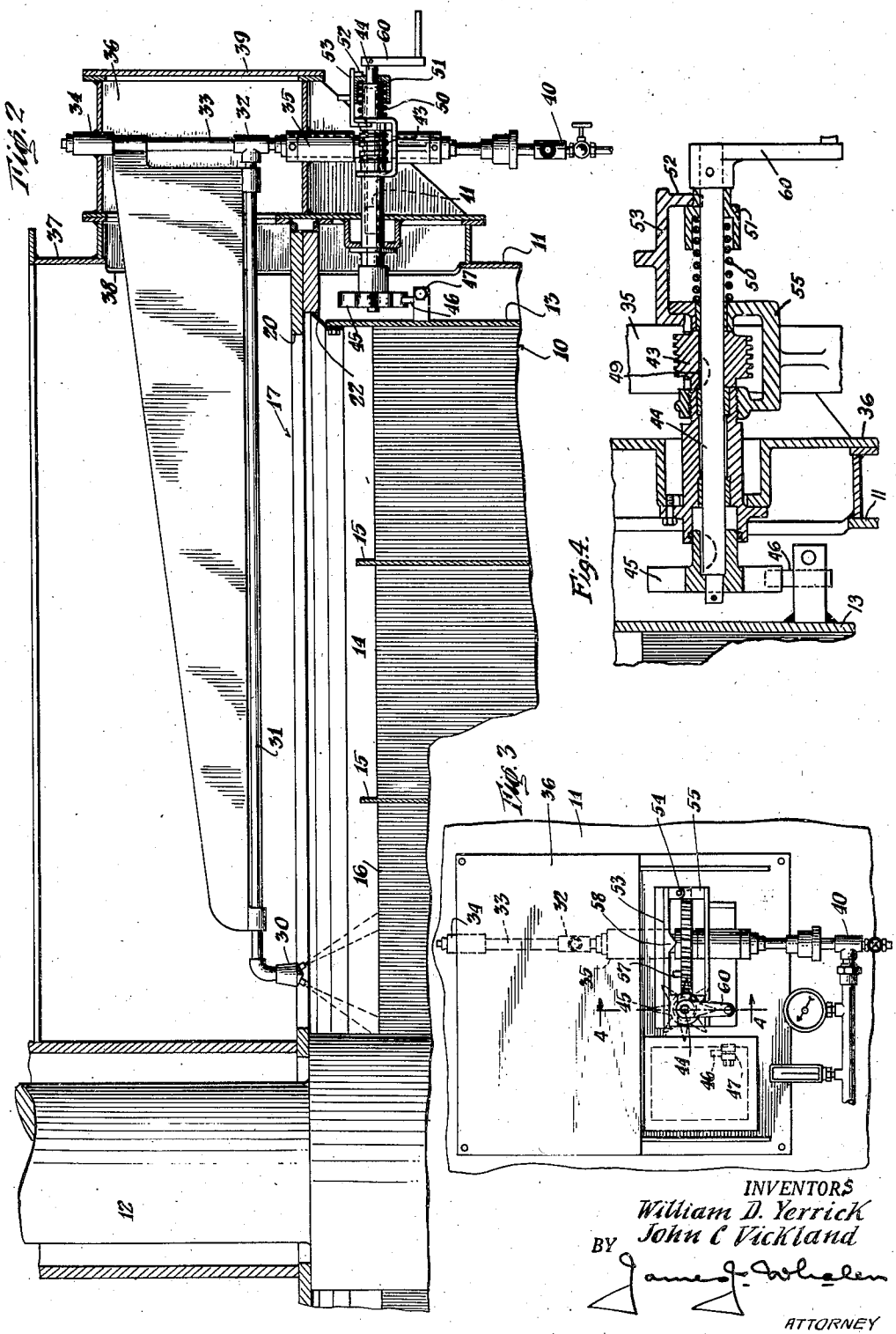


Fig. 2

Fig. 4

Fig. 3

INVENTORS
William D. Yerrick
John C Vickland
BY James J. Wheeler
ATTORNEY

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ROTOR OPERATED WASHING NOZZLE

William D. Yerrick and John C. Vickland, Wellsville, N. Y., assignors to The Air Preheater Corporation, New York, N. Y.

Application August 13, 1943, Serial No. 498,498

1 Claim. (Cl. 257—1)

The present invention relates to heat transfer apparatus and particularly to improved devices for cleaning the heat transfer surfaces of such apparatus.

The invention is especially concerned with the cleaning of the heat transfer surfaces in a rotary regenerative air preheater of the Ljungstrom type such as is disclosed in Patent 1,558,445. In this apparatus the heat transfer surface consists of spaced metallic plates mounted in a rotor turning to position them first in the path of gases to absorb heat and then in an air stream to impart the heat thereto. Soot and other deposits entrained in the gases accumulate on the heat transfer plates and therefore it is desirable to clean them to maintain the efficiency of the heater. One method of cleaning them is with jets of water, and the present invention contemplates provision of a cleaning nozzle in the air passage movable across the heat transfer plates and actuated directly by the rotor body when it is in operation.

The present 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 partial plan view of an air preheater equipped with cleaning apparatus embodying the present invention;

Figure 2 is a fragmentary sectional elevation as viewed on the line 2—2 in Figure 1;

Figure 3 is a fragmentary side elevation as viewed on the line 3—3 in Figures 1 and 2; and

Figure 4 is a vertical sectional view on an enlarged scale as seen on the line 4—4 of Figure 3.

The apparatus comprises a rotor, designated as a whole by the numeral 10 mounted within a housing 11, the rotor being driven at slow speed through its centrally located rotor post 12 by a motor, not shown. The rotor 10 consists of a cylindrical shell 13 interiorly divided by radial partitions 14 into a plurality of wedge or sector-shaped compartments, these partitions securing the shell to the rotor post. Circumferentially extending partitions or diaphragms 15 mounted concentrically with the rotor post 12 subdivide the sector-shaped compartments into a number of sections, each of which contains a plurality of metallic heat transfer plates 16 maintained in spaced relation to provide passages therebetween for the flow of gas and air axially of the rotor. Opposite each end of the rotor a stationary sector plate 17 is provided formed with openings for the flow of gas and air, the air opening being designated 20 in Fig. 1. The gas passage does not appear in the drawings. The air and gas openings in the sector plate are separated by its imperforate portions 21 which are at least as wide as the maximum width of the sector-shaped compartments of the rotor so that radial seals 22 on the partitions 14 by wiping against the parts 21 prevent cross flow of air and gas between their respective passages. The construction described above is conventional.

The washing apparatus comprises a nozzle 30 disposed in the air passage opposite the heat tranfer plates 16 for directing jets of cleaning fluid upon them as they pass slowly beneath the nozzle while the latter is moved step by step in an arcuate path from the rim of the rotor towards its center. The nozzle 30 is carried at the inner end of a pipe 31 provided at its outer end wtih a T 32 connecting it with a hollow shaft 33 journalled for rotation about a vertical axis in bearings 34, 35 mounted in the top and bottom plates of a box-like housing 36 projecting outwardly from the connecting plate 37 that forms an extension of the side wall of housing 11. To permit oscillation of nozzle pipe 31 a slot 38 of required size is provided opposite the outer wall 39 of the box-like housing, the escape of air being prevented by the housing that encloses the outer end of the nozzle pipe. Water is supplied to the oscillation nozzle pipe 31 from a supply pipe 40, a suitable connection permitting the rotation of the hollow shaft 33 while maintaining fluid communication between it and the supply pipe 40.

For effecting rotation of the shaft 33 and movement of the nozzle pipe 31 in an arcuate path the shaft is provided with a worm wheel 41 meshing with a worm 43 carried by a shaft 44 disposed transversely with respect to shaft 33 and extending through the side wall of the housing 11 to a position closely adjacent the rotor shell 13 where it is provided with a star wheel 45. Wheel 45 is engageable by a pin 46 mounted on a bracket 47 projecting from the rotor shell 13. Several pins 46 may be spaced about periphery of the rotor 10 or only one may be utilized depending upon the number of increments of movement it is desired to impart to the nozzle pipe 31 for each rotation of the rotor. The relative speed of movement of the rotor 10 and nozzle pipe 31 and consequently the period of time required for moving the nozzle 30 from the outermost point A to the innermost point B of its arcuate path movement are determined by the speed of rotor 10, the num-

ber of pins 46 carried thereby and the gear ratio of worm 43 and worm wheel 41.

From the above it may be seen that each rotation of rotor 10 imparts one or more increments of movement to the nozzle 30 and thereby causes it to be displaced inwardly above the heat transfer surface 16 a pre-determined distance over its arcuate range for each rotation of the rotor. When the nozzle reaches the innermost point B in its travel the operating mechanism for advancing the nozzle pipe 31 step by step must be disconnected to avoid breakage. This is controlled by the mechanism presently to be described.

The worm 43 while rotatable by the shaft 44 that carries the star wheel 45 is not fixed thereto. A longitudinal or axial key connection 49 between worm 43 and the shaft 44 permits axial movement of the latter, while worm 43 is held in bracket 55, to carry star wheel 45 outwardly into a position beyond the circular path of movement of the pin 46 carried by the rotor 10. The shaft 44 is biased to its outer position by a spring 50 mounted between the bracket in which the shaft is journalled and a sleeve or collar 51 located outwardly thereof. However the shaft is held in position to maintain the star wheel 45 aligned with the path of pin 46 by a stop or pin 52 carried by a locking lever 53 and engaged with the outer face of the collar 51 so as to prevent the spring 50 from moving the star wheel 45 from its operative position. Lever 53 is pivoted at 54 on the bracket 55 so that when the nozzle 30 has been moved to the inner point B of its traverse, a pin 57 on the worm wheel 41 of the driving mechanism engages a cam 58 on the under side of the locking lever 53 and raises it. When the locking lever 53 is in its raised position the pin 52 is disengaged from the spring sleeve or collar 51, permitting the spring to move the shaft 44 outwardly in an axial direction to position the star wheel 45 so that it is no longer engageable by the pin 46 carried by the rotor. Consequently the rotor may continue to turn without traversing the nozzle 30 across the air passage above the heat transfer plates.

At its outer end the shaft 44 is provided with a crank 60 by means of which it may be reversely rotated sufficiently to retract the pin 57 on worm wheel 41 from engagement with cam 58 on the locking lever 53, so that when the shaft 44 is pressed inwardly (compressing spring 50) the pin 52 on the locking lever 53, again falls behind the spring sleeve or collar 51 thereby again holding the star wheel 45 in position to be actuated by the pin or pins 46 on the rotor. The crank 60 may be utilized to turn shaft 44 reversely to an extent sufficient to shift the washing nozzle 30 from its inner position B to its outer position A. This may be done before moving the shaft 44 inwardly to reposition star wheel 45 in its operative position. In any event inward movement of the shaft 44 should be accomplished at a time either when the rotor is not turning or during the interval when a pin 46 carried thereby has not reached the position of the star wheel 45 in order to avoid possibility of damage. The crank 60 may be employed for manually traversing the nozzle 30 across the heat transfer plates to wash them at times when the rotor 10 is not operating, turning of the latter being then effected by hand. While the rotor is turning the crank may also be used in the intervals between periodic engagements of the pin 46 with the star wheel 45 to traverse the nozzle more rapidly across the heat transfer surface.

What we claim is:

In an air preheater or the like having a housing formed with parallel passages for hot gases and air, a rotor for carrying heat transfer plates into the gas pass to absorb heat and then into the air passage to impart the heat thereto, and a cleaning nozzle mounted for movement transversely of the rotor for directing fluid onto the heat transfer plates carried thereby, a shaft operatively associated with said nozzle, and means operatively connecting said rotor and said shaft for actuating the latter during operation of said rotor so as to move said nozzle transversely of the rotor; means supporting said shaft for axial movement; locking means for holding said shaft against said axial movement; means operative upon movement of said nozzle to a predetermined point in its arcuate path for releasing said locking means; and means adapted on release of said locking means to move said shaft axially to interrupt its operative connection with said rotor for discontinuing the movement of said nozzle.

WILLIAM D. YERRICK.
JOHN C. VICKLAND.