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RETRACTABLE CLEANER FOR ROTARY REGENERATIVE HEAT EXCHANGER

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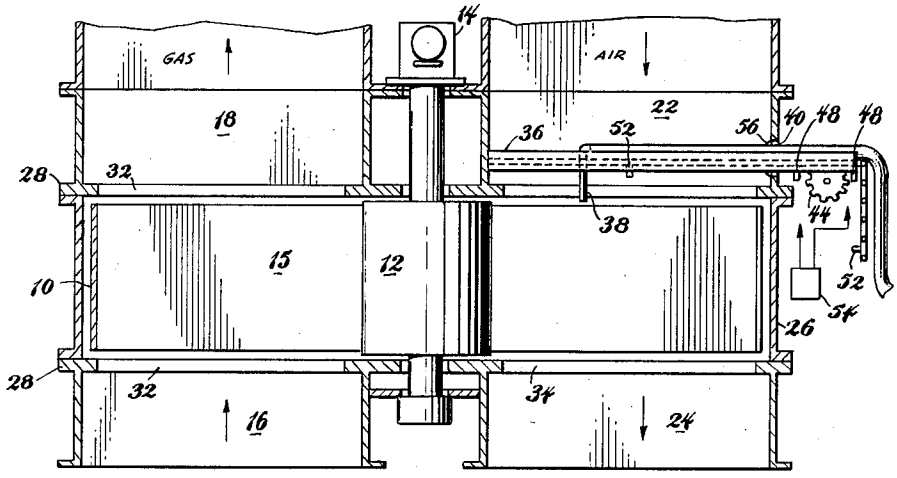

Fig. 1

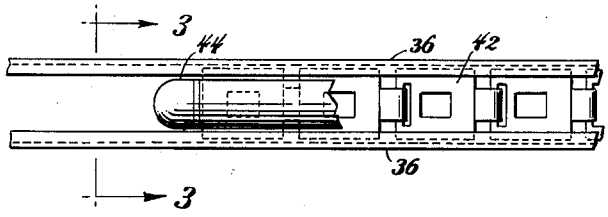

Fig. 2

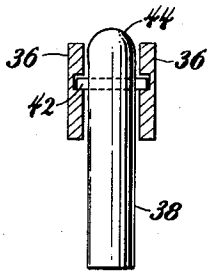

Fig. 3

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RETRACTABLE CLEANER FOR ROTARY REGENERATIVE HEAT EXCHANGER

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This invention relates to cleaning apparatus for heat exchangers, and particularly to a reciprocating type cleaning apparatus that progressively removes deposits of soot, fly-ash and other foreign matter from the heat absorbent surface of a heat exchanger.

Various attempts have been made to design apparatus for cleaning the heat absorbent surfaces of a rotary regenerative heat exchanger during its operation in order that the surfaces may be at all times maintained substantially free from undesirable deposits. Cleaning apparatus has assumed various forms, one of the more common being a tubular arm pivotally mounted adjacent to the outer housing of the heat exchanger in order that a nozzle carried by the tubular arm may be moved arcuately over the heat exchanger surface to subject it to a supply of cleaning fluid being supplied to the nozzle. As the size requirements of heat exchanger apparatus has been continuously increasing in accordance with modern power requirements, the size of the cleaning device apparatus required has also increased until further increase in size of a non-supported cleaning arm is impractical.

Radially supported cleaning apparatus has been used effectively. However, such apparatus usually requires a support structure outside the heat exchanger housing having substantially the same radial proportions as that required within the heat exchanger structure. Thus with rotary regenerative heat exchange apparatus being constructed with a radius of fifteen feet or more, it is apparent that support structure that extends a similar distance outside the housing must be provided to support the cleaning apparatus when it is in a retracted position. Such space requirement is at best difficult to provide, expensive, and in many instances due to the machinery arrangement required, actually prohibitive.

The present invention therefore attempts to provide a reciprocating cleaning apparatus for a rotary regenerative heat exchanger that is strongly supported within the heat exchanger housing but which requires no support and occupies little space outside of the housing. The exact manner in which this arrangement is carried out 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 sectional elevation in diagrammatic form of a rotary regenerative heat exchanger that embodies the invention;

FIGURE 2 is a plan view of the cleaning apparatus; and

FIGURE 3 is a side view of the nozzle arrangement as seen from line 3—3 of FIGURE 2.

In the drawing the numeral **10** designates the cylindrical shell of a rotor that is divided into sector-shaped compartments by radial partitions that extend radially between the rotor shell and a rotor post **12**. The rotor is driven about its axis by a motor and reduction gearing arrangement shown generally at **14**. The sectorial compartments contain heat absorbent material **15** commonly in the form of spaced metallic plates that provide a multiplicity of sub-compartments through which a heating fluid and a fluid to be heated are alternately directed in order that heat from the heating fluid may be passed to the fluid to be heated. The heating fluid enters the rotor through a duct **16** from a boiler or other source of usually contaminated hot gas and is discharged, after passing over the heat absorbent material **15**, through an outlet duct **18** to which an induced draft fan (not illustrated) is usually attached. As the rotor is turned about its axis the heated plates **15** are moved into the duct through which the fluid to be heated is directed. The fluid to be heated such as air enters the rotor through a duct **22** and after passing over the heated plates **15** and absorbing heat therefrom, is discharged through a duct **24** to a boiler furnace or other place of use. A housing **26** enclosing the rotor **10** is provided at either end with end or sector plates **28** which are apertured at **32** and **34** to permit the fluid streams to flow continuously through the rotor.

Since the heating fluid directed through the rotor is usually contaminated with dust, fly ash or other contaminants, deposits of these contaminants are commonly left on the surfaces of the heat absorbent plates to the extent that the flow passageways through the compartments may become plugged or at least so laden with deposits that the fluid flow is greatly retarded.

In order that deposits of contaminants may be removed from the walls of the compartments, the present invention provides a cleaning means that is moved radially over the rotor on a pair of mutually facing channel members **36** that are spaced apart to permit the nozzle **38** to pass therebetween and to be held in confronting relationship with the end of the rotor. The channel members are illustrated as extending radially across duct **22** with their radially outer extremities passing through an opening **40** in said duct and extending to a point somewhat removed from the outer housing wall. A square link gear chain **42** is slidably fitted into opposing channels **36** and is passed radially out through opening **40** to the end of channel members **36** where the absence of support by channel members **36** permits the free outer end thereof to hang down substantially parallel to the housing wall. The end of the chain **42** that lies within the channels **36** is secured to the nozzle **38** while the entire chain supports a flexible hose **44** that leads to the nozzle from a suitable source of cleaning fluid maintained outside housing **26**.

A drive motor having a gear means **46** intermeshing with gear chain **42** is mounted subjacent the channels **36** on the outer side of housing **26** to move the nozzle radially over the rotor. Limit switches **48** when contacted by actuators **52** that are carried by the gear chain **42** energize a relay **54** that reverses the direction of the motor and the movement of the chain **42** when the nozzle has moved radially its predetermined distance.

In practice a sealing means **56** is provided in opening **40** around the track **36** and flexible hose **44** to preclude leakage of fluid out of duct **22**. Although a protective housing could be constructed around the portion of the cleaning apparatus that lies outside of the rotor housing **26** and duct **22**, it is not deemed essential to its protection.

In operation, actuation of the cleaning apparatus may be effected either continuously or intermittently during normal rotation of the rotor. The nozzle **38** is moved radially over the rotor while water, steam, air or other cleaning fluid is ejected therefrom onto a small section of the rotor where it dissolves or otherwise removes the deposits therefrom and entrains them in the air stream flowing through the rotor. Radial movement of the cleaning means continues until an actuator **52** contacts a limit switch **48** at which time the relay **54** reverses the drive **44** and moves the chain **42** and nozzle **38** in a reverse direction. As the chain **42** reaches the radial outer end of track **36** it becomes completely unsupported and loses the directional stability it had when embraced by the channel means **36** within the duct **22**. Thus when not supported by channel means **36** the chain hangs freely at

the side of the heat exchanger and does not interfere with the arrangement of other adjacent machinery.

While for the purposes of illustration and ease of description the invention has been disclosed as applying to a rotary regenerative heat exchanger it is understood that numerous changes may be made without departing from the spirit of the invention, and that the device could readily be adapted for use with other types of apparatus. It is moreover 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 I claim is:

1. In apparatus having a housing divided into a plurality of open-ended compartments adapted to direct a contaminated gas therethrough, cleaning means for the supply of a cleaning fluid to said compartments to remove deposits of contaminants therefrom, said cleaning means comprising a nozzle confronting the open ends of said compartments, a hose for the supply of a cleaning fluid to said nozzle, a radially disposed track within said housing adjacent the open ends of said compartments providing a support for said nozzle, and a drive mechanism moving said nozzle over said track including limp drive means having directional stability only when guided by said track.

2. In apparatus having a housing with partitions that divide the housing into a plurality of open-ended compartments that direct a contaminated gas therethrough, cleaning means for the supply of a cleaning fluid to said compartments to remove deposits of contaminants therefrom, said cleaning means including a nozzle confronting the open ends of the compartments, a flexible hose having one end thereof connected to said nozzle for the supply of cleaning fluid thereto, a track extending across the housing adjacent the open ends of said compartments to provide a support for the nozzle, a drive means connected to said nozzle and supported by said track adapted to move said nozzle across said housing, said drive mechanism comprising essentially a length of linked chain having directional stability only when in engagement with said track.

3. In apparatus having a housing with partitions that divide the housing into a plurality of open-ended compartments that direct a contaminated gas therethrough, cleaning means for the supply of a cleaning fluid to said compartments to remove deposits of contaminants from the walls of said compartments, said cleaning means including a nozzle confronting the open ends of said compartments, a flexible hose having one end connected to said nozzle for the supply of a cleaning fluid thereto, a track comprising a pair of channel means spaced apart to permit movement of the nozzle therebetween, an open ended drive chain having one end thereof connected to said nozzle and supported by the spaced channels, and driving means engaging said chain outside said housing at a point adjacent an end of said track to move said nozzle across said housing.

4. In apparatus having a housing with interior partitions that divide the housing into a plurality of open-ended compartments for the flow of a contaminated gas therethrough, cleaning means for the supply of a cleaning fluid to said compartments to remove deposits of contaminants from the walls thereof, said cleaning means comprising a nozzle confronting the open ends of said comportments, a flexible hose having one end connected to said nozzle, channel means extending across said housing to provide a track supporting said nozzle for movement with respect thereto, a length of parallel link chain having an end connected to said nozzle and supported by said channel means, and means adjacent an end of said track engaging said chain means to move the nozzle across the housing whereby fluid from the nozzle may be supplied to the walls of said compartments to remove the deposits therefrom.

5. Apparatus as defined in claim 4 wherein the channel means supporting said nozzle comprises a pair of spaced channel members having their open sides in confronting relationship to receive parallel sides of said chain means.

6. Apparatus as defined in claim 5 having means responsive to movement of said chain adapted to effect reciprocation of said cleaning means between opposite sides of said housing.

7. In regenerative heat exchange apparatus having a rotor including a cylindrical rotor post and a concentric rotor shell, radial partitions extending between the rotor post and rotor shell to form sectorial compartments that carry a mass of heat transfer material, a housing surrounding the rotor to provide an annular space therebetween, end plates at opposite ends of the housing provided with circumferentially spaced apertures that direct the flow of a heating fluid and a fluid to be heated to and through the heat transfer material carried by the rotor, cleaning means for supplying a cleaning fluid to said heat transfer material, said cleaning means comprising a nozzle, a flexible hose for the supply of cleaning fluid to said nozzle, a radial track axially spaced from said rotor providing a support for said nozzle confronting the rotor, and a drive mechanism for said nozzle including a length of linked chain extending radially over the rotor when guided by said track within said housing and hanging loosely beside said housing when not guided thereby.

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