Oct. 29, 1968 D. K. GRIFFITHS ET AL 3,408,058

ANTI-CLOGGING FURNACE REGENERATOR

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FIG. 1.

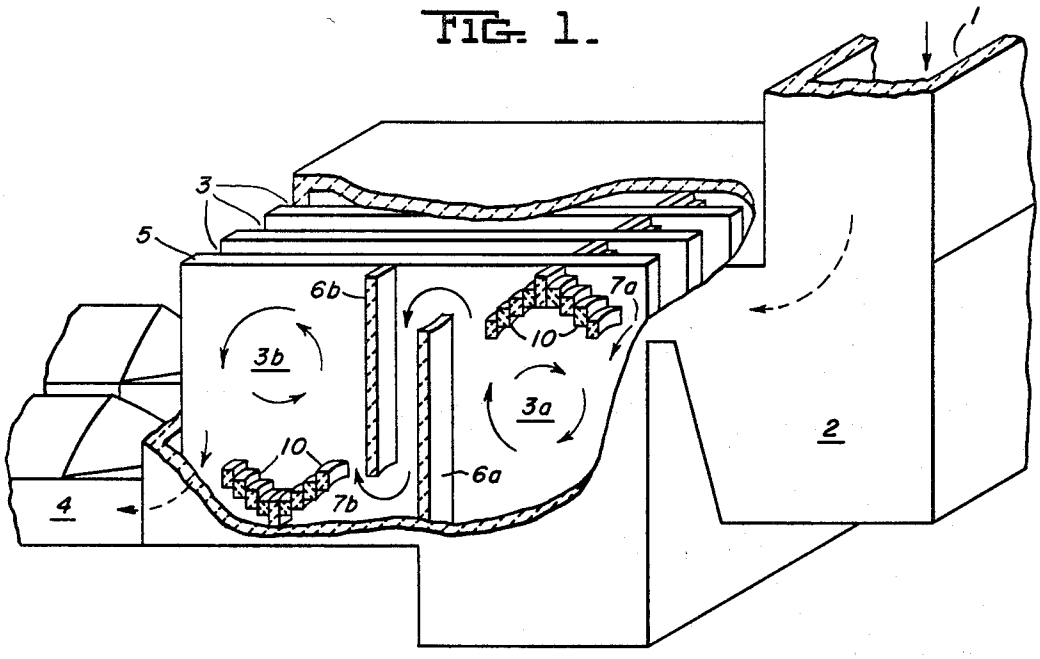
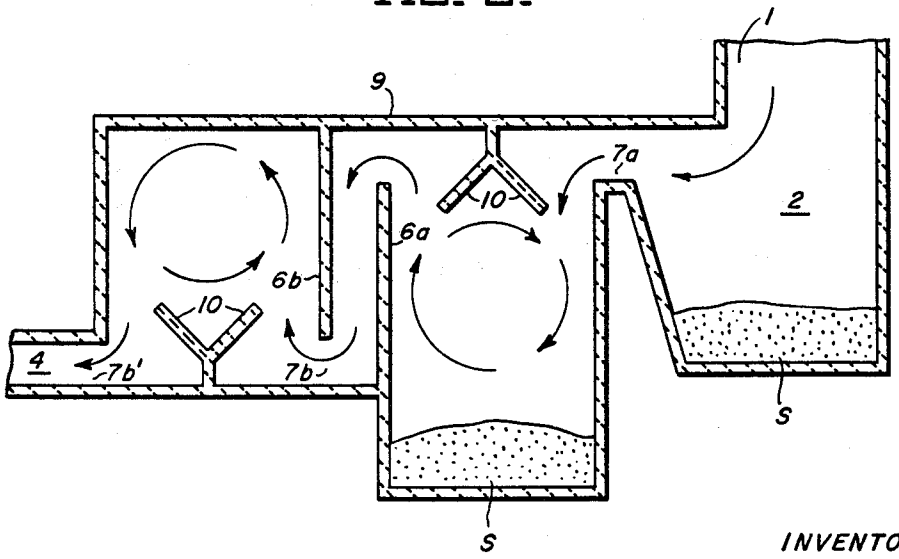


FIG. 2.



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FIG. 3.

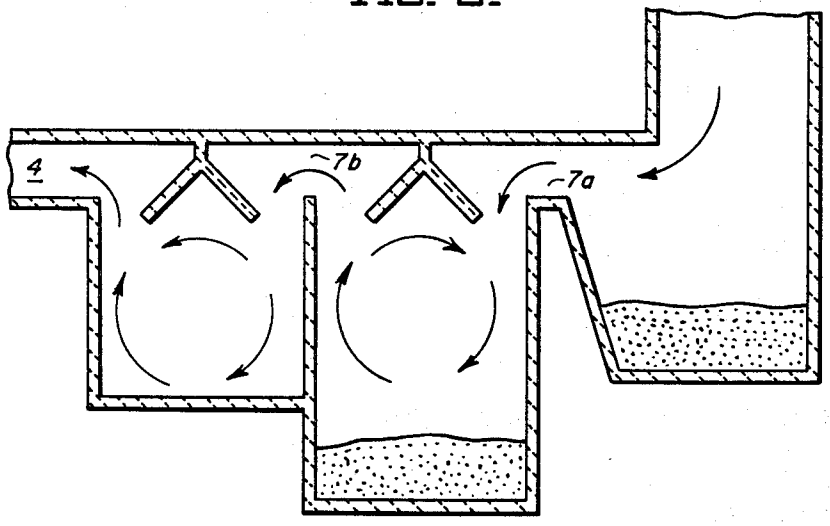
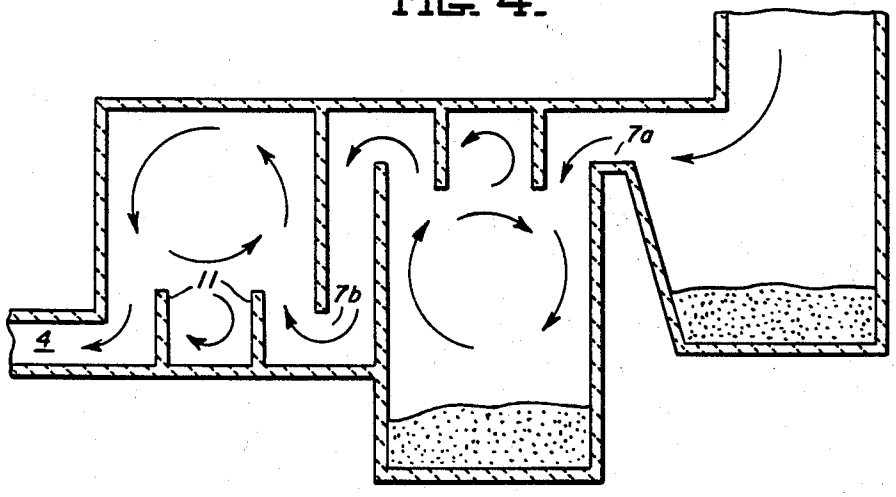


FIG. 4.



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FIG. 5.

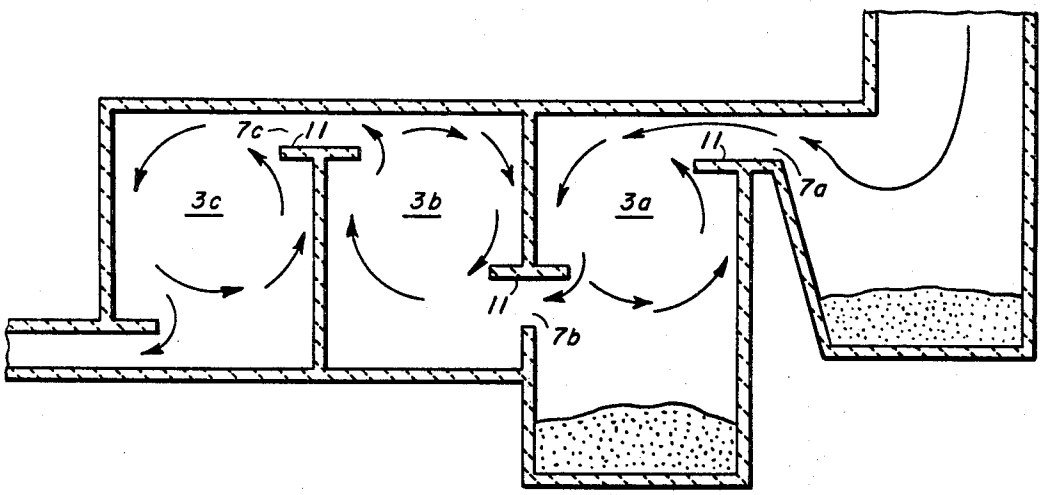


FIG. 6.

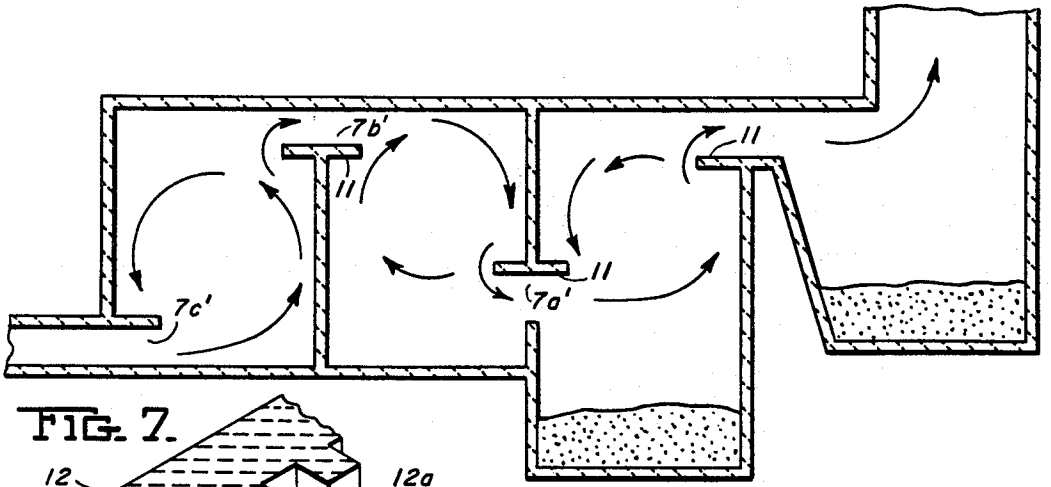
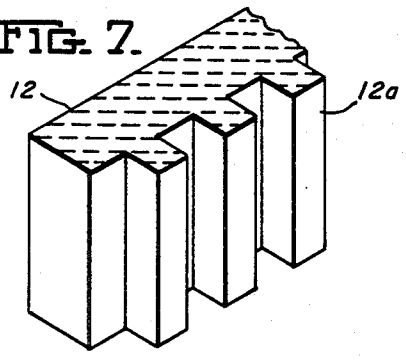


FIG. 7.



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ANTI-CLOGGING FURNACE REGENERATOR

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2 Claims. (Cl. 263—19)

ABSTRACT OF THE DISCLOSURE

A regenerator for two-way fired industrial furnaces, which replaces conventional regenerators having closely-spaced checker work construction with units having relatively open chambers adapted to provide cyclonic flow in alternating directions.

This invention relates to a construction for regenerators in industrial two-way fired furnaces, glass tank furnaces, and other furnaces which use regenerators to supply preheated air for combustion, and is characterized by permitting the elimination of conventional checker-flue construction, with its maize of small passages which impart inherent flue dust clogging and other maintenance difficulties.

The invention permits regenerators of relatively more open construction, which results in fabrication and maintenance advantages, as well as relatively unobstructed draft, while retaining high thermal efficiency. These advantages stem primarily from the provision of heat exchange chambers characterized by a capability of imparting a strongly rotary or cyclone-type motion to the gases passing therethrough, in both the input and exhaust cycles, the axis of the vortex being horizontal.

The principles of the invention, and modes for their effectuation, will become further apparent, in conjunction with reference to the drawings, wherein:

FIGURE 8 is an isometric view of a regenerative chamber construction of the invention, with parts broken away to show interior construction. The arrows depict gas flow direction during a waste gas exhaust cycle;

FIGURE 2 is a diagrammatic cross-sectional view, in elevation of FIGURE 1;

FIGURES 3, 4 and 5, are views similar to those of FIGURE 2, and present modifications of the structure thereof;

FIGURE 6, identical in construction with FIGURE 5, typifies the air cycle, which is in the reverse direction of flow, as compared to the exhaust cycle of FIGURES 1 to 5; and

FIGURE 7 is a fragmentary section of fin type chamber liner.

Referring primarily to FIGURES 1 and 2, but with functionally similar elements being similarly designated throughout the drawings, it will be noted that exhaust gases from the furnace, not shown, travel through downtake **1** to conventional slag pocket **2**, and thence through a parallel array of several series of chambers through which the gases flow in a vortical-flow pattern, as depicted by the arrows. These chambers are collectively designated **3**, with individual chambers being designated **3***a*, *b*, and *c*. On the pass of FIGURE 1, the gases exit through stack flue **4**.

The vortical-flow chambers have vertical longitudinal side walls generally designated **5** and transverse vertical side walls generally designated **6**. The latter have gas flow ports therein, generally designated **7**, with ports adjacent to lettered chambers bearing similar suffixes. The ports,

particularly in regions where flue dust may accumulate, are located well above the bottoms of walls **6**.

Transverse side walls **6***a* and **6***b* of FIGURES 1, 2, and 4 provide a dummy pass for the purpose of permitting a bottom connection to stack flue **4**, to accomodate commonly existing furnace arrangements. FIGURES 5 and 6 depict another arrangement for accomplishing this purpose, while FIGURE 3 shows an elevated stack flue arrangement for new furnace construction.

Floor **8** and roof **9** complete the outlines of the chambers.

Transverse gas flow deflector walls **10**, as shown in FIGURES 1, 2, and 3 are preferred. These are constructed of brick athwart the chambers. Arched bricks, as shown in FIGURE 1, are preferably employed for strength.

Other arrangements of gas deflection, possibly offering some advantages of simplicity of construction, but with some sacrifice of effective heat-transfer surface area, as compared to the FIGURE 1 design, are presented in FIGURES, 4, 5, and 6. In this design baffles **11** assist in achievement of desired cyclonic flow.

Gas deflector walls **10** and baffles **11** are arranged, in conjunction with ports **7**, to provide an orifice-type flow for gas entering a chamber, Also, deflector walls **10** are curved at their inner faces to aid rotary gas flow. The openings between the chambers are desirably of graduated size, to account for changes in flue gas density with decrease of temperature as the gases progress through the unit.

Just as ports **7***a* and **7***b*, for example, cooperate with deflectors **10** or baffiles **11** to produce a peripheral jet stream for inducing vortical flow within the chambers in the exhaust cycle, so do ports **7***b'* and **7***a'*, shown in FIGURES 2 and 6, cooperate with the elements **10** or **11** to produce similar vortical flow excitement on the air cycle, to obtain efficient heat pick up.

The gases enter the individual chambers tangentially to the vortex. Ash and solid contaminants in the exhaust gases are thrown out by the centrifugal action of the circular flow pattern. Also, the centrifugal action of the vortex tends to concentrate the hotter, lighter gases near the axis and the colder, heavier gases toward the periphery. Thus, during the exhaust cycle, the colder gases will tend to move preferentially through the system toward the stack flue, and the hotter gases will tend to recirculate in the chamber until they become cooler.

The spacing between longitudinal walls **5** is preferably between about 16 and 24 inches, to permit passage of a man between them during rebuilding and to attain a high efficiency of radiant heat transfer during the exhaust cycle.

S represents slag and flue dust, which readily drops off of the vertical walls and roof, and settles to the bottom.

The chambers may be lined with finned material, of the type depicted schematically in FIGURE 7, composed of a base **12** and fins **12***a*. The fins are preferably installed to coincide with the direction of gas travel. They are for the purpose of improving heat exchange efficiency.

While several examples of the invention have been outlined in some detail, these are to be regarded as illustrative, to permit ready practice of the invention, and not as restrictive thereof.

We claim:

1. A furnace regenerator comprising a succession of chambers of sufficiently open interior construction to permit passage of a man, ports permitting two way flow therethrough, said ports, in areas of high flue dust concentration, being located a substantial distance above the chamber floor, means cooperating with said ports to pro-

duce a peripheral jet type flow in either direction, whereby a cyclonic flow, with horizontal axis, is induced within the chamber.

2. In two-way fired industrial furnace operation the steps of:

(a) passing waste gas, during the exhaust cycle, through a succession of chambers having open interior construction and means for imparting cyclonic flow to said gas, and

(b) subsequently passing input cycle gas through the aforementioned chambers in reverse direction, said chambers having means for imparting cyclonic flow to said gas.

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