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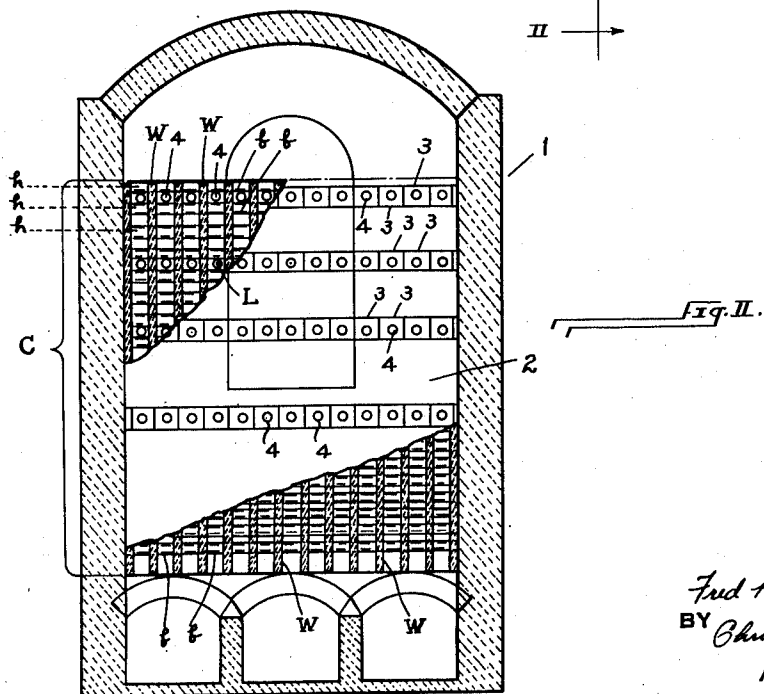
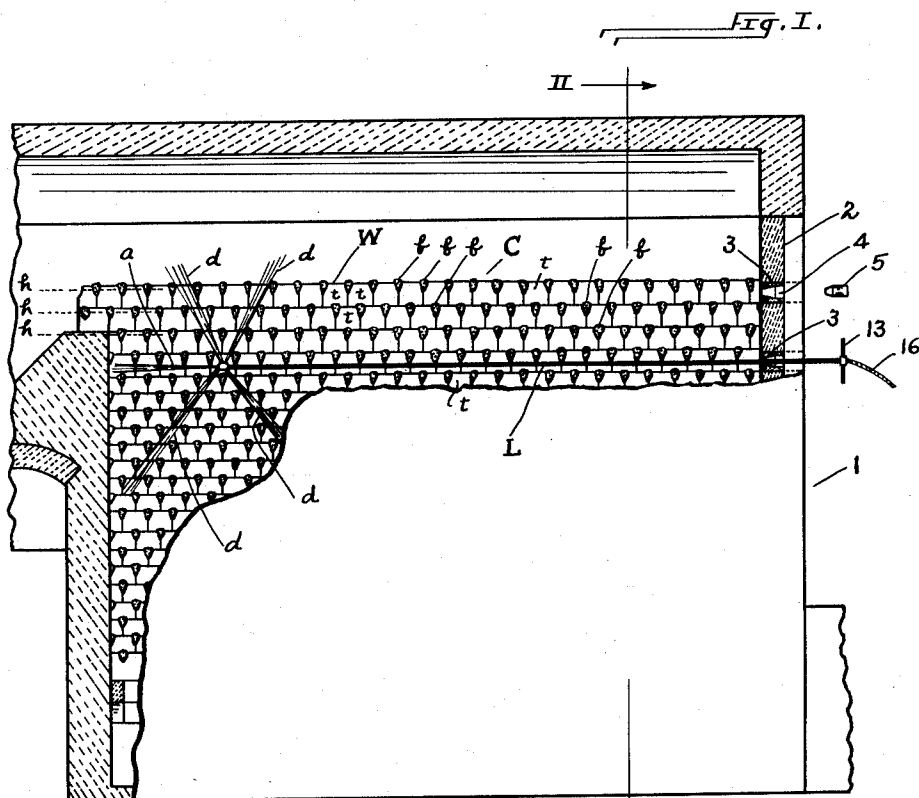
F. H. LOFTUS

2,136,113

METHOD OF CLEANING CHECKERWORK

Filed Dec. 15, 1936

2 Sheets-Sheet 1



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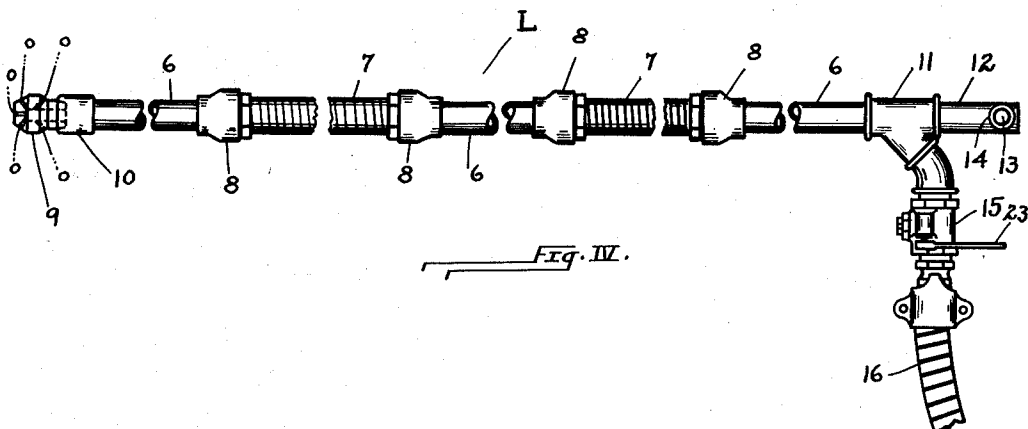
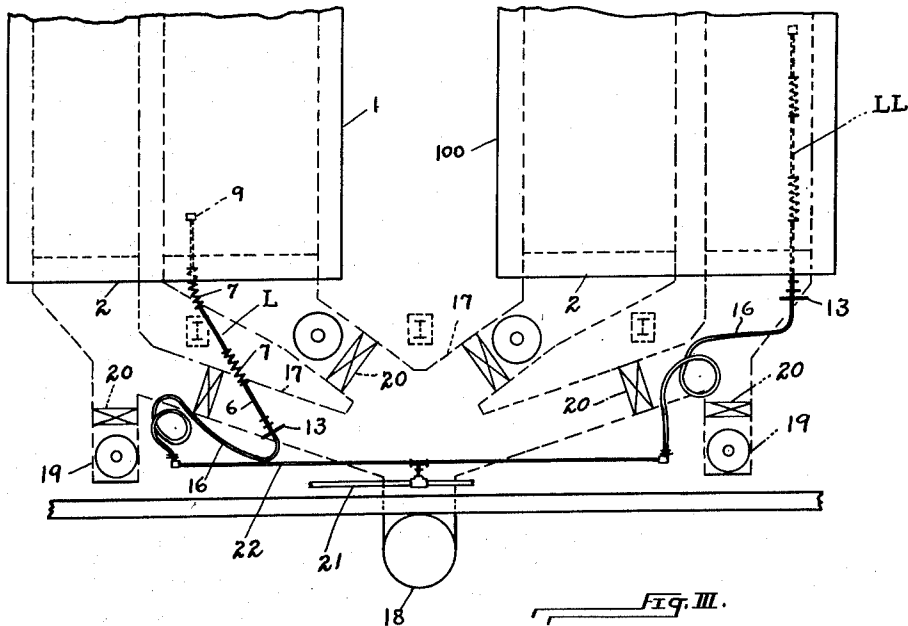
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UNITED STATES PATENT OFFICE

2,136,113

METHOD OF CLEANING CHECKERWORK

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Application December 15, 1936, Serial No. 115,946

2 Claims. (Cl. 263—19)

My invention relates to regenerative furnaces, and more particularly to the operation of the regenerators of such furnaces. In exemplary way, I shall consider the invention as it is practiced in glass furnaces.

The usual glass furnace includes two regenerators arranged at the opposite sides of the furnace chamber. The air for sustaining combustion within the furnace is led through and heated by the hot checkerwork in one regenerator, while the hot waste gases of the furnace are passed through and heat the checkerwork in the other regenerator. In known way the hot waste gases on their way through the furnace chamber entrain vapors and particles of dust and molten material, and, as the gases pass from the furnace into the regenerator, the included vapors condense. Substantial quantities of the condensate and other particulate material included in the streaming gases are precipitated upon the surfaces of the checkerwork within the regenerator. During normal furnace operation, this precipitated material accumulates and becomes incrustated upon the surfaces of the checkerwork, and, as the furnace continues in operation, the accumulations increase in size, until ultimately the passageways in the checkerwork become so constricted and clogged as to inhibit efficient operation.

More particularly, my invention concerns the removal of accumulated material from the checkerwork of a regenerator, and consists in method to such end.

In the accompanying drawings a regenerator, in the course of being cleansed in accordance with my invention, is illustrated partly in side elevation and partly in vertical section. Fig. II is a sectional view of the regenerator, taken on the plane II—II of Fig. I; the body of checkerwork within the regenerator is shown fragmentarily and in vertical section. Fig. III is a fragmentary, diagrammatic view in plan of the two regenerators of a glass furnace, illustrating the apparatus of the invention in use. And Fig. IV is a fragmentary view, in side elevation and to larger scale, of an instrument in which and in the operation of which the invention is realized.

Referring to Figs. I and II of the drawings, a regenerator 1 of known sort is illustrated. The walls and arched roof of the regenerator are constructed of refractory masonry, and within the chamber defined by such walls and roof a body of checkerwork C is provided. The checkerwork consists of a plurality of vertical walls W that are spaced apart transversely of the regenerator and extend in parallelism longitudinally thereof. The walls W are built of refractory tiles *t*, and are interconnected by refractory checker-blocks *b*. The blocks *b* lie in vertically spaced-apart horizontal courses *h*, and in the several courses the

blocks are vertically staggered, as illustrated in Fig. I. A more complete description of the checkerwork will be found in Patent No. 1,686,826, granted to me on October 9, 1928.

In the end-wall 2 of the regenerator, several horizontal lines of refractory blocks 3 are embodied. The blocks 3 are of specialized structure, including conical passages 4 that normally are closed, by means of refractory plugs 5 (Fig. I). The blocks are so positioned in the end-wall 2 that their passages 4 are severally directed into certain of the channels defined by and between the vertical walls W and the horizontal courses *h* of the blocks *b* of the checkerwork. As the drawings indicate, I do not provide a line of blocks 3 for each horizontal course *h* of blocks *b* in the checkerwork, and in this case I so arrange the several lines of blocks 3 that passages 4 are aligned with the channels between the first and second, fourth and fifth, and seventh and eighth, etc., courses *h* of the checker-blocks *b*.

The apparatus by means of which I practice my invention consists in a hollow, flexible lance L provided with a perforate head. The hollow shaft of the lance, otherwise closed, is provided with an inlet which in service is connected to a supply of steam, air, or other suitable fluid under high pressure, whereby violent jets of the compressed fluid may be caused to flow from the lance head.

Referring to Fig. IV, the body of the lance L consists in a shaft of steel tubing 6 of relatively great rigidity, embodying at one or more points (in this case at two points) in its extent a length 7 of metal tubing of relative great flexibility. The shaft of the lance may be said to comprise a plurality of rigid tubes that are flexibly interconnected. In this case each section of flexible tubing 7 comprises metal hose of known sort, 1" in diameter and 18" in length, while the several sections of rigid tubing 6 comprise 1" steel pipe, of such length as to afford in the assembly a lance of desired reach. Couplings 8 secure the tubing sections in assembly. The head or nozzle 9 of the lance, secured by a union 10 to the foremost section of rigid tubing 6, includes five orifices *o*, one directed axially of the lance, and the others inclined thereto, as shown. The tail-end of the lance is secured in a hollow Y fitting 11; one leg of the Y is closed by a short solid rod 12, equipped with a handle-bar 13 extending transversely through the rod 12 and covered with a jacket 14 of heat-insulating material, and the other leg of the Y is connected, through a valve 15, with the end of a flexible metallic hose 16.

In Fig. III two regenerators 1 and 100 are diagrammatically illustrated in plan. The furnace with which the regenerators are arranged is not shown, but the usual waste gas passages 17, 60

running below floor level from the regenerators to the furnace stack 18, are shown in dotted lines, together with the usual air inlets 19 and reversing valves 20.

5 A steam supply line 21 is run from a boiler (not shown) into the region or space between the stack 18 and the end-walls 2 of the regenerators 1, 100, it being understood that it is into this region or space that workmen enter, while the
10 furnace is in operation, to operate the reversing valves and practice the method of this invention. In the majority of cases the space available to workmen behind the regenerators is small, and, as will presently appear, the flexible structure of my
15 lance lends itself to ready operation in such cramped quarters.

When it is desired to clean the checkerwork in the regenerators 1 and 100, my lance L is by flexible hose 16 and a feed line 22 connected to the
20 steam line 21; indeed, a second lance LL may also be connected to the steam line, as shown in Fig. III. The valve 15 of each lance is closed, and steam is supplied to the line 21 under 125 pounds pressure. When the connections have
25 been completed, the attendant removes the plug 5 (Fig. I) from one of the openings 4 in the upper line of blocks 3 in the end-wall of the regenerator he is about to clean. Into the uncovered opening he projects the head-end of the lance,
30 as indicated in the regenerator 1 in Fig. III, and it will be observed that the shaft of the lance may be flexed or bowed, readily to admit of this operation in the cramped working quarters, alluded to above. Then, by means of a hand-lever 23 (Fig.
35 IV), he opens the valve 15, and charges the hollow shaft of the lance with steam under 125 pounds feed-line pressure. Immediately violent jets of steam shoot from the orifices o—o in lance head nozzle 9. The lance is moved inward, and
40 the head of the lance is projected into the body of checkerwork in the regenerator, that is so say, into a particular one of the horizontal channels formed by and between two of the walls W and two adjacent courses h of blocks b of the checker-
45 work. The violent jets of steam crack and blast away the dust and incrustated accumulations from the surfaces of the checkerwork tiles t and blocks b that border the channel into which the lance is moved, and the fragmented and detached material falls to the bottom of the regenerator,
50 whence it may be readily removed in known way. The lance is reciprocated and rotated several times in the channel, the handle-bar 13 facilitating the manipulation, and then the valve 15
55 is closed, the lance is withdrawn, and the plug 5 is restored to position in the opening in the wall 2. The operation is repeated for each opening 4 in the top line of blocks 3 in the end-wall 2 of the regenerator (cf. Fig. II), then in the next
60 lower line of blocks 3, and so on, until the lance has been operated in each of the checkerwork channels into which access may be had by way of the openings 4 in blocks 3. Thus, the checker-
65 work C is progressively cleaned from the top downward, and the detached material falling to the floor of the regenerator, is removed in usual way.

In the foregoing specification, it will be noted that in service the lance is snaked through the
70 end-wall of the regenerator, and, charged with fluid (steam, in this case) under high pressure,

is advanced in a horizontal channel through the checkerwork of the regenerator. The arrangement of the nozzles or orifices o in the lance is important. One orifice directs a jet a of steam
5 in the line of advance of the lance, and the other orifices direct four jets d angularly to such line of advance, two of the jets d extending angularly forward with respect to the nozzle and two rear-
10 ward, as shown in Fig. I. The angularly directed jets d are effective not only upon the tiles t and blocks b that immediately define the channel into which the lance is projected but upon all tiles and
15 blocks in the vicinity of such channel. That is to say, the jets d play diagonally into several courses of blocks b, both above and below the line of advance of the lance head 9, as may be visualized in Fig. I. Thus it is that the operation of the
20 lance in a channel formed by and between two vertical walls of tile and two horizontal courses of blocks is, advantageously, effective to clean the surfaces of the tile and blocks not only in such channel, but in the channels immediately above
25 and below.

I claim as my invention:

1. In the operation of a regenerator that com-
25 prises a refractory walled chamber including a body of checkerwork formed of a plurality of parallel, spaced-apart, vertical walls of refractory tile interconnected by transversely extending re-
30 fractory blocks, with such blocks arranged in vertically spaced-apart horizontal courses and with the blocks in one course staggered with respect to the blocks in adjacent courses; the here-
35 in described method which consists in introducing a lance horizontally through the refractory end wall of said chamber into a horizontal channel formed by and between two of said vertical walls of tile and two adjacent horizontal courses of
40 transverse blocks, advancing and turning the lance while causing jets of fluid to flow violently from the leading end of the lance in direction extending angularly to both the vertical and the horizontal, and thereby blasting away accumula-
45 tions from the surfaces of the tile and block in said channel and from the surfaces of the tile and blocks that form horizontal channels above and below said channel.

2. In the operation of a regenerator that com-
50 prises a refractory walled chamber including a body of checkerwork formed in a plurality of parallel, spaced-apart, vertical walls of refractory tile interconnected by transversely extending re-
55 fractory blocks, with such blocks arranged in vertically spaced-apart horizontal courses and with the blocks in one course staggered with respect to the blocks in adjacent courses; the here-
60 in described method which consists in introducing a lance horizontally through the refractory end wall of said chamber into a horizontal channel formed by and between two of said vertical walls
65 of tile and two adjacent horizontal courses of transverse blocks, advancing and turning the lance while causing fluid to flow violently from the leading end of said lance in jets extending angularly, two forward and two rearward, of the direction of advance, and thereby blasting away accumulations from the surfaces of the tile and blocks in said channel and from the surfaces of the tile and blocks that form horizontal channels above and below said channel.

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