Nov. 25, 1930. W. J. KELLY ET AL 1,782,430

RECUPERATOR

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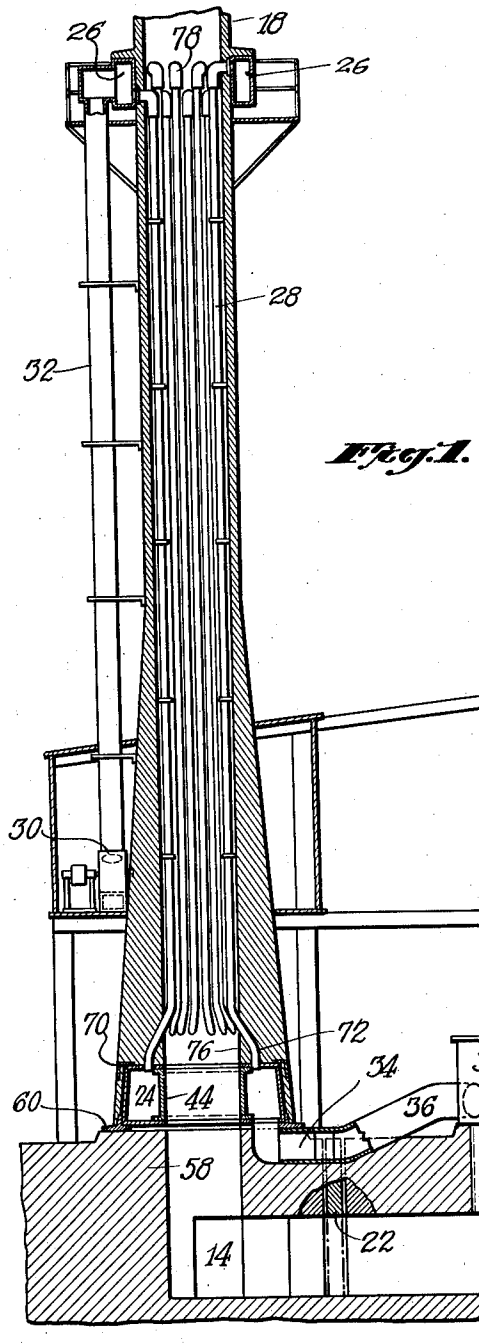


Fig. 1.

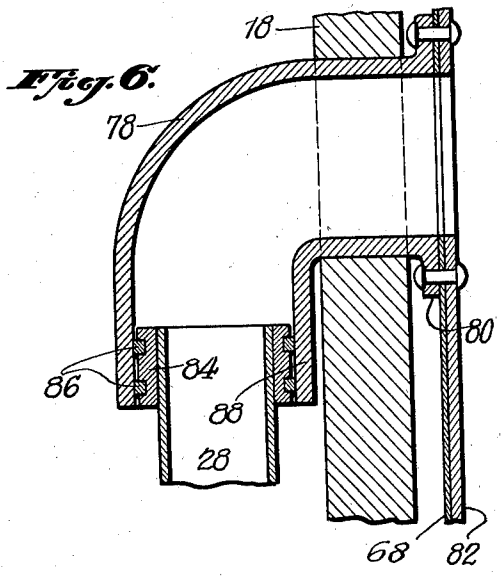


Fig. 6.

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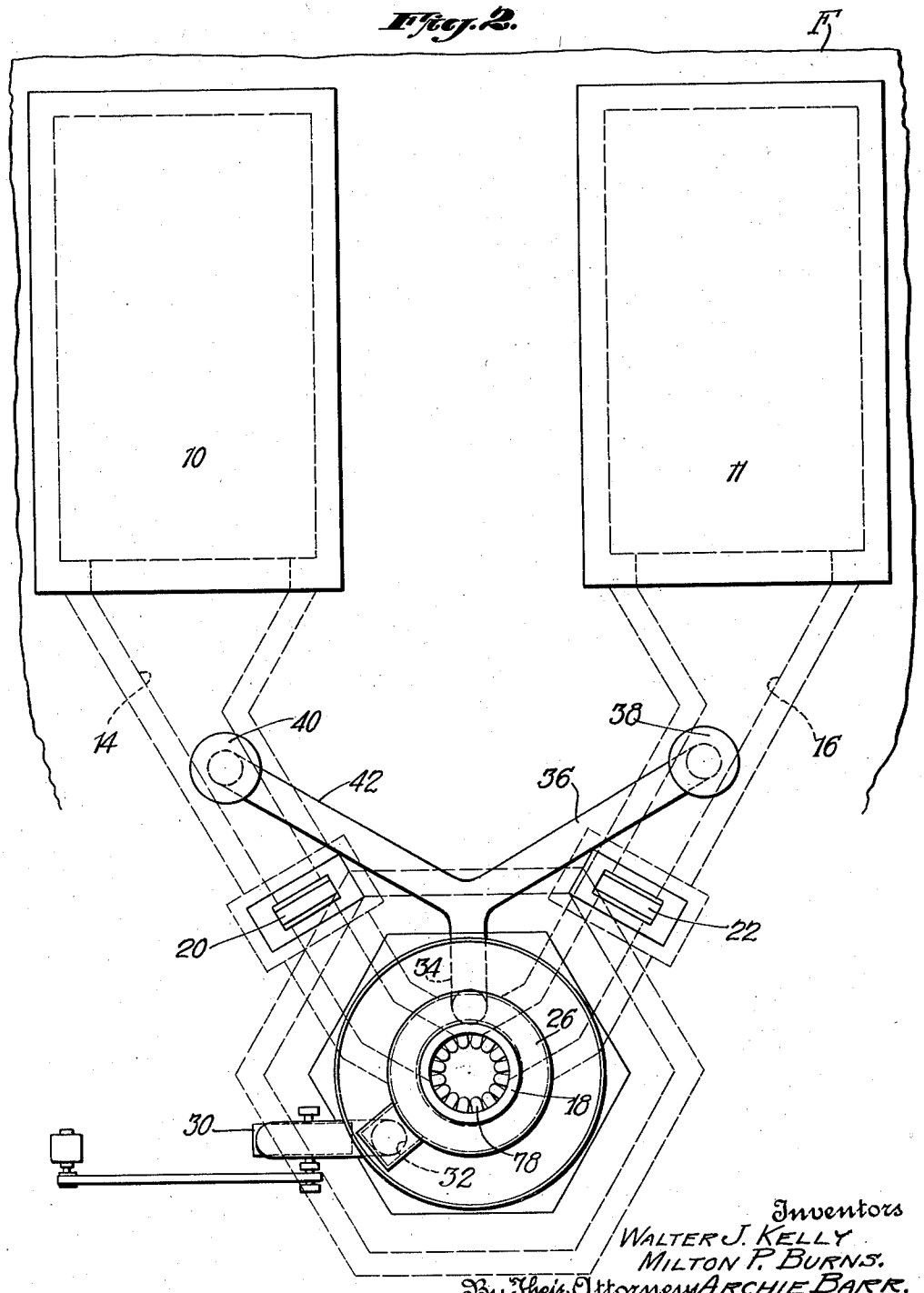
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RECUPERATOR

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Fig. 2.



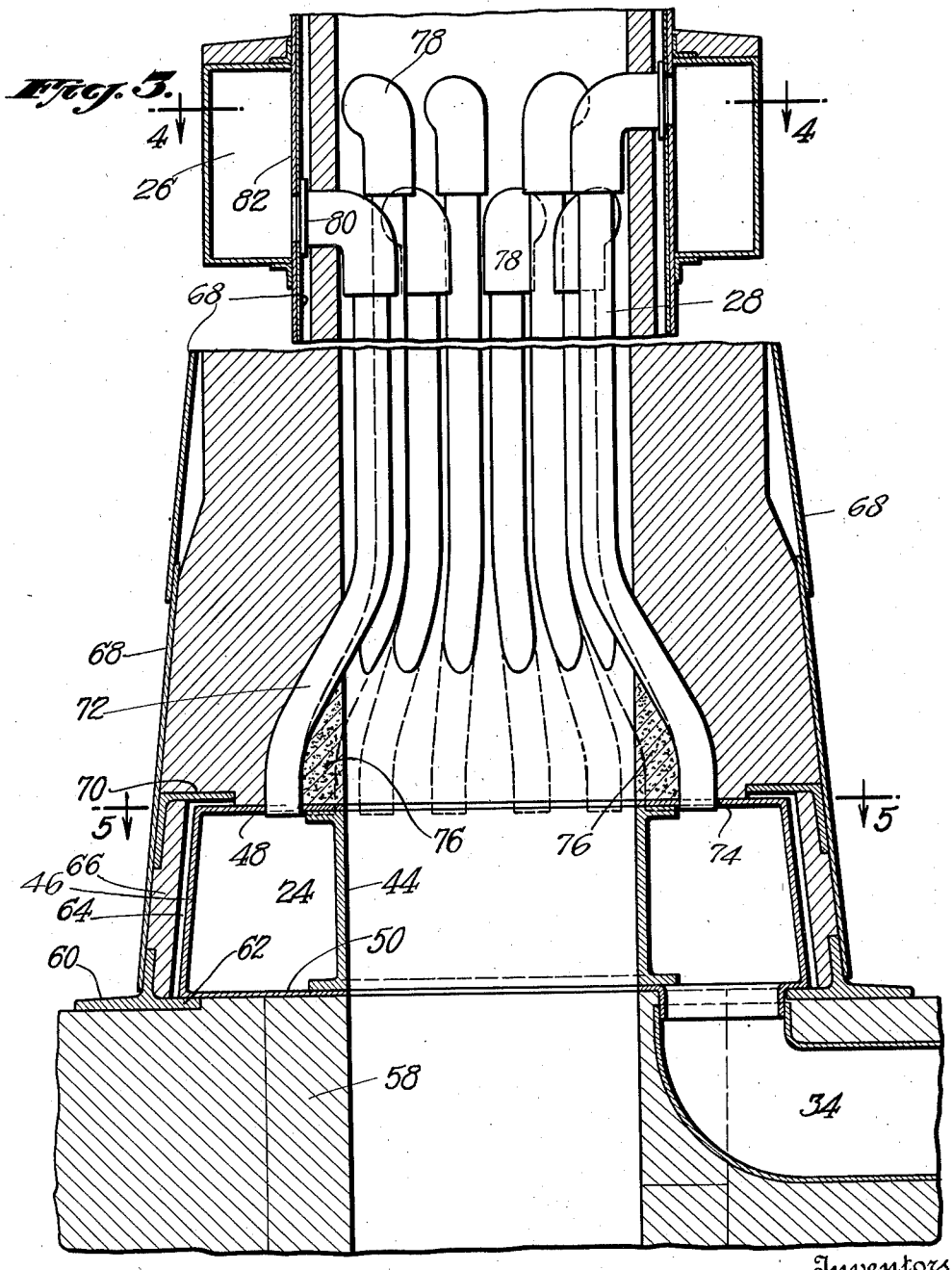
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Fig. 3.



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Fig. 4.

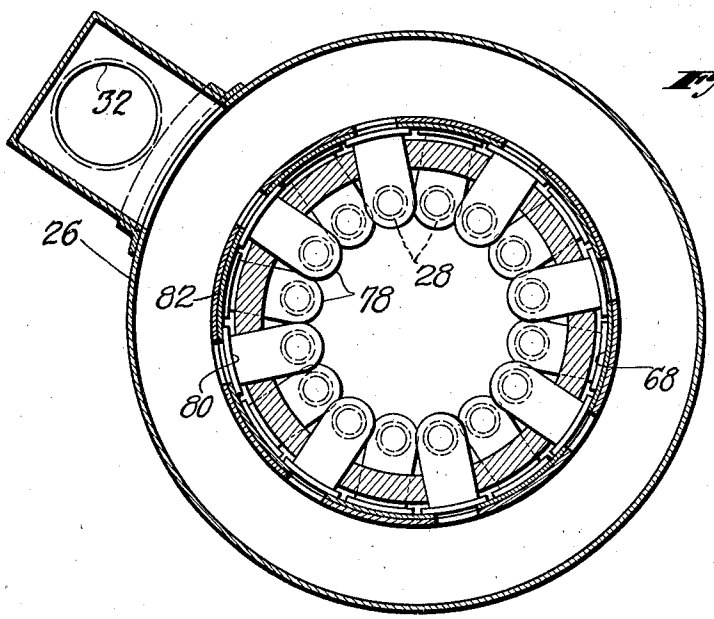
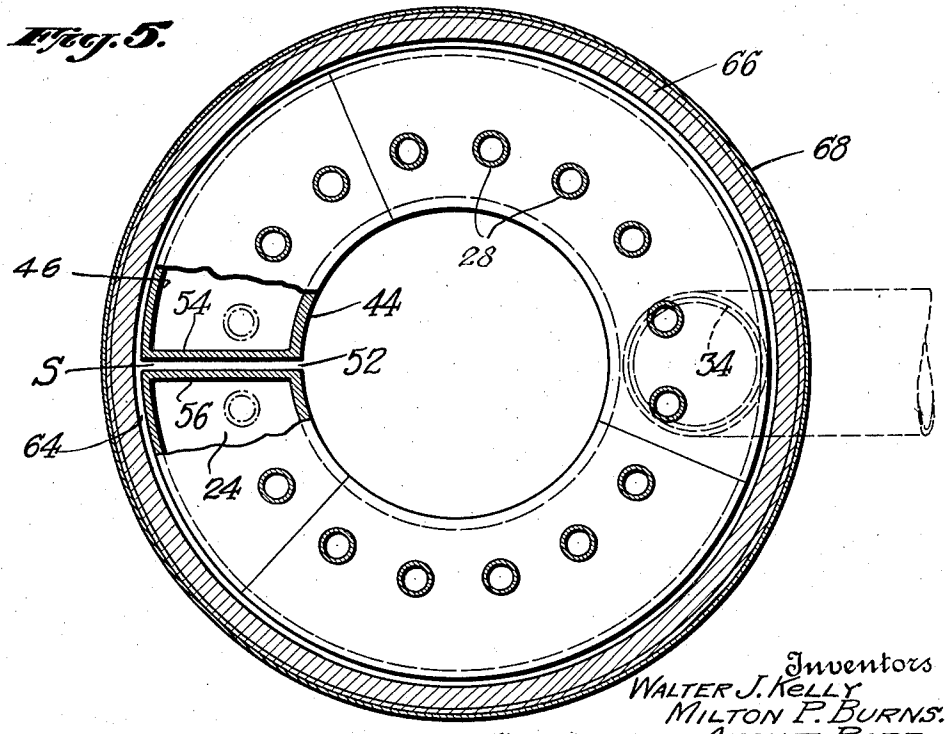


Fig. 5.



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UNITED STATES PATENT OFFICE

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RECUPERATOR

Application filed April 17, 1929. Serial No. 355,808.

This invention relates to improvements in recuperators and while not limited thereto is well adapted for use in combination with the stack and regenerators of an open hearth furnace.

The invention will be apparent from the following specification when read in connection with the accompanying drawings and the features of novelty will be defined with particularity in the appended claims.

In the drawings:

Fig. 1 is a side elevation with parts shown in section illustrating apparatus embodying our invention;

Fig. 2 is a plan view of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged longitudinal vertical section of a stack having our improved recuperator incorporated therein, an intermediate portion being broken away;

Fig. 4 is a horizontal section on line 4—4 of Fig. 3;

Fig. 5 is a similar section on line 5—5 of Fig. 3;

Fig. 6 is an enlarged detail vertical section illustrating structural features of the connection between a recuperator tube and a fitting secured to the upper header.

Referring in detail to the drawings, 10 and 11 represent regenerators connected with an open hearth furnace F. Flues 14 and 16 lead respectively from the regenerators 10 and 11 to the stack indicated as a whole at 18. Dampers 20 and 22 control the passage of gas from the regenerators 10 and 11 respectively to the stack.

The stack is of novel design and has incorporated therewith a lower header indicated as a whole at 24 and an upper header indicated as a whole at 26. Located adjacent the inner wall of the stack we provide a multiplicity of longitudinally extending tubes 28 which provide for the passage of air from the upper header to the lower header. Air at the temperature of atmosphere is forced by means of a blower 30 through a vertical pipe 32 to the upper header 26. This air flows downwardly through the multiplicity of tubes 28 to the lower header 24. The air is preheated by extracting the greater part of the heat from the gases passing up the stack which gases of course come from the outgoing end of the furnace F, said gases having first given up a certain amount of their heat to the checker brick in the particular regenerator which is cut in circuit according to the setting of the dampers 20 and 22.

The preheated air from the lower header 24 passes by way of a pipe 34 to a branch pipe 36 through an open valve 38 to the regenerator 11. At this time a valve 40 connected with a branch pipe 42 leading to the regenerator 10 is closed. Alternatively during another cycle of operation the preheated air may be passed through the regenerator 10 by way of branch 42 upon opening valve 40 and closing a valve 38.

Reference to Figs. 3 and 5 will show that the lower header 24 includes an inner shell 44 and an outer shell 46. These shells are closed at top and bottom by plates 48 and 50 respectively. As best shown in Fig. 5 it will be seen that the shells 44 and 46 are of incomplete circular form or substantially C-shape in plan, there being provided an interrupted portion indicated at 52. Adjacent this interrupted portion the air chamber of the header is closed by end walls 54 and 56. This arrangement provides a substantially radial clearance space s, in practice approximately 2½ inches adapted to compensate for expansion and contraction caused by temperature variations. This arrangement allows for a certain amount of circumferential crawl of the header structure so as to relieve the brick work of undue strains. The lower header, as clearly shown in Fig. 3, is incorporated bodily within and forms part of the base of the stack. The stack is supported by a suitable foundation 58 on which rests a base ring 60 having an inwardly extending flange 62 forming a footing for the outer shell of the lower header. Outside of the shell 46 an annular clearance space 64 is provided to allow for expansion and contraction between it and the outer course of brick work 66. A steel shell indicated at 68 encloses the stack and secured to this shell is an annular ring having an inwardly ex-

tending flange 70 overlapping the top plate 48 of the lower header. The brick work of the stack is supported jointly by this flange 70, the header structure 24, and the brick work 66, base ring flange 62 and foundation 58.

The lower end of each pipe 28 is offset obliquely as shown at 72 the extremity of the offset part being welded or otherwise secured as at 74 to the top plate of the lower header. A filling of chrome ore 76 encloses the lower portions of the several pipes. These pipes are arranged in a circle as shown in Fig. 4 and are spaced quite close together. They extend longitudinally within the stack for a great distance. In one installation embodying the invention the distance from the base of the lower header to the point where the tubes 28 communicate with the upper header is over 57 feet. These tubes are frequently six inches in diameter.

With tubes of such great length and diameter special provision must be made for expansion and contraction due to variations of temperature. For this purpose we provide a plurality of fittings which in the embodiment of the invention illustrated are in the form of elbows 78 having flanges 80 which are riveted or otherwise secured to the inner wall 82 of the upper header 26. To the upper extremity of each tube 28 is secured a head 84 grooved for the accommodation of packing rings 86 which slidingly engage the inner surface 88 of the downwardly extending part of the fitting 78. The several fittings 78 are staggered relatively to one another as shown in Fig. 3 to facilitate ease of connection and to avoid interference with one another. The fittings 78 and the related parts carried by the tubes form a slip joint which will permit the tubes to elongate and contract longitudinally without straining or distorting the stack structure.

While we have described quite specifically the structural features of the embodiment of the invention illustrated it is not to be construed that we are limited thereto since various modifications may be made by those skilled in the art without departing from the invention as defined in the appended claims.

We claim:

1. Recuperator apparatus comprising a stack having a plurality of longitudinally extending tubes arranged adjacent the inner surface thereof, a cold air header in communication with said tubes and surrounding an upper part of the stack and a hot air header connected with said tubes, said hot air header having a pair of adjacent walls with clearance between them to allow for circumferential crawl caused by temperature variations.

2. Recuperator apparatus comprising a stack having a plurality of longitudinally extending tubes arranged adjacent the inner surface thereof, a cold air header in communication with said tubes and surrounding an upper part of the stack and a hot air header incorporated in the base of the stack comprising an inner shell of nearly complete circular or C-shape in plan, an outer shell of similar shape, and top and bottom plates closing the spaces between said inner and outer shells and a pair of spaced walls closing the ends of the C-shaped structure.

3. Recuperator apparatus comprising a stack of brick construction having an outer steel shell, an upper header secured to said shell at a great distance above the base, a lower header, tubes within the stack, fittings secured to and extending inwardly from said upper header, said tubes having heads with packing rings which make a sliding fit with said fittings.

4. Recuperator apparatus comprising a stack of brick construction having an outer metallic shell, an upper header secured to said shell at a great distance above the base, a lower header, a plurality of circularly arranged tubes within the stack adjacent the inner wall thereof, fittings secured to said upper header and having portions extending through the brickwork of the stack, said tubes communicating with the upper header through said fittings.

5. A recuperator apparatus of the character described comprising a stack of brickwork having an outer metallic shell, an upper header surrounding said shell at a great distance above the base, a lower header incorporated in the base of the stack, tubes within the stack, fittings secured to and extending inwardly from the upper header, said tubes having portions making a sliding fit with said fittings.

6. Recuperator apparatus comprising a stack having a plurality of longitudinally extending tubes arranged adjacent the inner surface thereof, a cold air header in communication with said tubes located a great distance above the base of the stack, and a freely expansible and contractible hot air header incorporated in the base of the stack.

In witness whereof, we have hereunto signed our names.

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