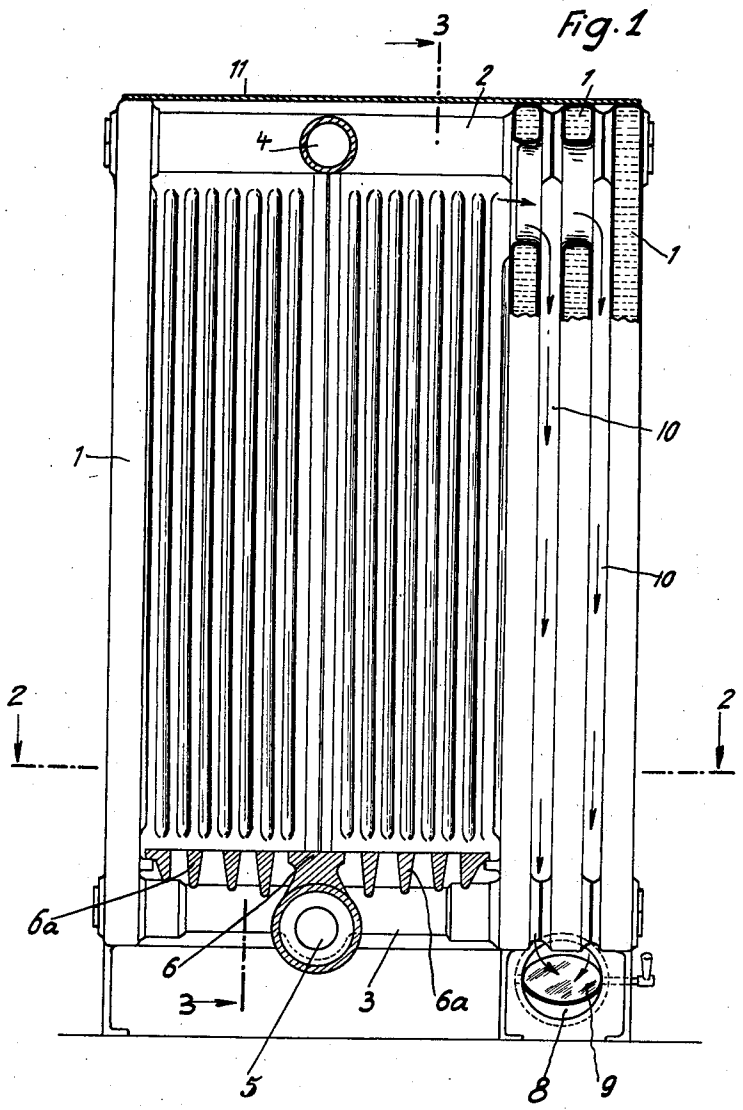
April 9, 1940. F. HERTEL 2,196,631

BOILER

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Fig. 1



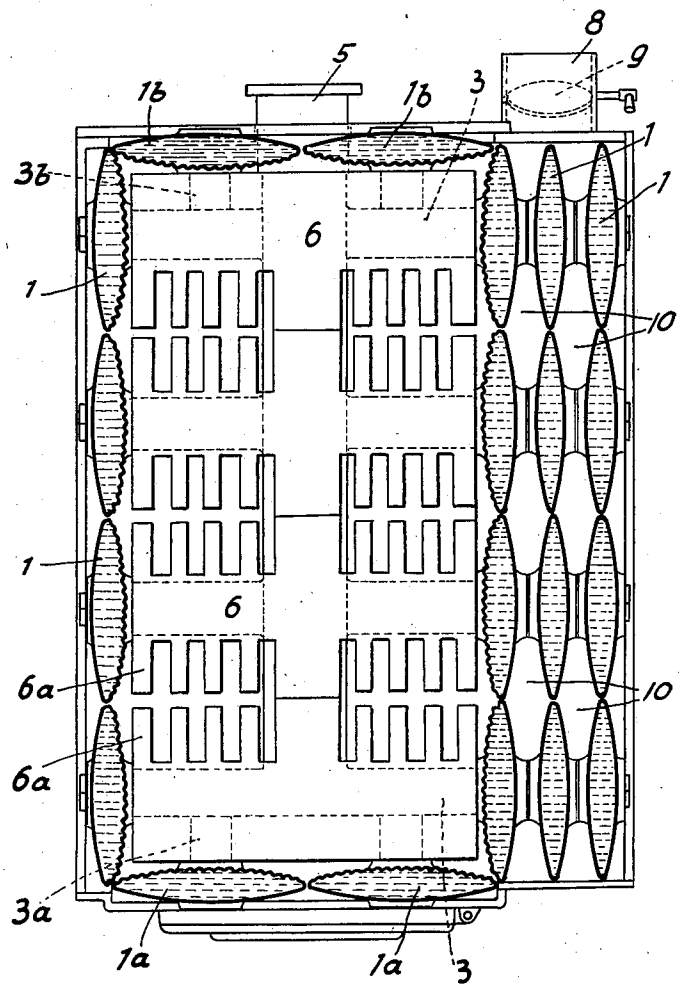
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April 9, 1940. F. HERTEL 2,196,631

BOILER

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Fig. 2



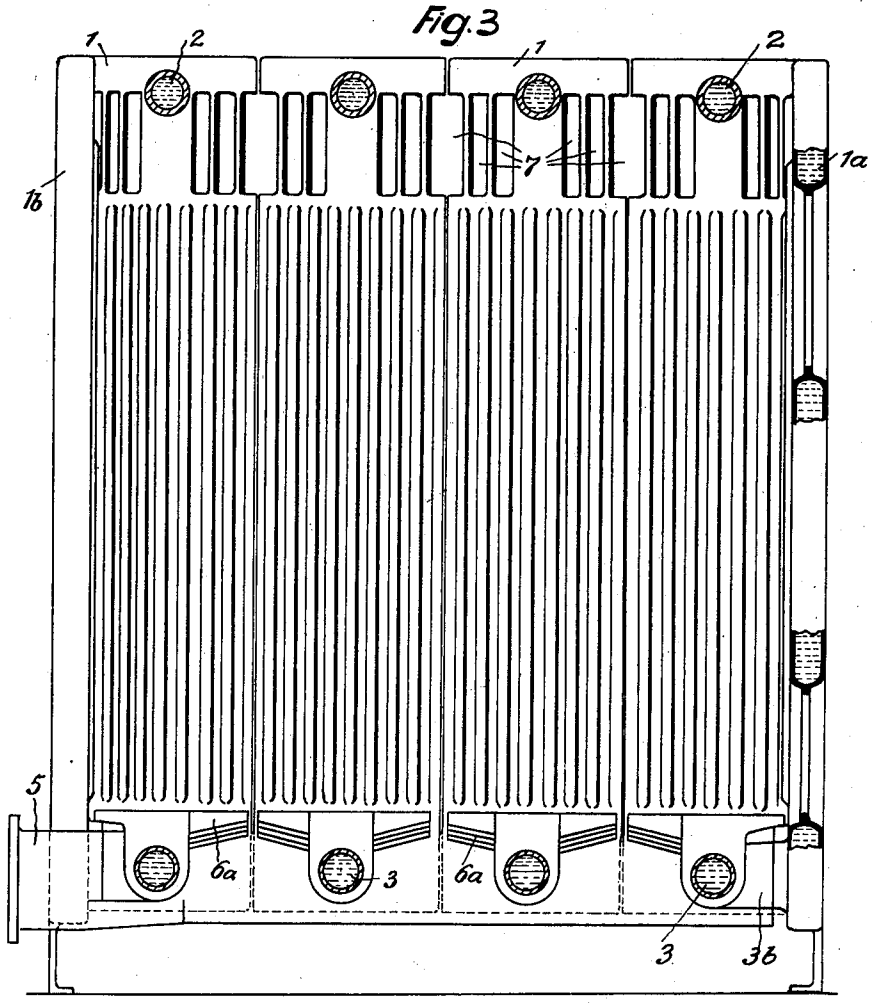
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BOILER

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Fig. 3



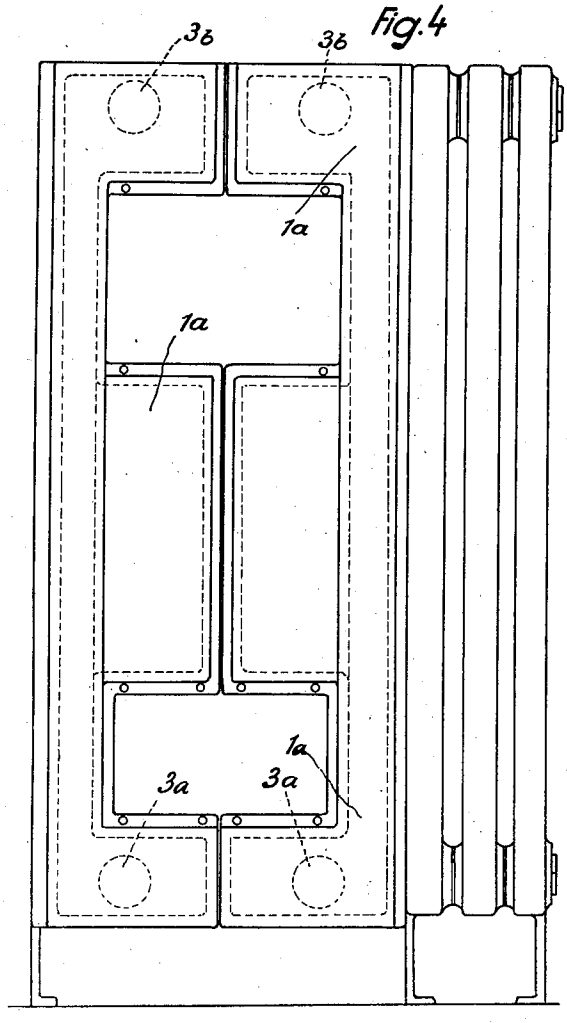
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Fig. 4



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Patented Apr. 9, 1940 2,196,631

UNITED STATES PATENT OFFICE

2,196,631

BOILER

Franz Hertel, Steglitz, Berlin, Germany, assignor of one-half to Karl Franke, Berlin, Germany

Application June 4, 1938, Serial No. 211,904
In Great Britain June 9, 1937

6 Claims. (Cl. 122—225)

This invention relates to boilers, and more particularly to boilers of the kind which are employed for the collective heating of living rooms and the like, and it has for its objects to provide a structural embodiment of the elements from which the boiler is built up and an assembly of the same, by means of which there is a saving of material, whilst at the same time there is obtained an extensive separation into a comparatively large number of single elements having uniformly thin walls, so that upon the occurrence of inner stresses in the material owing to heating and cooling cracks and like injuries are avoided. Provision is also made for the heated water from each single element to be discharged from the boiler by the shortest route. In this way a greater lift is imparted to the water, whereby the complete heating system is rapidly heated.

The invention also relates to an embodiment of the grate in such fashion that the water returning to the boiler to be re-heated is utilised in full extent for cooling the grate. The walls of the elements bounding the fire shaft are furnished with readily cast semi-circular corrugations of small radius, by means of which these heating surfaces subjected to the maximum heat are doubled in size.

It has already been proposed to construct a boiler from separate elements on the lines of a radiator and to dispose the same in such fashion that they enclose a central space forming a fuel shaft. In this connection, however, there has not been sufficient economic utilisation of the furnace gases, which have been conducted along the walls of the elements only in the one direction.

It has also been proposed to produce a boiler from tubular elements, which are situated in close proximity to one another but are flattened at certain points or so disposed as to form downcomer passages for the furnace gases, and are connected at the top and the bottom to collecting pipes. Here again, however, there is an insufficient economical utilisation of the heating gases.

The boiler according to the invention combines the following features:

The single elements, which are in the form of flattened tubes of hollow lenticular cross-section and adjoin each other at their narrow sides, are disposed to form the front and rear and side walls of the fire shaft, and their interior spaces conducting the water are interconnected at the top and the bottom by transverse pipes opening directly into top and bottom collecting pipes which extends across the fire shaft and the ash box in the lengthwise direction of the boiler. The elements which form one or both side walls of the shaft are furnished at the top with gas passages leading towards the flues which are formed behind the side elements between them and additional elements and open out into a common draught passage. The grate consists of parts integral with the lower collecting pipe and the transverse pipes opening out into the same or is separate therefrom but is placed in direct heat-conductive connection therewith. In this way there are ensured the advantages according to the invention, viz., a saving of material, division of the boiler into numerous single elements having uniform walls, so that there are no accumulations of material at certain points in which cracks or other damage may readily occur, considerable circulating power of the heated water and cooling of the grate by the water returned. The elements forming the front and rear walls of the shaft are furnished with passage ways for furnace and ash openings.

An additional important feature of the invention consists in the fact that the walls of the elements enclosing the shaft are provided with semicircular corrugations of comparatively small radius. It has already been proposed in other boilers to provide ribs or fins extending into the furnace space, but these, however, have various disadvantages, as the spaces between the same cannot be seen from the furnace door and also cannot be cleaned from that point, so that they assist the baking of slag thereon and accordingly readily burn.

The corrugations according to the invention are for this reason in the form of semicircles having a small radius, in order that the surface-like character of the bounding walls of the shaft shall be maintained despite the fact that the heating surface is doubled, the corrugations being so small that the baking on of slag can be observed from the door of the shaft and accordingly prevented.

In the practical embodiment of the grate composed of one piece together with the pipes for the returning water or provided in heat-conductive connection with the same the arrangement in accordance with the invention is such that the grate consists of single parts, each part including a piece of the collecting pipe and a transverse connecting pipe. Above the transverse connecting pipe there is located a grate bearer from which the grate bars project at right angles towards both sides. In this connection the ar-

rangement may be such that the front half of the first grate portion and preferably also the rear half of the final grate portion are not divided into grate bars, the middle grate portion extending over this section in the form of a flat surface and thus providing a stoking area.

An embodiment of the invention is illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a cross-section through the boiler.

Fig. 2 is a horizontal section taken along the line 2—2 in Fig. 1.

Fig. 3 is a vertical longitudinal section along the line 3—3 in Fig. 1, and

Fig. 4 is a view looking towards the front wall of the boiler.

The boiler is composed of single elements 1 of hollow lenticular cross-section as may be seen in Fig. 2, so that they are similar to flattened tubes and each element is provided at the top and the bottom with projecting hollow bosses. The walls of the elements bounding the fire shaft on all four sides are furnished with corrugations of small radius, as shown in Fig. 2. The single elements disposed transversely one against the other are connected at the top and the bottom to transverse connecting pipes 2 and 3, which open out into the central collecting pipes 4 and 5. These collecting pipes extend, in the front to back direction of the boiler, across the furnace shaft and the ash box below the grate 6, and serve for the discharge of the heated water (through the collecting pipe 4) and the return of the water to be re-heated (through the collecting pipe 5). Since each single element is connected in direct fashion through the medium of the transverse pipes 2 and 3 to the collecting pipes 4 and 5, the water ascending in the single elements by reason of the heating takes the shortest path to the collection pipe, so that there is considerable lifting and circulating power of the water with rapid heating of the heating units connected with the collecting pipes. As shown by Figs. 1 and 3, the single elements 1 which bound the furnace shaft on one side are furnished at the top with gas passages 7, which are preferably interrupted in grid-like fashion (Fig. 3) and open out into flues 10, which are formed between the elements and in turn open out into a lower collection passage 8 with a damper 9.

In Fig. 1 the furnace shaft is located towards one side of the boiler as it is bounded along one side only by one row of single elements and along the opposite side wall by three rows of single elements, between which there is formed in each case a flue 10. The furnace shaft, however, may also be located centrally of the width of the boiler with spaced elements forming flues at both sides.

At the top the single elements are preferably covered by plates 11, which may be welded thereto at single points.

The single elements 1*a* forming the front wall of the boiler are furnished, according to Fig. 4 with passage ways for the furnace door and the ash door.

The single elements 1*a* and 1*b* forming the front and rear walls are connected at the top and the bottom by means of their hollow bosses to the transverse connecting pipes 2 and 3 situated in front of these walls by pipe sections 3*a* and 3*b* disposed parallel to the collecting pipes.

The grate is preferably integral with the lower transverse pipes 3 and the lower collecting pipe 5, and is sub-divided in accordance with the number of transverse pipes 3, as shown in Fig. 2. In each grate section there is provided a section of the collecting pipe 5 and in each case a transverse pipe 3. Above the transverse pipe 3 there is provided a grate bearer, from which the grate bars 6*a* extend on both sides. In the front half of the first grate section and the rear half of the final grate section this separation into bars is omitted, so that stoking areas are formed. By reason of this separation of the grate each transverse connection of single elements with the grate and the transverse pipes and with the parts of the collecting pipes 4 and 5 consisting of one piece with the transverse pipes may be performed separately, whereupon these parts are aligned to form the length of the boiler. This represents a very simple assembly or also disassembly in the event of repairs. It has been found, however, that a boiler according to the invention may be maintained in use for a number of years without damage, which is due to the fact that accumulations of material, such as in part were inevitable in previous boiler constructions, are avoided. There is the same thickness of wall at all points. If, therefore, expansion occurs as the result of heat this has a uniform effect throughout.

Instead of producing the grate sections with the appertaining transverse pipes and the collecting pipe sections in one piece as shown, the grate portions may also be placed afterwards in heat-conductive connection with the pipes. The embodiment in the drawings, however, is to be preferred, as it provides considerable advantages upon the assembly and in operation and hardly causes difficulties upon the production. The pipes may be cast into the material upon the casting of the grate sections.

What I claim as new and desire to secure by Letters Patent is:

1. A boiler, consisting of a plurality of individual elements in the form of flattened tubes of hollow lenticular cross-section disposed to form the front and rear and side walls of a chamber forming a furnace shaft, said elements adjoining one another at their narrow sides, transverse pipes interconnecting the water conducting interior spaces of said elements at the top and at the bottom thereof, collecting pipes extending across the furnace shaft at the top and at the bottom and having said first pipes opening thereinto, the elements forming a side wall of the shaft being provided at the top with gas passages leading to flues formed between such side elements and additional elements and opening into a common discharge passage, and a grate disposed over the lower collecting and transverse pipes and having heat conductive connection therewith.

2. A boiler according to claim 1, in which the elements forming the front and rear walls of the shafts are connected by water conduits with the transverse pipes extending between the side wall elements, the said front wall elements having a fuel and ash opening formed therethrough.

3. A boiler constructed in accordance with claim 1, in which the walls of the elements enclosing the shaft are formed to have substantially semi-circular corrugations of small radius.

4. A boiler constructed in accordance with claim 1, in which said grate is formed in sections, each of said grate sections including a section of the lower collecting pipe and a transverse connecting pipe, the grate sections having flat tops in a common plane forming a flat grate area, the front and rear sections having bars ex-

tending toward the center of the shaft and the intermediate grate sections having oppositely directed bars upon two sides thereof, the adjacent bars of the sections being in spaced end to end relation.

5. A boiler structure of the character described, comprising a plurality of vertically disposed individual elements in the form of flattened tubes of hollow lenticular cross-section disposed to form the front, rear and side walls of a furnace combustion chamber, the tubes of each of said walls being in edge to edge adjoining relation, one of said walls being made up of a series of rows of such tubes in edge to edge relation, the tubes being joined at their upper and lower ends for the passage of water from one to the other thereof, transverse pipes interconnecting the water conducting interior spaces of said tubes at the top and bottom thereof, collecting pipes extending across the furnace combustion chamber at the top and at the bottom and having said transverse pipes opening thereinto, the tubes forming the said one of the walls being provided at the tops with gas passageways leading into longitudinally extending areas between the rows of the tubes of the said one wall, said areas at the lower end of the boiler communicating with a gas lead-off flue, and a grate disposed in the lower portion of said chamber and having the said lower transverse and collecting pipes formed integrally therewith.

6. A boiler structure of the character described, comprising a plurality of vertically disposed individual elements in the form of flattened tubes of hollow lenticular cross-section disposed to form the front, rear and side walls of a furnace combustion chamber, the tubes of each of said walls being in edge to edge adjoining relation, one of said walls being made up of a series of rows of such tubes in edge to edge relation, the tubes being joined at their upper and lower ends for the passage of water from one to the other thereof, transverse pipes interconnecting the water conducting interior spaces of said tubes at the top and bottom thereof, collecting pipes extending across the furnace combustion chamber at the top and at the bottom and having said transverse pipes opening thereinto, the tubes forming the said one of the walls being provided at the tops with gas passageways leading into longitudinally extending areas between the rows of the tubes of the said one wall, said areas at the lower end of the boiler communicating with a gas lead-off flue, and a grate disposed in the lower portion of said chamber and having the said lower transverse and collecting pipes formed integrally therewith, the inner walls of those tubes defining the said combustion chamber being formed to provide longitudinally extending semicircular corrugations.

FRANZ HERTEL.