United States Patent

[11] 3,533,379

[72] Inventors **Allan E. Martin**
Pekin, Indiana;
Jack N. Tutterrow, Louisville, Kentucky

[21] Appl. No. **765,483**
[22] Filed **Oct. 7, 1968**
[45] Patented **Oct. 13, 1970**

[73] Assignee **American Standard Inc.**
New York, New York
a corporation of Delaware

[54] **FORCED DRAFT BOILER CONSTRUCTION**
17 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **122/225,** 122/231
[51] **Int. Cl.** **F22b 23/00**
[50] **Field of Search** 122/225, 231; 29/157.4

[56] **References Cited**

UNITED STATES PATENTS

3,215,125 11/1965 Mueller 122/225

FOREIGN PATENTS

1,427,127 12/1965 France 122/231

Primary Examiner—Kenneth W. Sprague
Attorneys—Jefferson Ehrlich, Tennes I. Erstad and Robert G. Crooks

ABSTRACT: Covers a boiler having grooved or channeled spaces at the interface of adjacent sections. A putty-like, pliable elastic sealant, which remains substantially permanently pliable and elastic, will fill the grooved or channeled spaces to overflowing to join the sections. The joinder so formed will be leakproof at all ambient temperatures and flue pressures, including the flue pressures encountered in forced draft boiler systems.

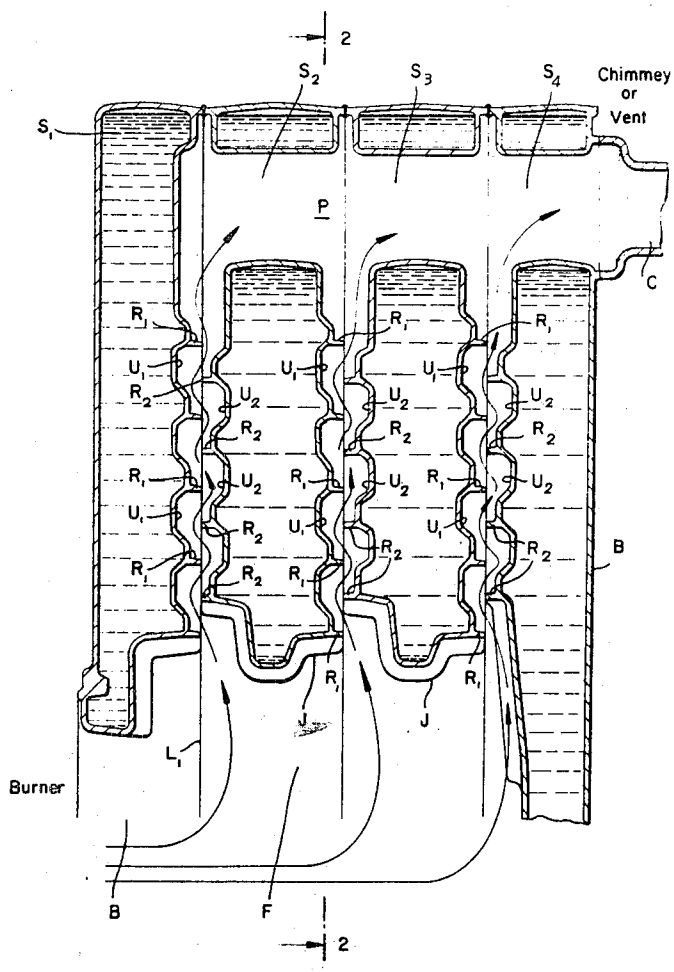
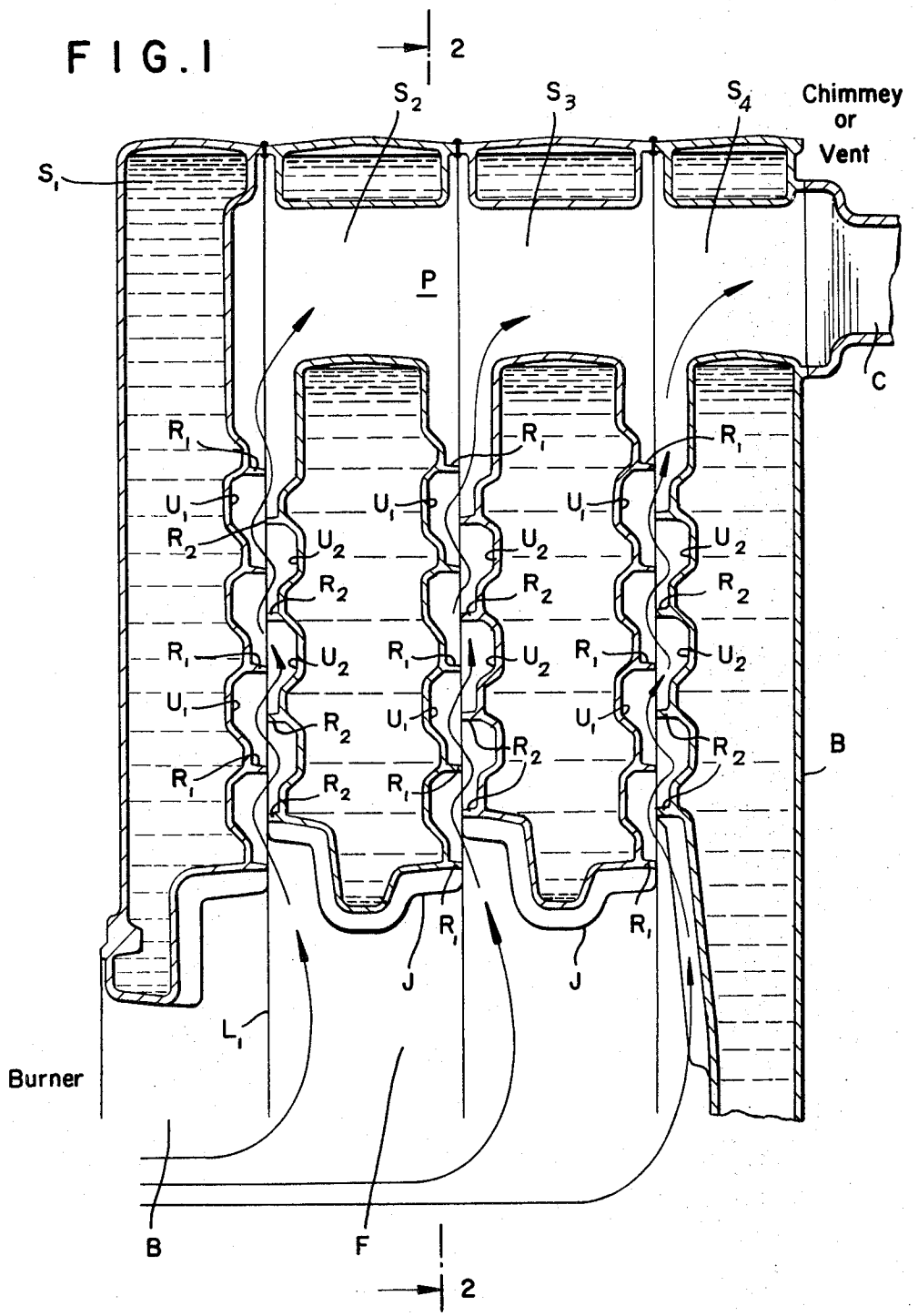


FIG. 1



INVENTORS.
A. E. MARTIN
BY J. N. TUTTERROW
Jefferson Ehrlich
ATTORNEY

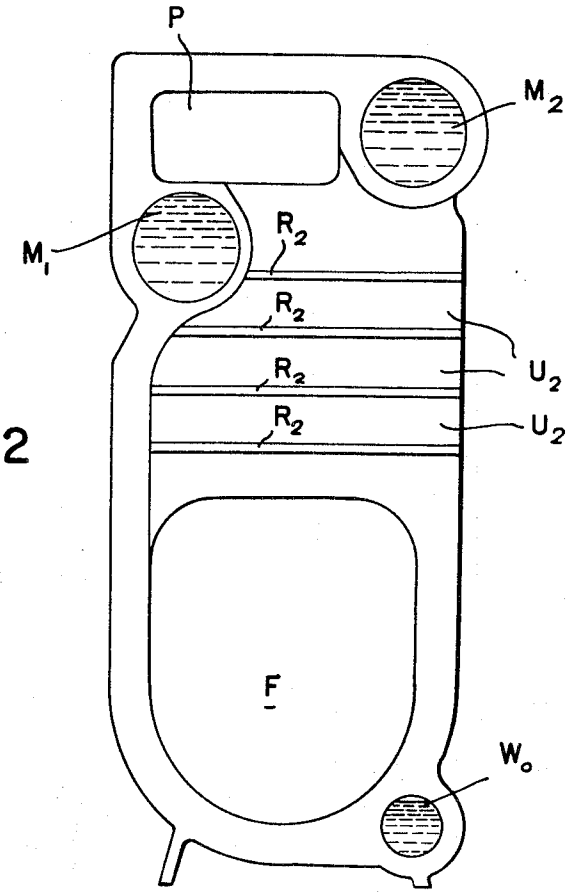


FIG. 2

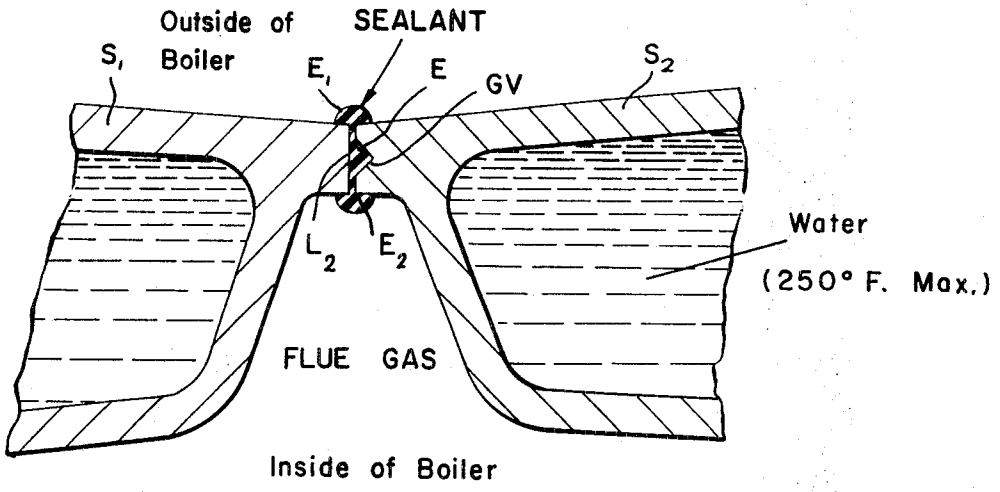


FIG. 3

INVENTORS.
A. E. MARTIN
BY J. N. TUTTERROW
Jefferson Ehrlich
ATTORNEY

FIG. 4a

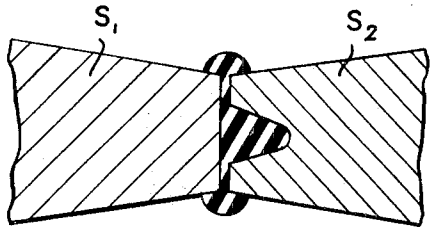


FIG. 4b

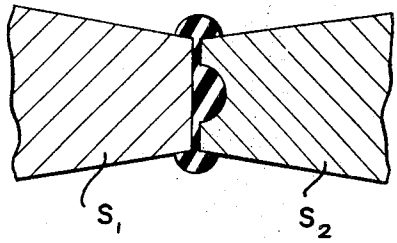


FIG. 4c

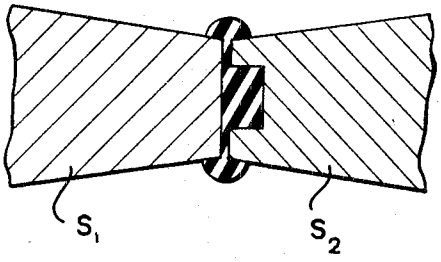


FIG. 4d

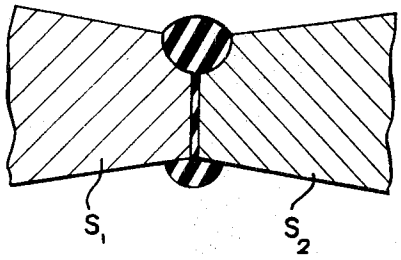
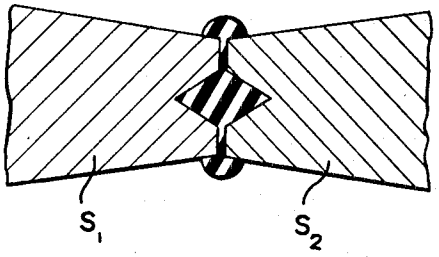


FIG. 4e



INVENTOR.
A. E. MARTIN
BY J. N. TUTTERROW
Jefferson Ehrlich
ATTORNEY

FORCED DRAFT BOILER CONSTRUCTION

This invention relates to sectional boilers and, more particularly, to sectional boilers for use in forced draft systems.

Forced draft sectional boilers have been suggested heretofore for steam or hot water heating plants for furnishing the heat required by large commercial installations. A principal advantage in a forced draft boiler system is that it requires very little, if any, chimney or venting passages, *i.e.*, passages extending above the rooftop of the building in which the boiler is installed. A 3-foot vent or chimney, for example, may be sufficient for most commercial installations and, in many cases, shorter passages may be adequate.

However, forced draft boiler systems have not found significant acceptance in residential housing for various reasons. Not only are the generally available forced draft constructions too large for small home use, but also, due to the superatmospheric pressure developed by the boiler unit of the installations, there is a real hazard in the presence of obnoxious or lethal gases which may leak out of the boiler, principally through the small openings or crevices between the boiler sections.

In accordance with this invention, a new form of boiler construction has been developed which is especially suitable for use in forced draft boiler systems employing a burner unit operating at superatmospheric pressures. One of the main features of the construction of the boiler is the shape of the joints or the interface between boiler sections, the means by which the sections are joined together, and the sealant employed to render the construction of the joints leakproof to a degree at least as good as, if not substantially better than, joints available in conventional constructions.

In accordance with this invention, a multisection boiler will be described for a forced draft system in which the burner unit may develop a relatively high pressure in the burning gases. The sections of the boiler will be joined together only along the outer walls of the boiler in the regions where the sections meet. The surface or planar interface at which two adjacent boiler sections meet is supplied with an elastic sealant material having a consistency about like that of toothpaste so that the sealant may be easily and rapidly applied to the adjacent surfaces and wherever else required by means of a conventional hand caulking gun. The adjacent surfaces of each of the respective pairs of sections have, according to this invention, a common groove or channel or a plurality of common grooves or channels which may be provided in either or both of the adjacent sections which are to be joined together. The groove or grooves may be shaped triangularly, rectangularly, circularly, semicircularly, elliptically, semielliptically, etc., so that that the sealant not only will be applied to the respective flat or curved surfaces of the adjacent sections which are to be joined, but will be supplied to overflowing into the grooves or channels which are specially provided in the sectional constructions. The sealant should be one that can be readily set, that is, set almost immediately after application, yet one that remains elastic and pliable for a long time, preferably throughout the life of the installation. Moreover, the sealant must be capable of remaining leakproof at all times, from very low temperatures, *i.e.*, temperatures below freezing, to temperatures up to about 500°F. The types of grooved surfaces heretofore joined together with a sealant of the kind used in this invention have remained leakproof and, therefore, safe even under widely varying conditions. Pressure tests have confirmed the freedom from leakage at pressures substantially greater than those encountered in forced draft boiler operation. Indeed, the types of constructions and materials contemplated by this invention permit a multisectional boiler, no matter how large, whether for a commercial installation or for a small residential house, to be used for installation and repair on the very premises where it is or will be put into use (as well as at the factory).

One of the principal objects of this invention, therefore, is to join each pair of adjacent sections of a multisection boiler, especially one to be used in a forced draft boiler system, in such a way that it will be rendered leakproof against the flue gases under all contemplated conditions, the joinder being made by means of an elastic and pliable material.

Another object is to join two adjacent sections of a multisection boiler by grooving one or both of the adjacent faces of the sections to be joined together so that a pliable substance may be inserted within the grooved portions and along the faces of the adjacent sections so that they may be joined together and rendered impervious or leakproof under all ambient conditions of temperature and pressure encountered in the operation of the boiler.

Another object of this invention is to employ an elastic, paste-like material having, for example, the consistency of a toothpaste, to join together the adjacent surfaces of sections of a boiler so as to bind the surfaces together in order to prevent the leakage of flue gases therethrough even at superatmospheric pressures and the wide range of temperatures encountered throughout the seasons of the year.

Another object of this invention is to provide a construction of the multiple sections of the boiler and a medium for joining the sections so that they may be readily installed in place or repaired at, for example, a residence, and be rendered leakproof against superatmospheric gas pressures generated within a forced draft boiler system.

These and other objects of this invention, as well as its features and advantages, will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawings in which:

FIG. 1 illustrates schematically the essential components of a four-section boiler assemblage to which the invention and its principles may be applied;

FIG. 2 provides a simplified sketch illustrating the arrangement of FIG. 1 when viewed along the lines 2–2 of FIG. 1;

FIG. 3 illustrates one form of grooving or channeling which may be employed in the practice of this invention; and

FIG. 4 illustrates several different or selected grooved or channeled arrangements which may be employed in accordance with this invention.

Referring to FIG. 1 of the drawing, which illustrates only the important apparatus or components of a heating system to explain the invention, there is shown a schematic form of boiler assemblage B suitable for use in a multisection boiler employed for pressure fired burner operation. The construction of FIG. 1 includes, for illustration, four sections designated S1, S2, S3 and S4, which are adjacent to each other as shown. The boiler includes a burner unit (not shown), which would be positioned adjacent to or within the lower left hand corner of the boiler B, and which is mounted and operated in the customary way adjacent to the firebox F of the boiler construction. The burner unit may be of any type, but preferably of the type shown and described in an application of A. E. Martin, Ser. No. 599,905, filed Dec. 7, 1966, entitled "Cup Cone Flame Retention Burner," assigned to the same assignee as the present application. The burner unit is designed to operate on fluid fuel and to generate a pressure within the firebox F which is above atmospheric pressure. The pressure of the flue gases within the firebox F may be, for example, 0.2 or 0.5 inches of water, or it may be as high as or substantially higher than 3 inches of water. However, it is a sufficient pressure to overcome the resistances encountered by the gases in traversing the several parallel or serial passages of the boiler B.

The adjacent sections of the boiler, such as sections S1 and S2, are spaced from each other about an intervening line or interface L1, and they are so constructed as to provide a sinuous path for the movement of the flue gases between the adjacent sections from the firebox F to a substantially horizontal or common passage P extending to the chimney or vent C. It will be observed that the adjacent boiler sections S1 and S2 are provided with repetitive grooved heat-receiving surfaces U1 for section S1 and corresponding surfaces U2 for section S2, together with protruding ribs R1 for section S1 and corresponding ribs R2 for section S2. This geometric configuration, which is employed in and repeated by the adjacent sec-

tions S2 and S3 and sections S3 and S4, enables the high pressure flue gases to traverse parallel paths extending vertically upwards along the respective sinuous paths provided by the ribbed constructions R1 and R2 and the curved surfaces U1 and U2 to the horizontal flue path P and then into the chimney or vent C. Water will normally fill the spaces within the several sections adjacent to the sinuous flue paths just referred to, as shown in FIG. 1. The hot flue gases, in rising to the passage P, transfer heat by convection to the water within the respective sections so that the water is raised to a desired or predetermined temperature. The heated water, if part of a steam boiler operation, will be converted into steam, as will be readily understood, and travel to steam radiators (not shown); and, if part of a hot water system, the heated water will be moved by suitable piping to the rooms (not shown) to be heated. Continuous fins, such as J, may be positioned in the flueways.

FIG. 2 schematically shows the boiler construction when viewed along the line 2–2 of FIG. 1. The water inlet is designated W. Influent water is fed therethrough to the respective sections S1 to S4 in the usual way. The ribs R2 (four in number) appear in this figure as continuous horizontal spaced barriers for deflecting the gas flues in their vertical paths to the horizontal passage P but, as seen in FIG. 1, the ribs R2 are joined by curved surfaces U2. It will be apparent that the exhaust passage P provides a continuous linear path through which the exhaust gases travel under the pressure influence generated by the fuel burner unit adjacent to firebox F, after the gases have efficiently convected heat to the water contained within the several sections, S1, S2, S3 and S4. The circular or circular cylindrical compartments M1 and M2 of FIG. 2 provide spaces in which heated water is circulated between the several sections in a water heating boiler. On the other hand, in a steam boiler, the compartment M1 will be employed for water circulation between the several sections and the compartment M2 for steam circulation.

FIG. 3 represents parts of two adjacent sections such as S1 and S2 of the boiler system which are to be joined together in accordance with this invention. Here the sections S1 and S2, for example, have adjoining faces or walls which are to be rendered impervious to the gases at the superatmospheric pressure prevailing within the boiler system. The adjacent walls meet at line L2, which is or may be colinear with line L1 shown in FIG. 1. It will be observed from FIG. 3 that the section S2 has a triangular groove GV therein for illustration. In FIG. 3 the triangular groove is shown formed in section S2 but, if desired, it may be formed in section S1 or partly in section S1 and partly in section S2. An elastic sealant E should be applied throughout the entire length of the groove GV of the section S2 so that, before the adjacent sections S1 and S2 are joined together, the sealant will be supplied in excess, that is, more than sufficiently to fill the space of the groove GV. Some of the sealant, therefore, will be pressed out of the groove GV during the joinder of the two sections S1 and S2 and out of the space or dividing plane between sections S1 and S2. The excess of the sealant is designated E1 and E2 in FIG. 3. The presence of the excess material forms a reserve or reservoir for subsequent repair work and to give or take material as changes occur due to continual or almost continual expansion or contraction or other changes in spacing of the sections S1 and S2. The water within the sections S1 and S2 (as in other sections also) may reach a temperature perhaps as high as 250°F and the walls of the sections S1 and S2 may reach even higher temperatures due to the heat generated or developed within the boiler but the sealant will continuously hold the flue gases within the boiler under all ambient pressure and temperature conditions and bar leakage to spaces external to the boiler.

With each change in temperature, the spacing between the adjacent walls of the two sections S1 and S2 may change. The ambient temperature may be the reason for the spacing change or the temperature of the flue gases or of the water may be the reason. Whatever the reason, however, the gap between these substantially colinear walls will remain filled with the sealant E and the groove GV will also remain filled. The junction of sections S1 and S2 will remain permanently leakproof to bar the exit of flue gases. The excess of sealant at E1 and E2 and the longitudinal groove GV with its supply of sealant together act like an accordion throughout the interface between adjacent sections to give or take sealant material as required to continually maintain a leakproof condition.

FIG. 4 shows five different grooved constructions, given here for illustration, to explain some of the many types of grooved arrangements that can be employed in this invention. FIG. 4*a* shows a triangular grooved construction similar to the one shown in FIG. 3. FIG. 4*b* shows a semicircular or semielliptical groove in one of the sections which, like the others, will be filled with a sealant. FIG. 4*c* illustrates a rectangular or square groove. FIG. 4*d* shows a semicircular or semielliptical groove, *i.e.*, lateral or open ended groove which will be filled with the sealant to be employed in this invention. FIG. 4*e* shows both adjacent sections of the boiler construction employing triangular grooves which are adjacent to and face-to-face with each other so that the sealant may be inserted into both grooves for fastening the two sections together.

One form of sealant which has been successfully employed in carrying out this invention is known as "Silastic," and it is made and sold by Dow Corning Corporation and sold as "Silastic 732 RTV Silicon Rubber." A similar silicone rubber is also made and sold by the General Electric Company. Either of these silicone rubbers, or other equivalent products, may be housed in a caulking gun and applied by hand by the installer or repairman. Indeed, the installation may be made even within the building where the boiler is to be used regularly. The product referred to above is capable of remaining elastic and pliable from temperatures below freezing to those extending up to about 500°F. The elasticity and pliability remain unchanged throughout the life of the installation. The use of the arrangement of this invention enables boiler constructions, whatever their size—especially small boilers—to be manufactured and rapidly installed and easily repaired, and the sections may be replaced without much difficulty. The cost of the construction, including labor and installation costs, is relatively small and so will enable home owners to acquire efficient boilers at relatively low cost.

While this invention has been shown and described in connection with a four-section boiler which is pressure fired, the invention is equally applicable to boilers having any number of sections, whether or not they are pressure fired. The shapes and contours of the grooves or channels may have any desired or varied formation even though certain preferred forms have been shown and described hereinabove for illustrative purposes. It will be apparent also that only the essential components of the boiler and its sections have been shown and described and that other appurtenances which are commonly used in conventional boiler constructions would necessarily form parts of the overall arrangements, even though they have not been illustrated or described hereinabove.

Although this invention is herein described and demonstrated in certain particular arrangements merely for illustration the general principles and features of this invention may be employed in other and widely varied organizations and applications without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. A boiler having two exteriorly arranged wall sections with adjoining mating sides having a groove at the interface filled with an elastic pliable sealant to prevent the leakage of flue gas, said groove having an expanded region filled with the sealant, the expanded region being so shaped and so enclosed that the sealant retained within the groove is not exposed to radiation from the flame within the boiler.

2. A boiler according to claim 1 in which the flue gas is at superatmospheric pressure and the sealant is a silicone rubber which remains pliable continuously after it is inserted in said groove and prevents leakage for all temperatures between the freezing and boiling points.

3. A forced draft boiler having a plurality of wall sections forming at least one of the exterior walls of said boiler, and means for rendering said sections leakproof against and unexposed to and unaffected by flue gases under superatmospheric pressures traversing said boiler, said means comprising an expanded longitudinal groove between each pair of said adjacent sections at the interface of said adjacent sections, and a pliable, elastic material supplied in excess throughout the length of said groove to completely fill the space of said groove and to be enclosed therein, said groove being so shaped and so enclosed that the elastic material enclosed therein cannot be subjected to or decomposed by radiant heat within the boiler.

4. A forced draft boiler according to claim 3 in which the pliable, elastic material remains pliable and elastic with a temperature range extending from below freezing temperature to 500°F.

5. A forced draft boiler according to claim 4 in which the pliable, elastic material is a silicone rubber composition.

6. A forced draft boiler according to claim 4 in which the pressure of the flue gases may exceed 3 inches of water.

7. A boiler having a plurality of adjacent wall sections having contoured ribbed spacings between each immediately adjacent pair of sections and so shaped as to provide a plurality of vertically extending sinuous special paths for the passage of flue gases upwards therethrough, means within each section to contain water to be heated, each pair of immediately adjacent sections having abutting faces with a continuous broadened channel common to, but spaced from the outer walls of said sections, and a sealant filling each of said channels to prevent the leakage of flue gases at the interfaces of the immediately adjacent sections, the sealant within each broadened channel being enclosed therein, so as to prevent radiant heat from attacking and deteriorating said sealant.

8. A boiler according to claim 7 in which the sealant fills the associated channel to excess when the immediately adjacent sections are assembled to form the boiler.

9. A boiler according to claim 8 in which the sealant is elastic and pliable so as to be formed into the shape of the channel.

10. A boiler according to claim 9 in which the sealant remains elastic and pliable while it is in said channel and remains elastic and pliable continuously thereafter to permit repairs to be made in said boiler.

11. A boiler according to claim 10 in which the sealant is a silicone rubber capable of maintaining its elastic and pliable condition over temperatures between the freezing and boiling points of water.

12. A boiler according to claim 11 having, in addition, a firebox and an oil burner producing flue gases at superatmospheric pressures for convecting heat to the water within the several sections as the flue gases traverse the vertically extending sinuous spacial paths between the several pairs of sections.

13. The method of rendering two adjacent end-wall plates of a super-pressure boiler leakproof against gases, said plates having similarly shaped end walls, which consists in longitudinally grooving the end walls at their interface, filling the grooving with an elastic sealant so that the sealant overflows the grooving, whereby there will be an excess of sealant, and enclosing the sealant within the grooving so that the sealant cannot be subjected to deterioration by radiant heat within said boiler.

14. The method of rendering two adjoining end-wall plates leakproof against gases, the plates having similarly shaped end walls which may be changed in their spacing due to temperature or other changes, which consists in forming an expanded longitudinal groove which would be at the interface of said end walls when they abut each other, filling to overflowing the groove and the gap between said end walls with an elastic sealant material which remains substantially permanently elastic, so that there will be an excess of sealant material to supply material to said gap or to receive sealant material from said gap, and enclosing the sealant material within the groove so that radiant heat within the boiler cannot deteriorate the sealant material.

15. The combination of two adjoining longitudinal plates having similarly shaped end walls, a longitudinal expanded groove at the interface of said end walls, and a paste-like sealant filling said groove to overflowing to render the end walls leakproof under conditions which tend to change the spacing of said end walls, the end walls being so shaped as to enclose and protect the sealant against exposure to radiated heat, thereby to protect the sealant against deterioration.

16. The combination of claim 15 including, in addition, means for generating flue gases traveling along the walls of said plates.

17. The combination of claim 16 including, in addition, means for conveying water varying in temperature up to that of superheated steam along a path adjacent to said plates.