July 30, 1940. S. K. DIGGINS 2,209,913

FURNACE

Original Filed June 13, 1936 3 Sheets-Sheet 1

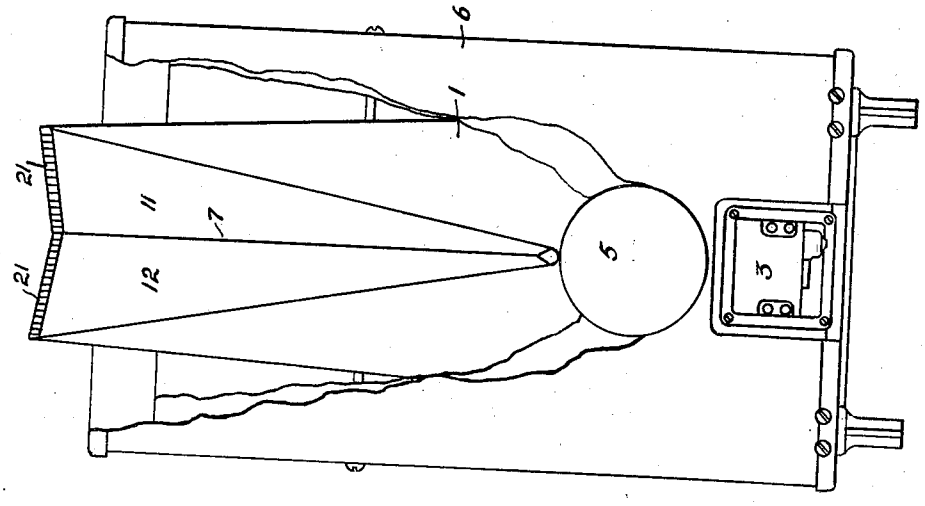


Fig. 2.

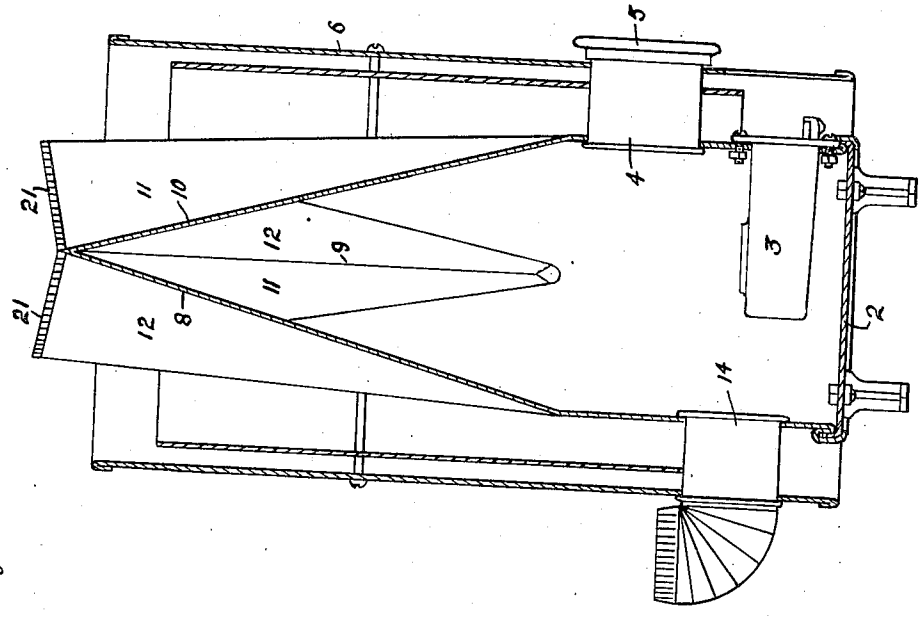


Fig. 1.

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Fig. 3.

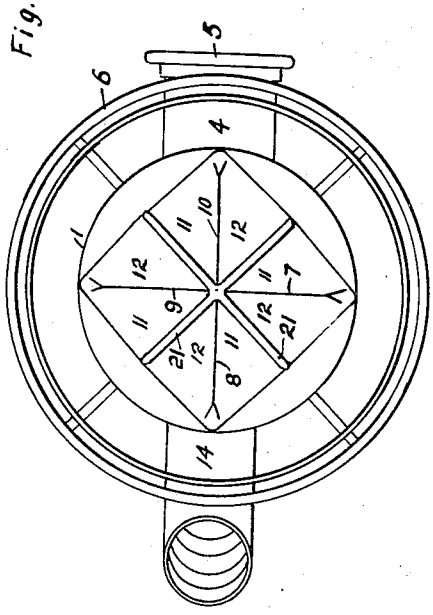
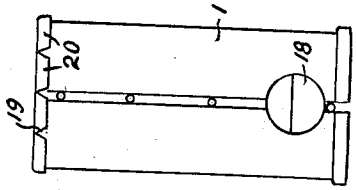


Fig. 5.



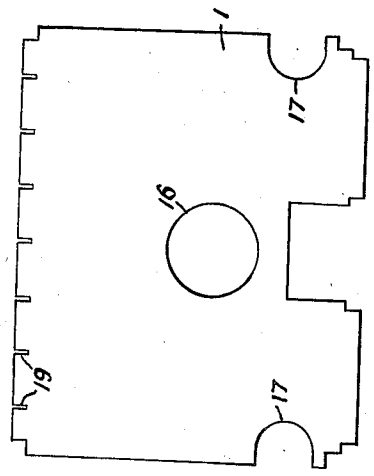


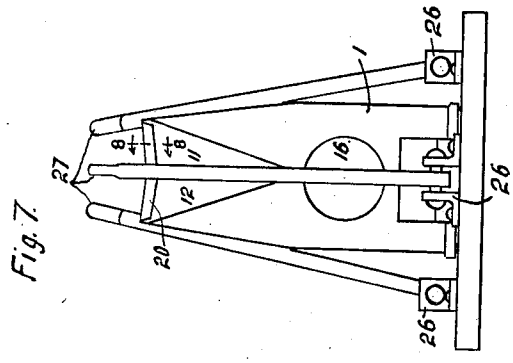
Fig. 4.

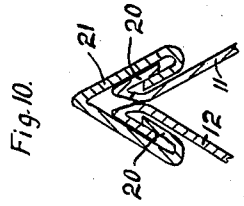
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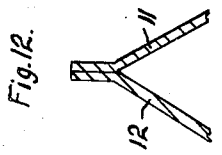
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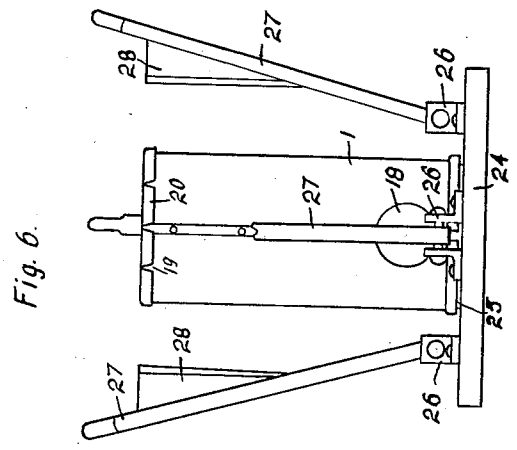
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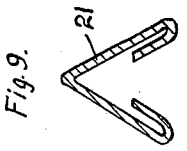
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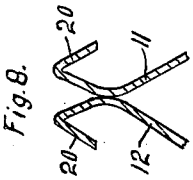


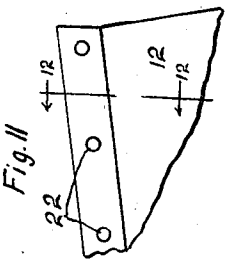












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Patented July 30, 1940 2,209,913

UNITED STATES PATENT OFFICE

2,209,913

FURNACE

Stuart K. Diggins, Woodstock, Ill.

Application June 13, 1936, Serial No. 85,132
Renewed December 22, 1939

7 Claims. (Cl. 126—99)

The present invention has for its object the production of an inexpensive, highly efficient hot air heater. This object is attained through a novel heater construction, a novel form of fire box or combustion chamber, a novel method of manufacturing the latter, and novel means for carrying out such method; and the invention, in its more specific aspects, may therefore be regarded as comprising any one or all of these things.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a vertical central section through a preferred form of heater; Fig. 2 is a front view of the heater, portions of the shells that surround the fire box or combustion chamber being broken away; Fig. 3 is a top plan view of the heater illustrated, as in Figs. 1 and 2, without a top; Fig. 4 is an elevational view of the blank from which the fire box or combustion chamber is made; Fig. 5 is an elevational view of the rudimentary fire box before crimping; Fig. 6 is an elevational view of the rudimentary fire box positioned in the open crimping apparatus; Fig. 7 is a view similar to Fig. 6, showing the crimping apparatus closed on the fire box; Fig. 8 is a vertical section, on an enlarged scale, on line 8—8 of Fig. 7; Fig. 9 is a section through a binding strip adapted to be applied to the meeting elements of Fig. 8; Fig. 10 is a sectional view showing the parts appearing in Figs. 8 and 9 assembled; Fig. 11 is a side view of a fragment of the extreme upper end of the combustion chamber, showing a modification; and Fig. 12 is a section on line 12—12 of Fig. 11.

The important novel feature of the heater illustrated in Figs. 1, 2 and 3 is the combustion chamber or fire box. This element comprises a vertical shell 1 which is closed at the bottom by a wall 2. The shell may be of any desired size and shape, but is preferably quite tall. In the arrangement shown, the shell is cylindrical, and its height is almost three times as great as the diameter thereof. Where oil or gas are to be burned, a suitable burner device 3 is positioned within the shell close to the bottom. In the wall of the shell, directly above the burner, is a door opening into which is fitted a tubular part or sleeve 4 that projects outwardly and is provided at its outer end with a door or closure 5. Surrounding the member 1 and spaced apart therefrom to provide an air space, is an outer shell 6. Air to be heated flows up through the space between the combustion chamber and the outer shell and emerges at the top where its further movements may be controlled in any usual or suitable manner.

In accordance with my invention, I so shape the walls of the combustion chamber as to provide for a maximum heating of the surfaces with which the air to be warmed comes in contact, to provide a streamline effect to avoid turbulence in the air streams, and to give room for the natural expansion of the rising air as its temperature increases. This is accomplished by crimping the shell that forms the combustion chamber, along longitudinal lines beginning in the vicinity of the door and continuing to the upper end of the shell. The crimping is done in such a manner that grooves of progressively increasing depth and width from the lower ends of the grooves to the upper ends are created. The crimping is preferably done in such a manner that the grooves or valleys shall have flat sides past which the rising air will flow readily. A further characteristic of the crimping is that each flat wall or side bounding a groove or valley shall meet and lie flat against a corresponding member of an adjacent groove or valley at the extreme upper end of the shell; whereby two, meeting, inclined wall elements produce a ridge and all of the ridges together constitute the actual top of the combustion chamber.

In the arrangement shown, the crimping is done along four longitudinal lines distributed 90° apart around the member 1. In the drawings the lines 7, 8, 9 and 10, represent the junctures of the sloping sides of the four V-shaped grooves or valleys, and the walls or sides of each valley are indicated by the numbers 11 and 12. The extreme upper end of each of the walls 12 lies flat against the wall 11 of an adjacent valley and is joined thereto in such a manner as to produce a seal and prevent the escape of combustion gases between the same. This may be accomplished in various ways as will hereafter be explained.

Since the hottest gases in the combustion chamber are at the top, I prefer that the discharge of the combustion gases take place at a point near the bottom of the combustion chamber where they are coolest. I have therefore provided the combustion chamber with a smoke outlet in the form of a sleeve 14 of large diameter positioned behind the burner. With this arrangement, only the cooler combustion gases, which have just transmitted heat to the cold incoming air, are

withdrawn from the combustion chamber, while the hottest gases are in the upper part of the chamber and heat the surfaces which come in contact with air that is already hot. Thus, there is not only a saving in heat units through the withdrawal of the cooler combustion gases, but the heating surfaces with which the upflowing air comes into contact become progressively hotter so that the air at all times meets heating surfaces whose temperatures are sufficiently above those of the air to insure an effective heat transference. In this connection it should also be noted that while the hot gases rising from the burner may be surrounded by a blanket of cooler air in the lower part of the combustion chamber, the cross sectional area of the combustion chamber decreases progressively, beginning with a point not very far above the burner; so that in the upper third of the combustion chamber the gases are crowded out of the way just as soon as they have given up a proper amount of heat to the heating surfaces of the combustion chamber, and the temperature of these surfaces will therefore be kept relatively high.

The shell for the combustion chamber in small units may be formed from a single sheet metal blank such as illustrated in Fig. 4; the opening **16** in the blank being the door opening and the two semi-circular edge notches **17** cooperating to produce the smoke outlet which appears at **18** in Fig. 6. A series of notches or slits **19** may be cut into the upper edge of the blank to permit the ears or flaps thus produced to be bent downwardly or outwardly as a sectional flange **20**, in the manner illustrated in Figs. 5 and 8. The blank is first rolled into a cylindrical form and the longitudinal edges joined in any suitable manner. This open ended shell is then crimped; the lines of crimping registering with alternate notches **19**. After the crimping has been accomplished, binding or sealing strips **21**, such as illustrated in Fig. 9, may be engaged with each meeting pair of flanged wall sections **11** and **12**, by being slipped on lengthwise of the flanges **20**; thereby producing the condition illustrated in Fig. 10. Then, by running each of these joints or seams through an ordinary crimping machine, tight, crimped seams, such as illustrated in Figs. 1 and 2, are obtained.

If desired, the joints between the upper ends of meeting walls **11** and **12** may be made without providing the flanges **20**. Thus, as shown in Figs. 11 and 12, the upper marginal portions of meeting walls **11** and **12** may simply engage with each other and be united by riveting or spot welding; the rivets or spot welds being indicated at **22** in Fig. 11.

In Figs. 6 and 7 I have illustrated a simple apparatus for crimping a cylindrical shell. This apparatus comprises a suitable base **24** having on the upper side a projection **25** adapted to fit into the open lower end of the shell and thereby hold the shell centered on the base. Distributed around the centering member **25**, upon the base, are four brackets **26**, spaced 90° apart and rigidly secured to the base. Hinged to each bracket is a long arm or lever **27** which is adapted to swing in a plane extending radially of a shell mounted on the base. Each of the arms **27** has on the inner side a long triangular blade **28** whose greatest width is at the top and which vanishes into its supporting arm at the lower end. These blades are located in the planes of the swinging movements of their respective supporting arms. Since the supporting arms are disposed 90° apart around the center of the base, they are naturally disposed in two pairs, those in each pair swinging in the same plane. Consequently, there being a rudimentary combustion chamber in position on the base of the apparatus, as shown in Fig. 6: upon grasping the upper ends of one such pair of arms and forcing them toward each other, the blades are caused to engage with the shell and form two deep crimps in the same. Then, by operating the other pair of arms in the same way, while the first pair is held closed on the work, the second pair of grooves or valleys is produced; the condition being now as illustrated in Fig. 7. The shell is now ready to have the edges of the walls **11** and **12**, where they meet across the top of the unit, joined together in one of the ways heretofore described, or in any other suitable way.

It will thus be seen that I have produced a simple and novel heater which may be made from sheet metal at a low cost. Furthermore, the heater is highly efficient because the heat generated in the combustion chamber is applied to the best advantage to heating surfaces which, in turn transfer their heat in the most advantageous manner to the air to be heated. In addition, a streamline effect, which allows the air to flow straight up and not to eddy, is secured by first making a simple shell of any desired cross sectional shape and then, by a single simple operation, transforming the shell into a streamlined structure.

While I have illustrated and described with particularity only a preferred manner of carrying out my invention, I do not desire to be limited to the exact details thus illustrated and described; but intend to cover every structure and apparatus that comes within the definitions of my invention constituting the oppended claims.

I claim:

1. In a heater, a vertical combustion chamber having a door near the lower end, the sides of the chamber being crimped inwardly to a progressively increasing depth and width from the vicinity of the door to the upper end of the chamber and terminating in sharp ridges that form the top of the chamber, the circumference of the chamber following the surface contours being substantially equal throughout the height of the chamber.

2. In a heater, a vertical combustion chamber having a door near the lower end, the sides of the chamber having V-shaped grooves lying inwardly from the periphery thereof and extending from the vicinity of the door to the top, the grooves increasing progressively in depth and width from the lower ends toward the top, the circumference of the chamber following the surface contours being substantially equal throughout the height of the chamber.

3. In a heater, a vertical combustion chamber having a door near the lower end, the sides of the chamber having V-shaped grooves extending from the vicinity of the door to the top, the grooves increasing progressively in depth and width from the lower ends toward the top, the circumference of the chamber following the surface contours being substantially equal throughout the height of the chamber, and each wall that forms the side of a groove meeting a wall of an adjacent groove and united therewith in a ridge at the upper end of the chamber, the ridges constituting the top of the chamber.

4. In a heater, a tall vertical combustion chamber having in the lower end means to permit

fuel to be burned, the sides of the chamber being crimped inwardly along longitudinal lines to a progressively increasing depth and width from a point a short distance above said means to the upper end of said chamber, the lower portion of the chamber being cylindrical and the circumference at all points of the chamber following the different contours being substantially uniform.

5. In a heater a tall cylindrical combustion chamber having in the lower end means to permit fuel to be burned, the sides of the chamber being crimped inwardly along longitudinal lines to a progressively increasing depth and width from a point a short distance above said means to the upper end of the chamber and forming with each other a pair of ridges that are transverse to each other and extend diametrically across the chamber and constitute the top of the chamber.

6. In a heater, a tall vertical combustion chamber formed from a single sheet of material, the upper two-thirds of the chamber being crimped along longitudinal lines into grooves which increase gradually in depth and width from their lower to their upper ends which increase progressively in depth and width until, at their upper ends, the depth of each is substantially equal to one-half of the longest transverse dimension of the top of the chamber and the circumference width is substantially ninety degrees.

7. In a heater, a tall vertical combustion chamber closed at the top and having a smoke outlet at the bottom, said chamber being formed from a single sheet of material and the upper two-thirds thereof being crimped along longitudinal lines into four grooves, said grooves increasing gradually in width and depth from their lower ends to their upper ends and the side walls thereof meeting in ridges that constitute the top of the combustion chamber.

STUART K. DIGGINS.