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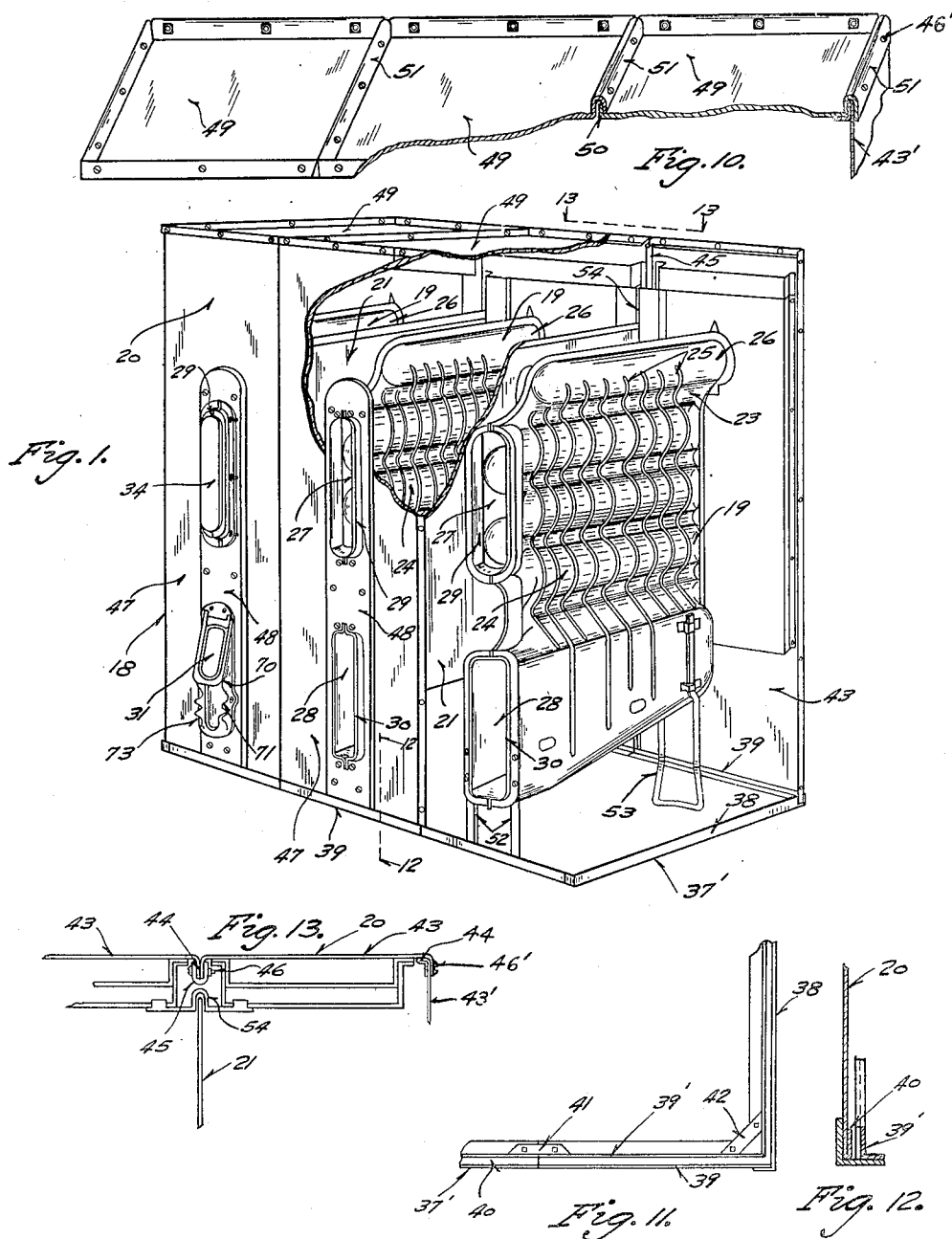
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1,927,174

GAS FURNACE

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7 Sheets-Sheet 1



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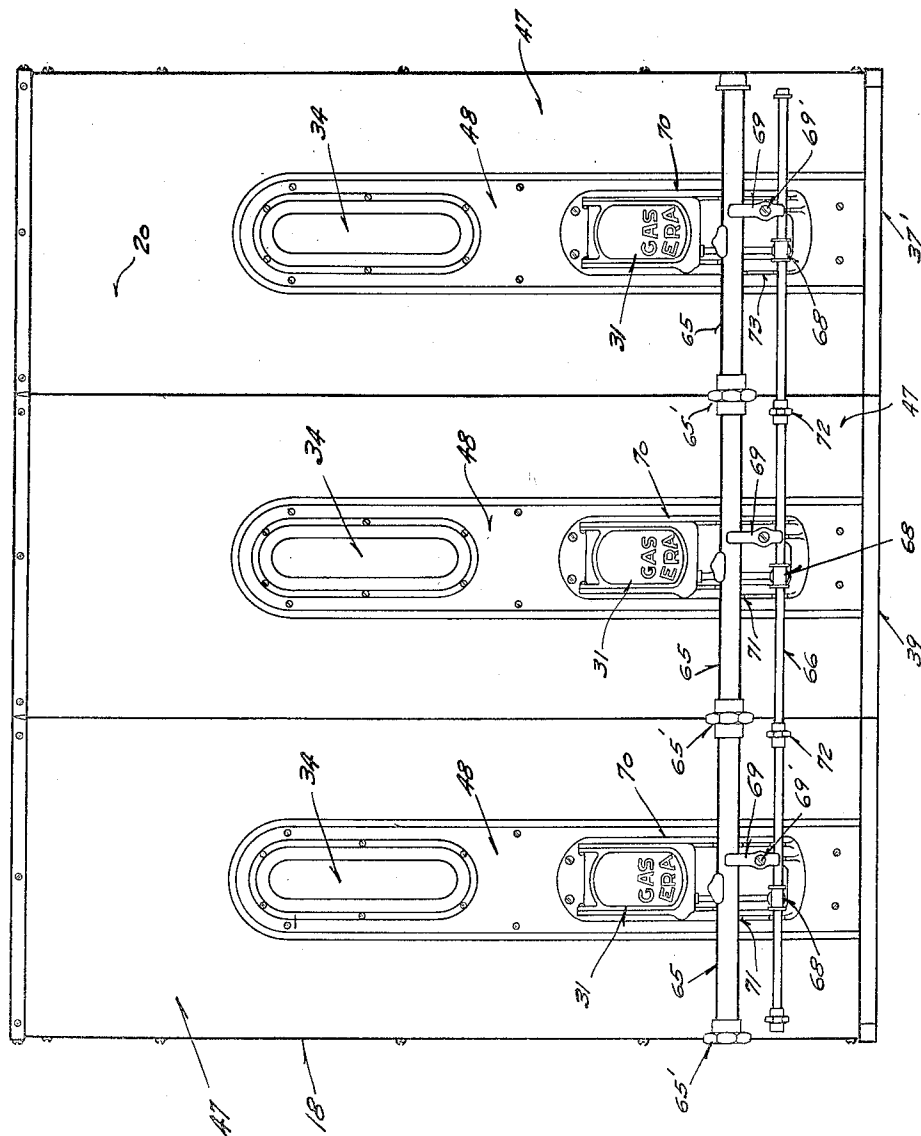
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7 Sheets-Sheet 2

Fig. 2.



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7 Sheets-Sheet 3

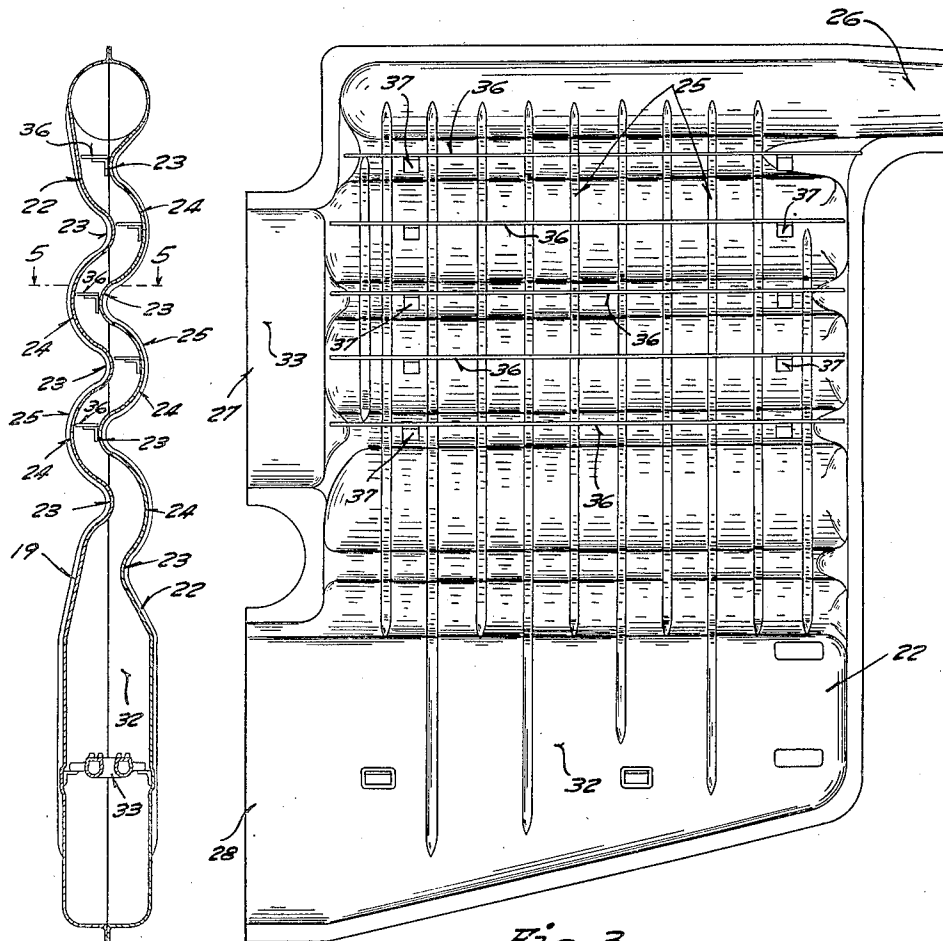


Fig. 4.

Fig. 3.

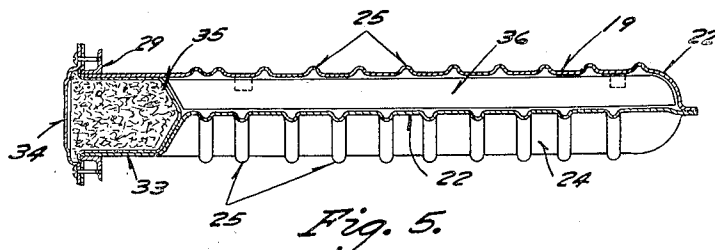


Fig. 5.

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7 Sheets-Sheet 4

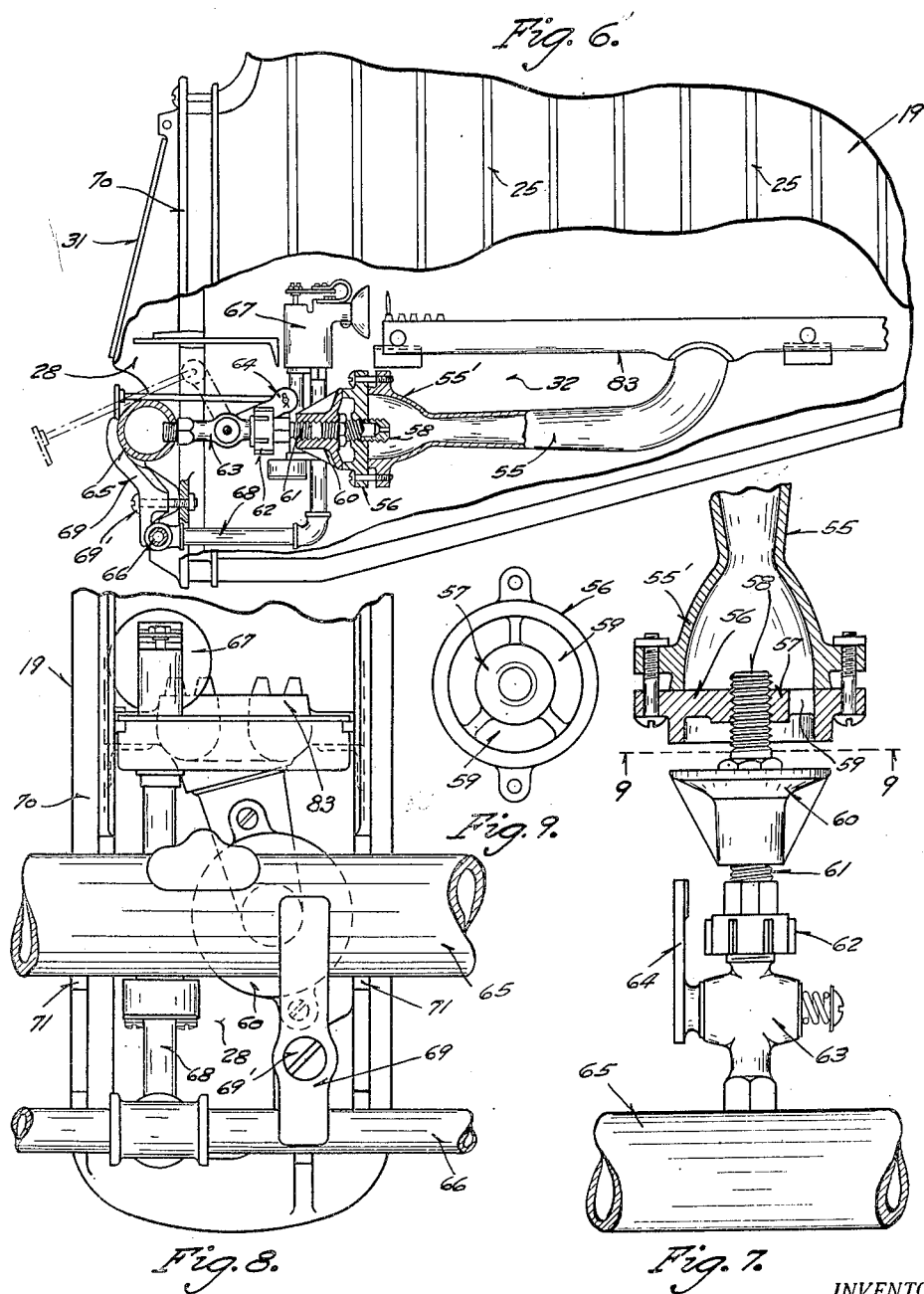


Fig. 7.
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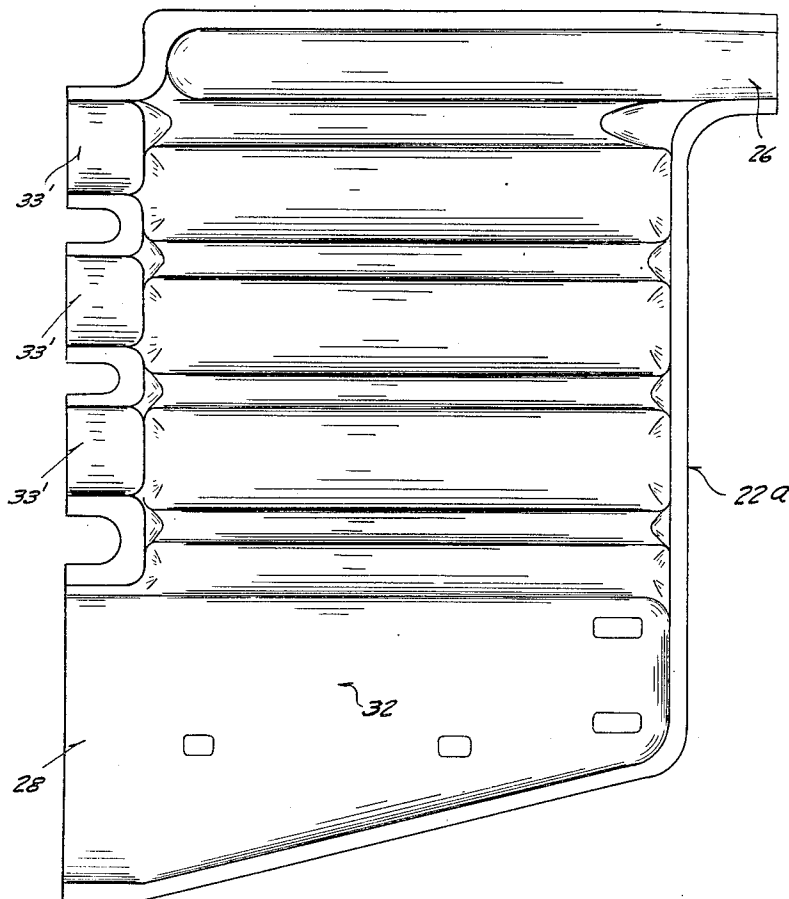
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GAS FURNACE

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7 Sheets-Sheet 5

Fig. 14.



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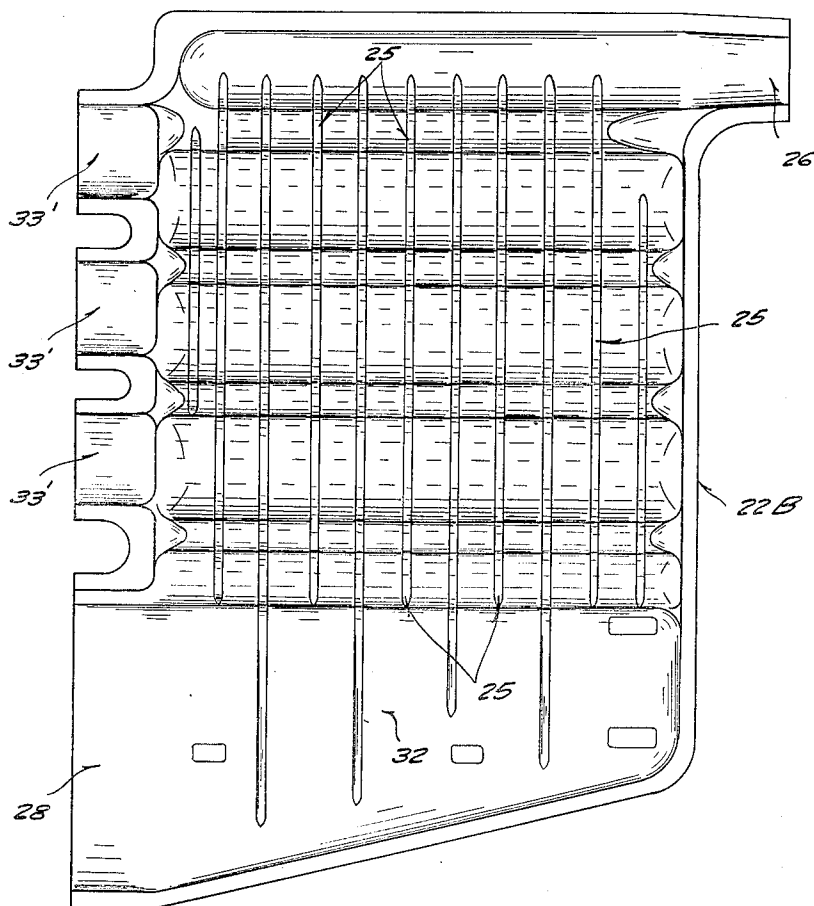
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GAS FURNACE

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7 Sheets-Sheet 6

Fig. 15.



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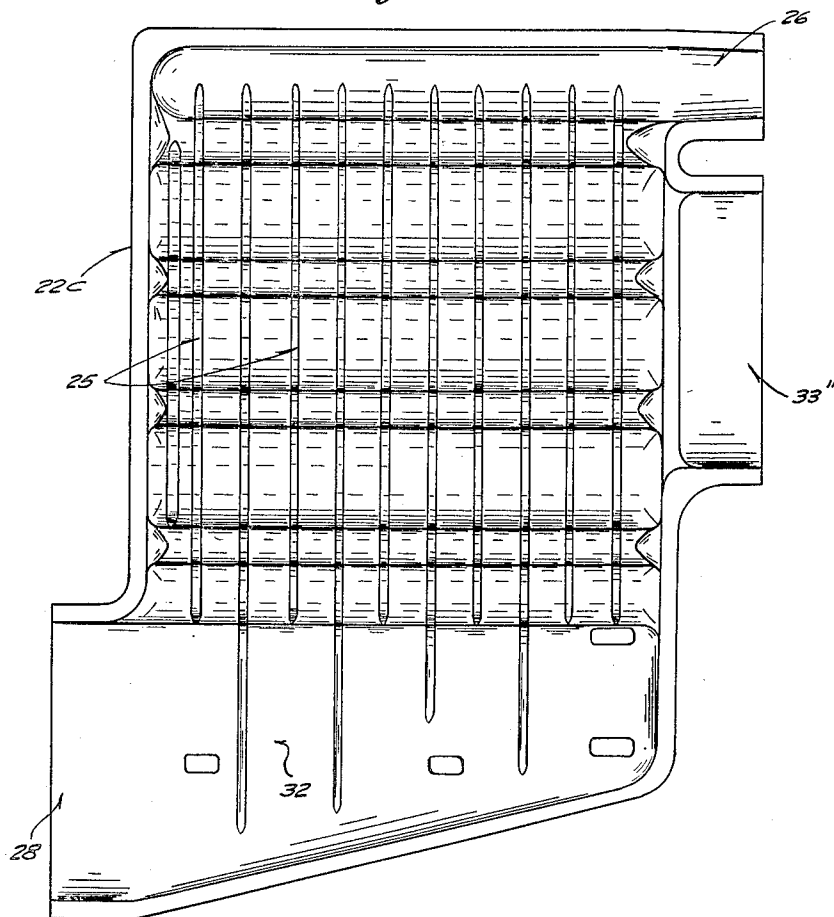
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7 Sheets-Sheet 7

Fig. 16.



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UNITED STATES PATENT OFFICE

1,927,174

GAS FURNACE

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Application February 5, 1931. Serial No. 513,470

5 Claims. (Cl. 126—116)

This invention relates to Improvements in gas furnaces, and more particularly to pressed sheet metal gas furnaces.

In my reissue Letters Patent Re. 17,817 (original
5 No. 1,657,125) I have shown and described a gas furnace wherein the complementary unit or section members are cast. The present invention constitutes an improvement over my prior Letters
10 Patent in that according to the present invention the furnace casing and the constituent parts of the units or sections are formed of pressed metal, preferably steel, whereby the present gas furnace, while retaining certain structural and design ad-
15 vantages of the construction exemplified by my former patent, possesses the further advantage in that it can be produced at a very much lower manufacturing cost, and the constituent parts are susceptible of easy and rapid connection and assembly.

20 Generally, the invention has as further objects the provision of a gas furnace having a serpentine-like flue passage with provision for complete accessibility from exteriorly of the furnace casing to all parts of the flue passage for cleaning
25 purposes; high efficiency due to maximum heat emission and uniform air distribution; and unique flue baffling for controlling the motion of hot gases.

Further specific objects of the present invention are as follows:

The provision of a gas furnace wherein the units or sections are pressed out of sheet metal in corrugated form and have their peripheries formed with flanges for abutment with complementary members for joining by welding;

A gas furnace equipped within the casing, equidistant between the sections or units, with vertical, metallic radiation shields or partitions which serve to increase the heat emission per
40 square foot of heating surface presented, secure better scrubbing action of air columns, and equalize the distribution of air passing through the various units;

A gas furnace construction whereby a complete
45 furnace may be built up of any desired number of units or sections with the constituent parts in uniform or standard sections for easy connection with adjacent unit or section parts, and complete interchangeability of all section parts and casing parts; and

A gas furnace construction having a burner including novel means for controlling the amount of air admitted to the burner.

With the above and other objects in view the
55 invention consists of the improved gas furnace,

and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a perspective view of a three unit gas furnace constructed in accordance with the invention, parts being broken away to show details of construction;

Fig. 2 is an enlarged front view thereof;

Fig. 3 is an enlarged detail view of a furnace unit half section looking at the inner surface thereof;

Fig. 4 is an enlarged, transverse, vertical sectional view of a furnace unit;

Fig. 5 is a horizontal sectional view thereof taken on line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary side view of the lower portion of a furnace unit with portions broken away to show the burner chamber and the burner therein; portions of the burner being in section;

Fig. 7 is a fragmentary plan view of the burner and its associated connections, on a larger scale, portions being shown in section;

Fig. 8 is a front view of the showing in Fig. 7 with the burner positioned within a burner chamber of a gas furnace unit;

Fig. 9 is a view of an element of the air regulating member taken on line 9—9 of Fig. 7;

Fig. 10 is a perspective view of the top of the furnace casing with part broken away and in section to show details of construction;

Fig. 11 is a fragmentary plan view of the base ring portion of the furnace casing;

Fig. 12 is an enlarged, fragmentary, detail sectional view taken on line 12—12 of Fig. 1;

Fig. 13 is a fragmentary plan view of a rear portion of the casing and a radiation shield or partition showing its engagement with the casing, said view being indicated by the line 13—13 of Fig. 1;

Fig. 14 is an enlarged detail view of a modified form of furnace unit half section looking at the inner surface thereof;

Fig. 15 is an enlarged detail view of another modified form of furnace unit half section looking at the inner surface thereof; and

Fig. 16 is an enlarged detail view of a third modified form of furnace unit half section looking at the inner surface thereof.

Referring now more particularly to the drawings, it will appear that the gas furnace is designated generally by the numeral 18, and may be composed of any number of independent units 19

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enclosed by a suitable casing 20, with the units preferably separated within the casing by vertical sheet metal shields or partitions 21. The furnace illustrated in Figs. 1 and 2 is composed of three units.

Each unit 19, shown in detail in Fig. 3, is formed of a pair of complementary side wall members or sections 22 formed of pressed steel. The upper portions of said members are formed with alternating rows of concaved and convex portions 23 and 24, respectively, providing wave-like curves, and said members 22 are further pressed with ribs or corrugations 25. Said arrangement insures the presentation of a large surface area for the heating of air by convection and for the transfer of heat to the air from hot gases of combustion. As shown most clearly in Figs. 3, 4 and 5, the peripheral portions of the sections 22 are flanged, and in the assembly of a unit the flanges of complementary sections are positioned together and are so secured by lines of welding. As so assembled, each unit is gas tight, and the space between the upper portions of the sections forms a flue.

The rear ends of each flue are closed, except for an upper vent pipe connection 26. The front portion of each unit has an upper opening 27, and a lower opening 28, and the sections adjacent said openings have welded to peripheral edge portions, flanged frames or collars 29 and 30. Each lower opening 28 is partly closed and controlled by a suitable plate 31. The enlarged cavity or space between the lower portions of each pair of sections 22 forms a burner chamber 32, into which, through the lower opening 28, a gas burner, designated generally by the numeral 83, extends. Each upper opening 27, so arranged that it provides complete access to all portions of the flue from the forward extension 33 thereof for cleaning purposes, is normally closed by a removable plate or door 34. Said forward extension 33 directly registers with all portions of the flue and preferably extends from immediately above the burner chamber to substantially the top portion of the flue. Removable, metallic baffling receptacles 35 are mounted within each extension. Said receptacles are filled with asbestos, or a similar material and prevent the products of combustion from short circuiting through the front cleaning extensions from the flues, and the removability of the doors 34 and the baffling members 35 permit ready accessibility to the flues for cleaning.

By reference to Fig. 4 it will be seen that when the two sections 22 of a unit are secured together in proper relationship, a vertically extending flue of serpentine shape is formed therebetween, cooperating complementary convex and concave portions therein forming courses, which courses, in their vertical relationship are staggered and are connected. It is desirable, however, that the flue opening or passage be restricted or diminished as to volumetric content, and to that end a plurality of horizontally extending internal flue baffles 36 are provided. The baffles 36 are elongated plate-like members carried by and welded to lugs 37 which in turn are welded to interior surface portions of the sections 22. The specific purpose of said baffles is to direct thin streams of flue gases against the curved and corrugated surfaces of the sections 22, insuring the utmost heat discharge, efficiency and economy.

The outer casing 20 is of sectional, interchangeable construction whereby standard casing parts are employed to assemble a casing of any desired

length for the accommodation of any suitable number of units. The bottom of a casing comprises a rectangular base frame 37' formed with end transverse members 38 and front and rear longitudinal members 39. The various members 38 and 39 (see Figs. 11 and 12) are L-shaped with rear flanges 39', providing channels 40. For the front and rear, a suitable number of the members 39 are secured together in endwise relation by joint strips 41 bolted thereto, and the transverse members 38 are secured to the ends of the members 39 by angularly disposed, bolted joint strips 42. The rear and ends of the casing are closed by vertically disposed outer sheets 43 and 43' whose lower edge portions are disposed within the channels 40 of the base frame. Said sheets 43 are formed along their side edges with inturned apertured flanges 44 and the flanges of adjacent rear sheets are in abutment and are covered and secured together by U-strips 45 and bolts 46 (see Fig. 13). The front of the casing is closed by front casing sheets 47 having their lower edge portions fitted into the base ring channel. Said front sheets are bolted together in the same manner as are the rear sheets and are provided with elongated openings covered by front plates 48 also having openings therein through which the unit portions 29 and 30 project. Said front plates 48 are secured to the sheets and also to the members 29 and 30 carried by the sections. So far as the ends of the casing are concerned, the end sheets 43' are flanged along their side edges as at 44 (see Fig. 13) and are secured to adjacent flanged portions of front and rear casing sheets by metal screws 46'.

Within the lower section portions 30 and secured to the unit sections are lower door frames 70 for the burner chamber openings and said door frames provide hangings for the lower doors 31 and also provide hangings or support means for manifold and pilot lines, as will later be more fully explained.

The built-up assembly of a casing top is shown in Fig. 10 and it will appear that the top comprises a plurality of pan-like members 49 with upturned flanges 50 at one side edge and rolled hooking flanges 51 at the other side edges. Members 49 are secured together by having adjacent flanges engaged and bolted together as shown. Also, the front and rear edge portions of the members 49 are flanged, and to secure the top to the casing, said flanges are engaged with upper edge portions of the sheets 43 and 47 and are bolted thereto. Flanges 50 and 51 are engaged with upper edge portions of end sheets 43' in a like manner and are bolted thereto.

The units 19 are supported in slightly elevated, spaced positions within the casing by removable front and rear legs 52 and 53 respectively. As previously mentioned, each pair of adjacent units 19, is separated, within the casing by a thin, flat vertical radiation shield or partition 21 formed of sheet metal. Said shields are positioned preferably equidistant between adjacent units and extend from an elevation in accord with upper portions of the burner chambers to the upper portions of the units. Essentially each radiation shield 21 serves a two-fold function. In the first place it secures a greater heat emission per square foot of heating surface presented by increasing radiation from the sections served thereby. This is accomplished through the absorption of radiant heat. Radiant heat is not absorbed by the air, and in the present instance, maximum efficiency

is gained by the flat shape and positioning of the shield 21. Radiant heat absorbed by each shield is then transferred to air passing there-adjacent by convection. Each shield also aids the transfer of heat by convection and this is a function independent of the absorption of radiant heat. Convection is a function of friction, and frictional increase bears a direct ratio to the velocity. In the present arrangement the velocity of the air is increased at the points of restriction between the convex portions of the unit sections and the shields. Each shield also insures better scrubbing action of air passing between a unit and a shield by setting up eddy currents as the air scrubs along the sections, whereby the transfer of heat by convection is aided. In addition to the foregoing functions the radiation shields equalize and cause an even distribution of air passing through the units separated and served by the shields. Each shield is held in its position within the casing by having its front and rear edge portions engaged in channels 54 carried by the casing members 43 and 47.

The burner and associated parts and connections employed in the present gas furnace are shown in detail in Figs. 6, 7, 8 and 9. The burner 33 is lodged within a burner chamber 32 and a mixture conducting member 55 opens at its inner end thereto. The outer end portion of said member 55 is flared as at 55' and carries a spider 56 to provide support for and a threaded connection with an orifice fitting 58. Said spider 56 has the usual air entrances 59 adjacent its central portion 57. An air shutter 60 is also threaded on the orifice fitting 58 and is also in threaded engagement with a union tail piece 61, said air shutter being held tightly on both the members 58 and 61. The union tail piece 61 is connected to a gas cock 63, having a control arm 64 for controlling the flow of gas to the conducting member 55 and the burner, by a union nut 62. The other end portion of the gas cock enters a manifold section 65. The manifold, for the entire gas furnace, is made up of a plurality of manifold sections 65, of similar lengths, joined together by unions 65'. The assembled manifold extends horizontally along the lower front portion of the casing and is mounted in recessed portions 71 formed therefor in the lower door frames 70. Extending below the manifold is a pilot line 66 formed of a plurality of similar sections secured together by unions 72. Said pilot line is also mounted in recessed portions 73 formed therefor in the lower door frames 70. Within each burner chamber, adjacent the burner therein, is a pilot 67 to which gas is supplied from the pilot line 66 by connections 68. The manifold and pilot lines are jointly held in position by simple one-piece clamping brackets 69. One of said brackets is shown most clearly in Figs. 6 and 8 and it will be noted that the bracket has curved upper and lower portions to clampingly engage respectively, portions of the manifold and pilot lines and said bracket is adjustably held in clamping position by a screw 69' extended through a medial portion of the bracket and into a frame portion.

The assembly of a gas burner and associated parts and connections, and the adjustment of the burner is very simple, and minimizes the hazards of improper adjustments being made by novices. The gas burner and mixture conducting member are positioned within a burner chamber as shown in Fig. 6. Also, the manifold and pilot lines are clamped in position by the brackets 69, as previously described. The gas cock 63 is fitted into the

manifold and the air shutter 60 and orifice fitting 58 are both tightly threaded to the spider. Then, the union tail piece 61 is connected with the gas cock by a union nut 62. Adjustments, to regulate the amount of air admitted through the spider 56 to the member 55 and burner are regulated by turning the air shutter 60 which will also turn members 58 and 61 since said members 58, 60 and 61 are secured together to operate as a unit, but adjustments are only possible when the union nut is manipulated to disengage the union tail piece from the gas cock. Inasmuch as the manifold and connections outwardly of the air shutter are all fixed against movement, turning movements of the air shutter will cause the entire burner and member 55 carrying the spider to be drawn inwardly or outwardly to vary the proximity of the spider to the air shutter plate.

In Fig. 14 there is illustrated a modified form of unit section 22^a. This section 22^a differs from the section 22 only in that the corrugations or ribs 25 are eliminated. Also, access to the complete flue passage and the courses thereof is afforded by a plurality of forward clean out extensions 33', one above the other and each registering with portions of several courses.

The modification of a unit section 22^b, illustrated by Fig. 15, is similar to the modification shown in Fig. 14 with the addition thereto of vertical ribs or corrugations 25, as in the main form of the invention.

A third modified form of unit section 22^c is shown in Fig. 16. This section is similar to the section 22 except that the clean out extension 33'' is located at the rear of the section and registers with the rear ends of the flue courses. Said extension 33'' is, of course, adapted to extend through the rear wall of an enclosing casing.

It will therefore be seen that the improved gas furnace is composed of any number of units and each unit has a relatively long flue travel, with restrictions therein to cause scrubbing action and the maximum extraction of heat. Each flue passage is completely accessible from exteriorly of the casing for cleaning. The units are formed in half sections and in their secured together relation are gas tight. Due to the pressed sheet metal formation of the unit sections and the casing, the furnace is relatively inexpensive, is easily assembled, and is strong and durable. The sectional construction and interchangeability of the casing parts permits a casing to be assembled of any desired length. The gas furnace is furthermore of simple and novel construction, and is well adapted for the purposes described.

What I claim as my invention is:

1. A gas furnace, comprising at least two similar heating devices having adjoining and similar casing sections, each of said heating devices including a combustion unit formed of a pair of secured together, curved sheet metal sections, a vertically extending curved flue passage and a lower burner chamber being formed therebetween, an open ended cleaning extension formed on each unit in registration with said flue passage throughout substantially the entire height of the same for complete cleaning accessibility, said casing sections being detachably secured together and to the sections of the adjacent heating devices to provide a common entirely sectional enclosure for all of said heating devices, said cleaning extensions extending adjacent a wall of the enclosure, doors carried by said wall of the enclosure controlling the entrances to said cleaning extensions, vertically extending radiation shields in-

terposed transversely within said enclosure between adjacent heating devices and detachably engaged with the enclosure walls, a burner mounted within the burner chamber of each unit, and
 5 a fuel conduit secured adjacent the enclosure and communicating with each burner.

2. A gas furnace, comprising a pair of similar heating devices having adjoining casing sections, each of said heating devices including a combustion unit formed of a pair of secured together,
 10 curved sheet metal sections, a vertically extending curved flue passage and a lower burner chamber being formed therebetween, an open ended cleaning extension formed on each unit and in
 15 registration with substantially all portions of said flue passage, said casing sections for each unit being detachably secured together and to casing sections of the adjacent unit and providing a
 20 common entirely sectional enclosure for both of said heating devices, said cleaning extension extending adjacent a wall of the enclosure, openings in said wall for the open ends of said cleaning
 25 extensions, doors for the open ends of the cleaning extensions, a burner mounted within the burner chamber of each unit, a sectional manifold detachably clamped adjacent a wall of the
 30 enclosure, branch connections between the manifold and the burners, and adjustable air regulating means associated with each branch connection.

3. A multi-unit heating device, comprising a plurality of individual, sectional heating units, each having a main burner therein and a pilot
 35 light adjacent the burner, and sets of similar

knock-down casing elements, all susceptible of ready connection to form a unitary heating device including a predetermined number of heating units and an entirely sectional enclosing casing therefor, and sectional fuel conduits readily
 80 detachably mounted lengthwise of the casing and communicating with each heating unit to supply fuel to each burner and to each pilot light.

4. A heating device, comprising a heating unit formed of secured together sections providing
 85 therebetween a lower combustion chamber having an opening therein and a curved flue above said combustion chamber, a hot air casing enclosing said unit, a door frame surrounding said
 90 combustion chamber opening and projecting through said casing and formed with a pair of spaced grooves therein, a pair of manifolds mounted in proper alinement within said grooves,
 95 and means for removably securing said manifolds within the grooves.

5. A gas furnace, comprising a heating unit having therein a lower combustion chamber and
 100 an upper, curved flue, there being an opening in said unit to the combustion chamber, a hot air casing enclosing said unit, a door frame carried by said unit adjacent said opening, said door
 105 frame being formed with a pair of spaced grooves, a pair of elongated manifolds mounted within said grooves, and a one-piece yoke member detachably engaging said frame and detachably
 110 clamping both manifolds within said grooves in proper relationship.

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