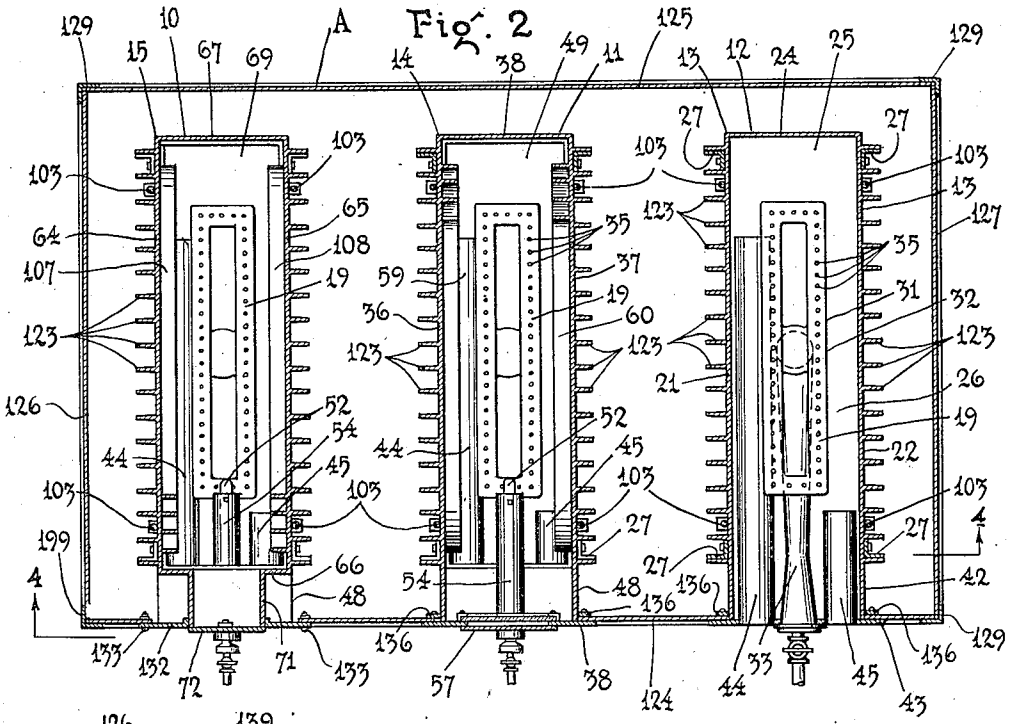
Aug. 10, 1937. V. S. BECK 2,089,329

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Fig. 2



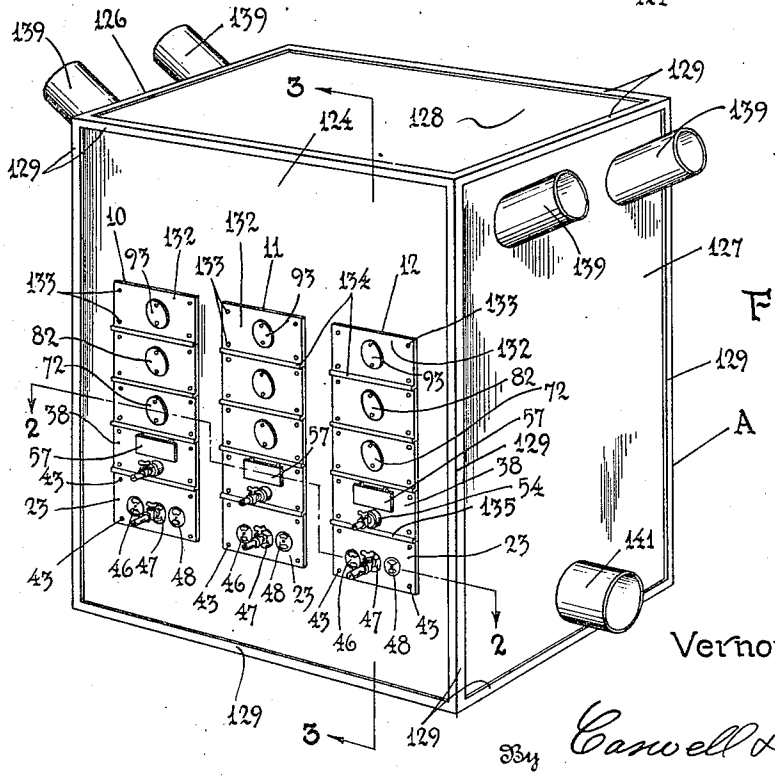


Fig. 1

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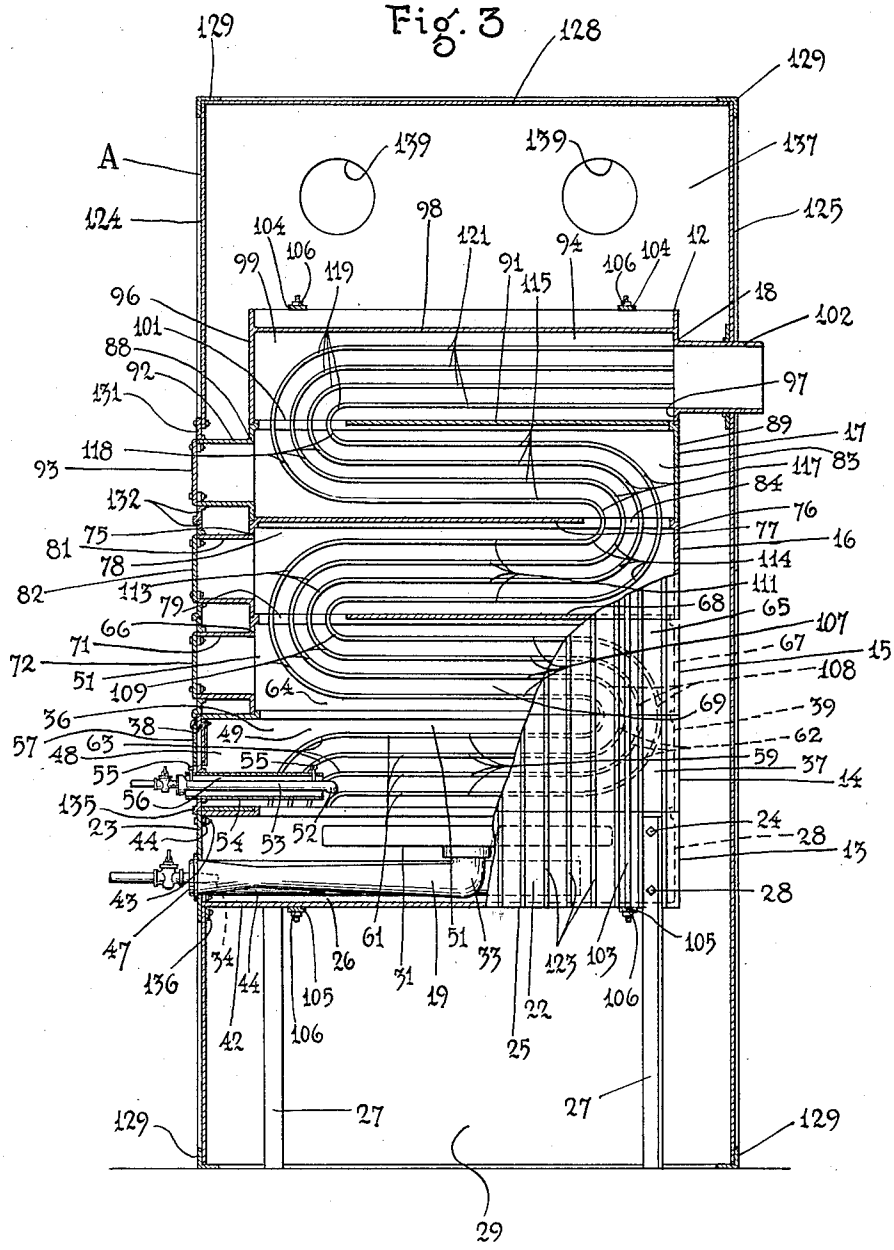
Attorneys

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Fig. 3



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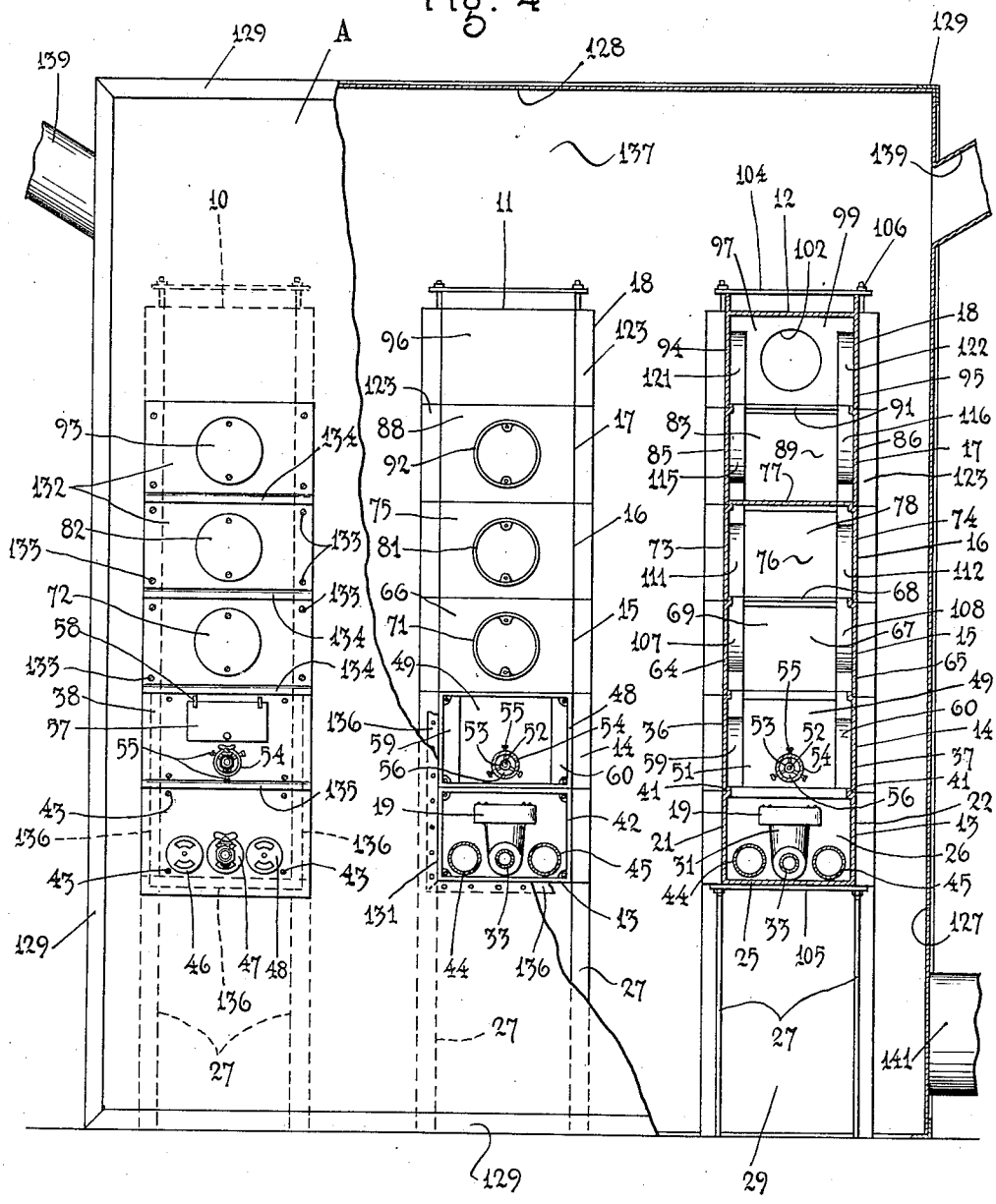
Attorneys

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Fig. 4

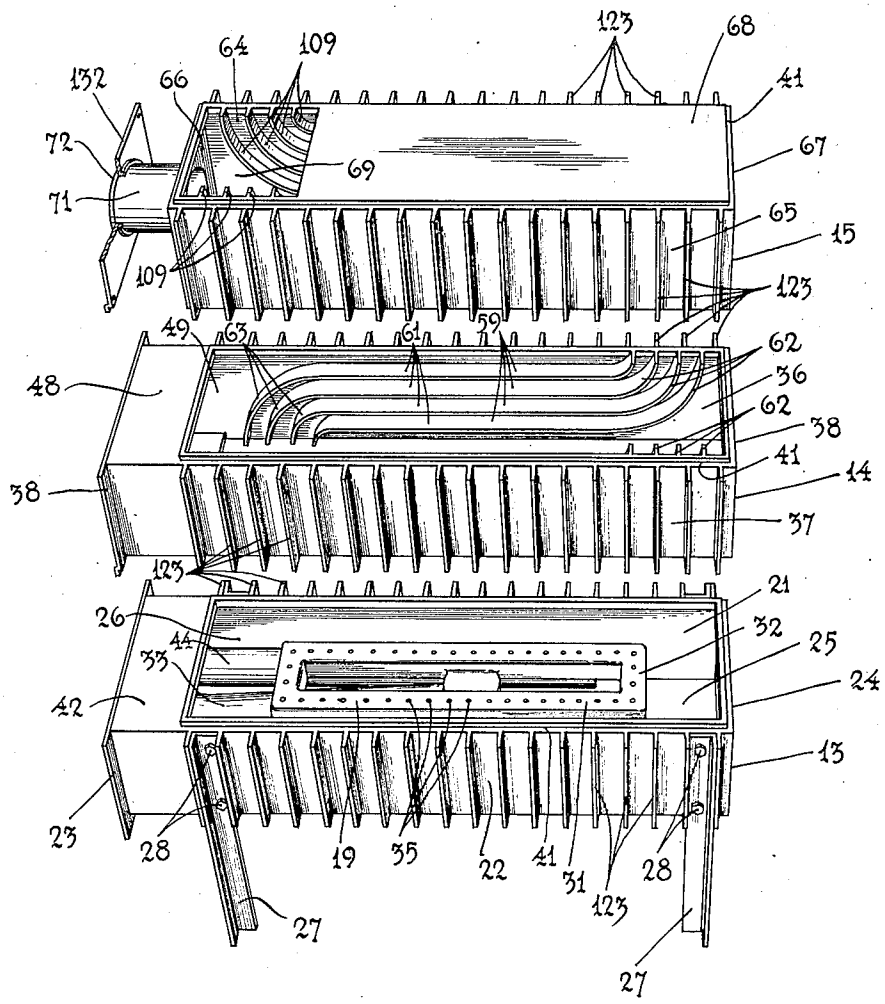


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Fig. 5



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FURNACE

Vernon S. Beck, St. Louis, Mo.

Application February 7, 1935, Serial No. 5,354

5 Claims. (Cl. 126—99)

My invention relates to furnaces and has for an object to provide a furnace made in sectional units in order to permit of building the same in different sizes or capacities.

Another object of the invention resides in constructing the furnace so as to increase the heat exchange between the gases of combustion and the air to be heated.

A still further object of the invention resides in constructing the sections so as to permit of readily cleaning the same.

Another object of the invention resides in providing a furnace having a tortuous gas passageway therethrough in which radiating fins are utilized and in which said fins are arranged so as to deflect the gases and cause them to travel through the furnace with a minimum amount of friction and loss of velocity or pressure.

An object of the invention resides in providing a furnace in which turbulence of the gases in passing through the furnace is greatly reduced.

A still further object of the invention resides in constructing the sections so that any size or capacity of furnace may be procured with but a few different types of sections, thereby reducing the number of sections necessarily carried in stock by the furnace builder.

An object of the invention resides in providing a furnace capable of producing different quantities of heat without varying the size of the flame.

Another object of the invention resides in arranging the combustion chamber section and the heating sections so that the gas flows through the entire furnace with the aid of gravity.

A still further object of the invention resides in providing a simple construction whereby intercommunication between the various sections may be had.

Another object of the invention resides in providing a sectional furnace in which provision is made for compensating for expansion and contraction.

In the drawings:

Fig. 1 is a perspective view of a furnace illustrating an embodiment of my invention.

Fig. 2 is a plan sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is an elevational sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is an elevational sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a perspective view of three of the sections isolated from the furnace.

In the designing of heating systems the customary practice has been to employ furnaces of different dimensions and to determine in advance the proper size of furnace for a particular installation. Where furnaces are kept in stock, an unusually large assortment of furnaces is necessary. Also after a furnace has once been installed it is extremely expensive and difficult to change the capacity of the furnace in the event that alteration is required. The present invention provides a simple construction by means of which a few different standard furnace sections may be kept in stock and a furnace of any desired capacity may be readily built up from the said standard sections.

A furnace constructed in accordance with my invention is shown in the drawings and comprises a casing A within which is disposed a number of independent heating units. As will become evident, any number of such units may be utilized depending upon the amount of heat required. For the purpose of illustration, I have shown in the drawings three units 10, 11 and 12 which illustrate a simple application of the invention. Inasmuch as all of these heating units are identical in construction, only the heating unit 12 will be described in detail.

The heating unit 12 comprises six sections 13, 14, 15, 16, 17 and 18 which are substantially the same in construction. The sections 15 and 17 are identical in construction while the section 16 is similar to these sections excepting that the clean out opening is at the opposite end. Section 13 forms a burner section in which a burner 19 is installed, while sections 14 and 15 provide a combustion chamber in which the fuel is originally burned. Section 18 provides an outlet chamber from which the products of combustion leave the furnace while all of the sections serve to transfer heat from the hot gas to the air to be heated.

The lowermost section 13 is constructed with side walls 21 and 22, an end wall 24 and a bottom or base 25, said section being open at the top. At the forward portion of said section is provided a neck 42 which extends outwardly beyond the furnace proper and has attached to it a cover plate 23. This plate is secured to the said neck by means of screws 43 which extend through said cover plate and through lugs 44 formed on the neck 42. Within section 13 is formed a chamber 26 in which the burner 19 is disposed. The lower section 13 is supported upon the floor on which the furnace rests through four angle iron legs 27 which are bolted to the side walls 21 and 22 by means of bolts 28, and is arranged at a suitable

distance above the floor to leave a space 29 between the floor and the said section through which the air to be heated may circulate.

The burner 19 may be of any desired type or construction and in the drawings has been shown as designed for gas. This burner comprises a casting 31 which is constructed with a hollow body 32 forming the burner proper. This body is constructed with orifices 35 from which the flames issue. A draft tube 33 communicates with the body 32 and extends through the cover plate 23 of the section 13. At the end of the draft tube 33 is provided a gas nozzle 34 by means of which a stream of gas is directed into the burner. The flow of gas through the draft tube 33 creates a suction in the draft tube which draws a certain amount of air in the same to promote combustion at the orifices 35 formed in the body 32. This produces a series of flames which issue upwardly from the burner and transfer heat to the various sections of the burner in a manner to be presently described in detail. In addition to the draft tube 33 for conducting air to the burner, two auxiliary air tubes 44 and 45 are employed which are attached to the cover plate 23 and which extend inwardly into the chamber 16, being disposed shortly above the bottom 25 thereof. The tube 45 is relatively short and delivers air into said chamber near the forward end of the burner 32. The tube 44 is considerably longer and similarly discharges air into the chamber 26 in proximity to the farthermost end of the burner. The amount of air entering the draft tube 33 and the air tubes 44 and 45 may be controlled through suitable shutters 46, 47 and 48 which are secured to the outer ends of the said tubes and which function in the usual manner for the desired purpose. By the use of the short and long auxiliary air tubes and the regulating shutters therefor, it is possible to precisely apportion and balance the secondary air at the two ends of the burner so that there will be no tendency to have excessive secondary air at the front end of the burner and a shortage of secondary air at the rear end of the burner, whereby complete combustion is procured throughout the length of the burner without excessive air.

The section 14 is constructed with side walls 36 and 37 and with an end wall 38, said section being open at the top and bottom. The side walls 36 and 37 have attached to them at their forward ends a neck 48 rectangular in cross section which is similar to the neck 42 and which is open at its outer end. A cover plate 38 similar to the cover plate 23 is attached to the neck 48 in a similar manner. By means of the construction shown a chamber 49 is formed within the interior of the section 14, said chamber forming part of the combustion chamber which is indicated in its entirety by the reference numeral 51.

Within the chamber 49 is disposed a gas pilot 52 which extends through the cover plate 38 of section 14. This pilot is mounted in a draft tube 53 which furnishes sufficient air to provide a combustible mixture at the end of said pilot. The draft tube 53 is mounted in a tubular housing 54 which is attached to the cover plate 38 of section 14. This tubular housing has a number of set screws 55 threaded into the same by means of which the draft tube 53 is centered within said housing. Housing 54 provides an annular space 56 extending about the air tube 53 by means of which auxiliary air is introduced into the chamber 49 to procure complete combustion of the gas directed into the combustion chamber from the pilot 52.

For the purpose of inspecting the operation of the furnace an inspection door 57 is provided which is attached to the cover plate 38. This door is constructed with hinges 58 by means of which the same is secured to said cover plate. The door 57 may be swung upwardly to permit of observation of the flame from the burner 19 and also enable the observer to ascertain if the pilot has gone out.

Section 15 is constructed with side walls 64 and 65, front and rear walls 66 and 67 and with a top 68, being open at the bottom. This construction forms a chamber 69 within the section which forms part of the combustion chamber 51 previously referred to. The front wall 66 has attached to it a cylindrical neck 71 which is similar to the necks 42 and 48 and which has attached to it a circular cover plate 72 in the same manner as the cover plates 38 and 23. The neck 71 is in communication with the chamber 69 and provides a clean-out opening through which access into the interior of section 15 may be had. Cover plate 72 serves merely to close the said clean-out opening and is only opened when necessary.

The section 16 is similar to the section 15, being constructed with side walls 73 and 74, front and rear end walls 75 and 76 and a top 77. This construction provides a chamber 78 within said section which communicates with the chamber 69 through an opening 79 at the forward end of the top 68 of section 15. Section 16 is constructed with a cylindrical neck 81 identical with the neck 71 which is closed by a cover plate 82 attached thereto in the same manner.

Section 17 is constructed with side walls 85 and 86, a front wall 88, a rear wall 89 and a top 91. A neck 92 cylindrical in form is attached to the wall 88 and is closed at its outer end by a cover plate 93. Within section 17 is formed a chamber 83 which communicates with the chamber 78 of section 16 through an opening 84 in the top 77 of said section.

The uppermost section 18 is constructed with side walls 94 and 95, front and rear end walls 96 and 97 and a top 98, all integral with one another. These walls form a chamber 99 within the said section which communicates with the chamber 83 through an opening 101 in the forward portion of the top 91 of section 17. The rear wall 97 of said section is provided with a smoke pipe nipple 102 to which the smoke pipe may be connected and by means of which the products of combustion may be conducted away from the furnace. If desired, the nipple 102 may be brought out through the front wall 124 of casing A where an additional section similar to section 16 is placed between sections 17 and 18.

All of the sections 13, 14, 15 and 17 are constructed at the uppermost portions thereof with recesses 41 which receive the lowermost edges of the vertical side walls and end walls of the superimposed sections. The front walls of the sections 15, 16 and 17 are received in similar recesses in the front walls of the corresponding sections on which they rest. The neck 48 of the section 14, rests directly upon the neck 42 of section 13. A suitable furnace cement is placed in the recesses which forms a gas tight joint between the various sections. The sections are held rigidly attached to one another through four stay bolts 103 which extend downwardly along the side walls of said sections. These bolts pass through bars 104 at

the upper ends of the section and through similar bars 105 at the lower ends of said sections. Nuts 106 screwed upon the ends of said bolts serve to draw said sections together and hold the same in proper relation.

Within the section 14 are disposed two sets of radiating fins 59 and 60 which are attached to the side walls 36 and 37 of said section. These fins are provided with horizontal portions 61 and with upturned portions 62 at their rearward ends and with downwardly turned portions 63 at their forward ends. These fins extend toward one another but fall short of each other. Similar fins 107 are provided in the section 15, which fins have downwardly turned parts 108 at the rearward ends thereof which lie in continuation of the upwardly turned part 62 of the fins 59 and 60 in section 14. Said fins at their forward ends have upturned parts 109 which lead to the opening 79 in top 68 of section 15.

Section 16 is constructed with fins 111 and 112 similar to the fins 107 and 108. These fins have downwardly turned portions 113 and upwardly turned portions 114 which extend from the opening 79 in top 68 to the opening 84 in top 77 and lie in continuation of the fins 107 and 108 at the opening 79. Section 17 is identical with section 15 and is constructed with fins 115 and 116 which have downwardly extending portions 117 extending from the opening 84 in top 77 and upwardly extending portions 118 leading toward the opening 101 in top 91. The upper section 98 is provided with fins 121 and 122 which are provided with downwardly extending portions 119 which lead from the opening 101, the said fins being directed toward the smoke pipe nipple 102. All of the fins in the various sections on one side of the sections extend toward the fins on the opposite walls of said sections and are spaced from one another. These fins are streamline in design and not only do not interfere with the travel of the gas, but serve to assist in causing the gas to flow in the direction thereof. By means of the structure shown a tortuous zig zag passageway through the various sections is provided whereby the time taken for the gas to travel through the sections is greatly increased to permit of the transfer of heat from the gas to the walls and fins of the various sections. The space between the fins in sections 14 and 15 constitute the combustion chamber in which combustion of the gas mixture from the burner 19 commences. The fins in these chambers assist in starting the gas to travel in the desired path so that the gas does not pass directly from said combustion chamber and into the chambers of the superimposed sections. The various fins in addition to directing the flow of gas increases the radiating surface by means of which heat is absorbed from the gas and transferred to the wall structure of the sections so that a highly efficient construction is provided.

As previously stated, air is circulated about the exterior surface of the various heating units 10, 11 and 12. To increase the radiating surface of the said heating units a number of vertically extending fins 123 are formed on the vertical walls of the various sections, which fins are preferably arranged in continuation of one another. By means of these fins the heat transmitted to the wall structure of the heating units is readily transferred to the air passing along the sides of the said units. These fins greatly increase the heating area of the furnace and being vertical do not interfere with the travel of the air through the furnace.

The casing A in which the various heating units are disposed consists of a front wall 124, a rear wall 125 and side walls 126 and 127. The said casing further includes a top 128. If desired the casing may be left open at the bottom in which case the casing rests directly upon the floor of the building in which the furnace is installed. The various walls of the casing are connected together through angle corner members 129 which are riveted or bolted thereto as desired.

In the front wall 128 of casing A are provided openings 131 through which the various necks of the heating units extend. Encircling each of the cylindrical necks of the upper sections are collars 132 which are slidably mounted thereon. These collars are bolted to the front wall 124 of casing A by means of bolts 133 which extend through slotted holes in the said casing, said holes not being shown in detail in the drawings. Each of the collars 132 is provided at its lowermost edge with an offset lip 134 which overlies the upper edge of the adjacent collar. Cover plate 38 is similarly constructed with a lip 135 which overlies the uppermost edge of the cover plate 23 while the lip 134 of the lowermost collar 132 similarly engages the upper edge of the cover plate 38. By means of this construction the various sections of the heating units may expand vertically without stressing the structure of the casing. As the said units expand the various collars and cover plates slide relative to one another. As vertical expansion occurs the various plates and collars are maintained closed by the lips which cover the gaps formed therebetween. While such sliding occurs the bolts securing the collars to the front wall 124 of the casing slide in the slots in said wall through which they extend. By means of this construction misalignment of the sections due to unevenness of the castings or irregularities in the erection of the sections is compensated for. Due to the fact that the various necks connected to the sections extend through the front wall of the casing, the cover plates therefor are exposed upon the exterior of the furnace and may be readily removed for the purpose of cleaning the sections upon the interior thereof.

Longitudinal expansion of the various sections is also compensated for in my improved construction through the various collars 132 which slide on the necks of the various sections on which they are mounted. In place of such collars for the two sections 13 and 14 where the necks are rectangular in cross section instead of cylindrical, three bars 136 are provided which are bolted or riveted to the front wall 124 of the section and which fit up against the sides and bottom of the necks 42 and 48 of the lower sections 13 and 14 of the heating units. These bars seal the space between the sections 13 and 14 and the casing A.

It will be noted that the top 128 of casing A is considerably above the uppermost section 18 of each of the heating units. This provides a plenum chamber 137 at the top of the casing from which the heated air may be conducted through ducts 139 connected to the side walls of the casing and led to the various rooms in which the heated air is to be utilized. Similar ducts 141 at the lower ends of said walls direct the cold air into the chamber 29 from which the same circulates about the various heating units and upwardly into the chamber 137.

My invention is extremely advantageous in

that a highly practical and efficient construction is provided. With my invention a few standard castings may be used to build up a furnace of any desired heating capacity. This may be accomplished by the use of heating units, each having a predetermined number of units. With my invention the furnace may be designed to accommodate the space available. Where the floor area is limited and the ceiling of sufficient height, added heating surface may be procured by utilizing a greater number of sections in each stack. Where the ceiling is low and the floor area is unlimited the number of heating units may be increased and a lesser number of sections used in each unit. All of the parts of the system are so designed that expansion in the heating sections does not cause strain upon any portion of the casing. The gas passageways are such that the flow of gas through the furnace is procured solely through gravity and the passageways are arranged in such a manner that logging of the gas will not result. By means of the sectional construction of my improved furnace, broken or worn out sections may be readily replaced without replacing the entire furnace and with much less expense than where similar damage is occasioned to the ordinary furnace. With my improved invention a single size of burner may be provided which is used in each heating unit. By using a number of heating units, better control of the resulting temperature can be procured and each burner while in operation operates at maximum efficiency. With my invention it becomes unnecessary to provide means for causing the burner to burn with more than one size flame, thereby eliminating the difficulties encountered when burners are operated on high and low flames. My invention is highly practical and when properly installed will require a minimum amount of attention.

Changes in the specific form of my invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a furnace, a stack of heating sections, each in the form of an elongated quadrangular prism, said sections being arranged horizontally, one above the other, and being provided with spaced side walls and a horizontal wall, said horizontal walls having openings therein at alternate ends to bring the sections in communication with one another and to form a tortuous passage therethrough, horizontal fins arranged upon the interior of said side walls intermediate the ends thereof and curved fins at the ends of said side walls connected to said horizontal fins and extending in the direction of the openings in said horizontal walls, the ends of the curved fins of adjacent sections at the openings registering with one another.

2. In a furnace, a stack of heating sections, each in the form of an elongated quadrangular prism, said sections being arranged horizontally, one above the other, and being provided with spaced side walls and an upper horizontal wall, said horizontal walls having openings therein at alternate ends to bring the sections in communication with one another and to form a tortuous passage therethrough, horizontal fins arranged upon the interior of said side walls intermediate the ends thereof and curved fins at the ends of said side walls connected to said horizontal fins and extending in the direction of the openings in said horizontal walls, the ends of the curved fins of adjacent sections at the openings registering with one another, all of the fins on one side wall being spaced from all of the fins on the other side wall to provide an intervening passageway within the sections clear of fins from one horizontal wall to the next.

3. In a furnace, a stack of heating sections, each in the form of an elongated quadrangular prism, said sections being arranged horizontally, one above the other, and being provided with spaced side walls and end walls connected thereto, horizontal partitions between said side walls and having openings therein at opposite ends to bring the sections into communication with one another and to form a tortuous passage therethrough, elongated horizontal fins arranged upon the interior of said side walls, and curved fins at the corners between said partitions and end walls, said curved fins serving as deflectors for deflecting the gas passing along said passage away from said end walls.

4. In a furnace, a stack of heating sections, each in the form of an elongated quadrangular prism, said sections being arranged horizontally, one above the other, and being provided with spaced side walls and end walls connected thereto, horizontal partitions between said side walls and having openings therein at opposite ends to bring the sections into communication with one another and to form a tortuous passage therethrough, elongated horizontal fins arranged upon the interior of said side walls, and curved fins at the corners between said partitions and end walls, said curved fins serving as deflectors for deflecting the gas passing along said passage away from said end walls, all of the fins on one side wall being spaced from the fins on the other side wall.

5. In a furnace, a stack of heating sections, each in the form of an elongated quadrangular prism, said sections being arranged horizontally, one above the other, and being provided with spaced side walls and an upper horizontal wall, said horizontal walls having openings therein at alternate ends to bring the sections in communication with one another and to form a tortuous passage therethrough, horizontal fins arranged upon the interior of said side walls intermediate the ends thereof and curved fins at the ends of said side walls connected to said horizontal fins and extending in the direction of the openings in said horizontal walls, all of the fins on one side wall being spaced from all of the fins on the other side wall to provide an intervening passageway within the sections clear of fins from one horizontal wall to the next.

VERNON S. BECK.