

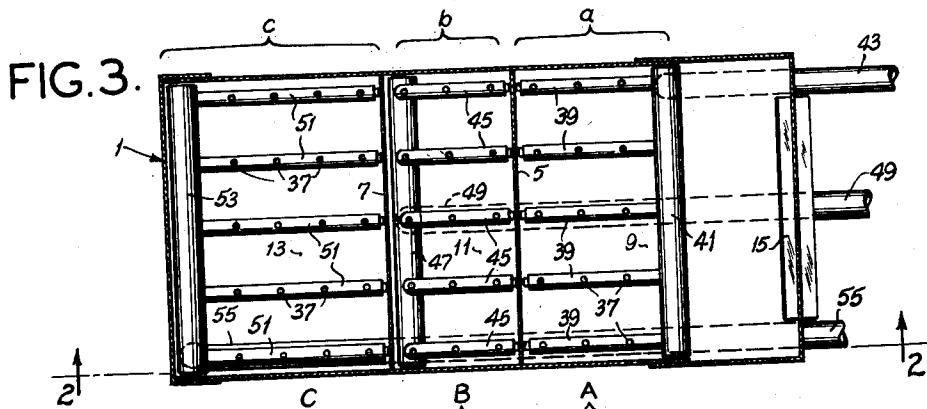
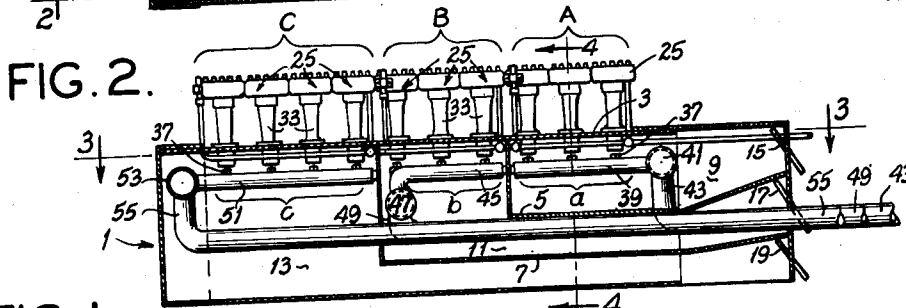
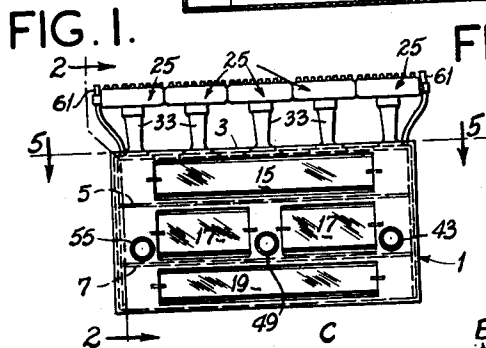
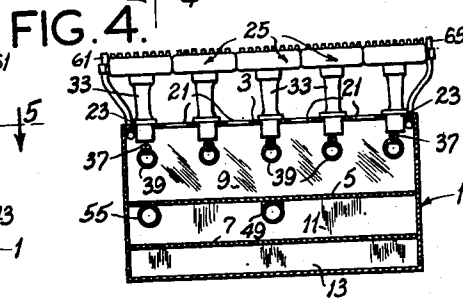
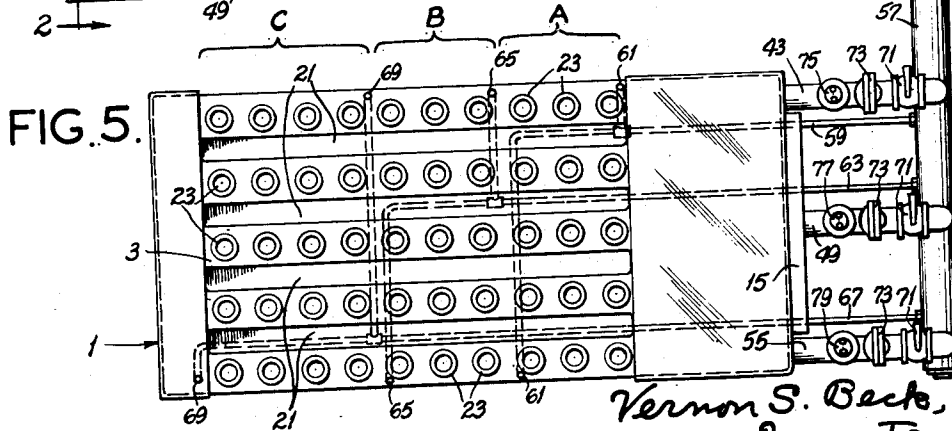
Jan. 20, 1953

V. S. BECK
MULTIPLE GROUP GAS BURNERS WITH INDEPENDENT
FUEL AND SECONDARY AIR SUPPLIES

2,625,992

Filed June 30, 1949

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

FIG. 6.

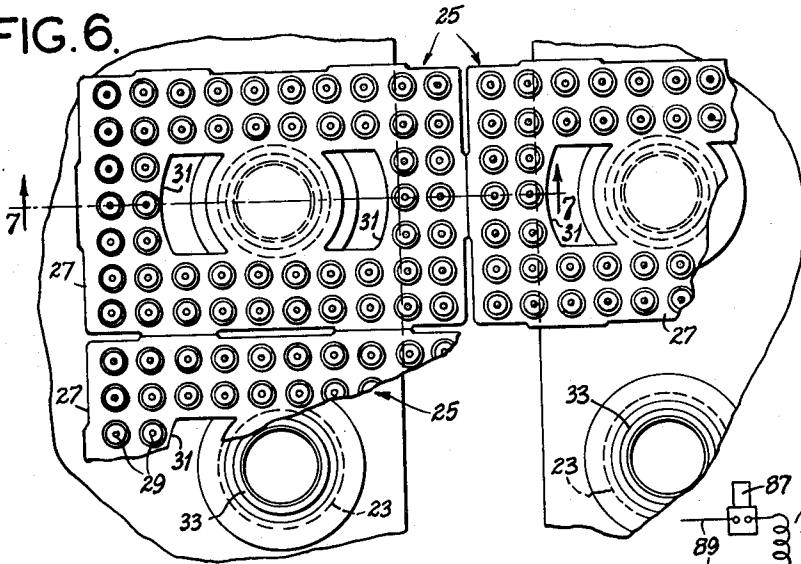


FIG. 7.

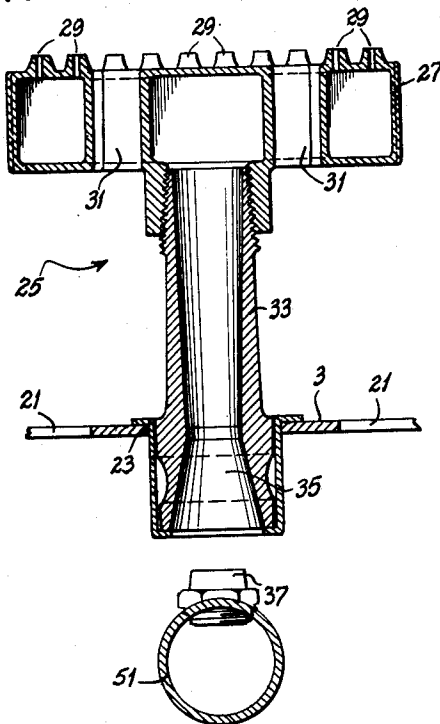
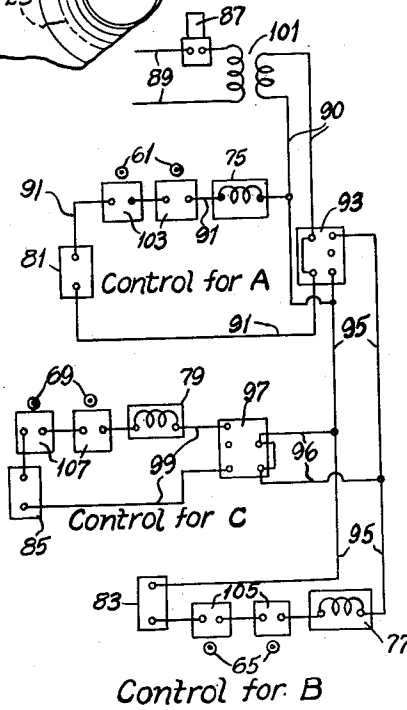


FIG. 8.

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UNITED STATES PATENT OFFICE

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MULTIPLE GROUP GAS BURNERS WITH
INDEPENDENT FUEL AND SECONDARY
AIR SUPPLIES

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Application June 30, 1949, Serial No. 102,370

3 Claims. (Cl. 158-105)

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This invention relates to gas burners of the modulating variety for heating and power systems.

Briefly, the invention consists in a multiple gas burner arrangement in a convenient integrally built unit wherein the burners for a given furnace are sectionalized into removable groups which are independently supplied with primary and secondary air for combustion. Each group is supplied by a gas valve which closes in response to a predetermined pressure of the boiler served by the furnace. The pressures controlling these valves are in ascending order, according to the boiler pressures needed for satisfying normal heating requirements under varying conditions of heat loss from the region being heated. A thermostat responsive to a desired temperature, through a sequence relay circuit, controls the sequence of starting of the burner groups. Thus only a sufficient number of burner groups is in operation at any one time, operating at best efficiency to supply the existent heating load; and in addition, when it is necessary to bring more than one group of burners into operation, the respective groups are sequentially introduced so as to eliminate the concussion which ordinarily occurs when all of the burners of a furnace of substantial size are ignited at once. Thus the invention results in automatically obtaining higher operating efficiencies under all load conditions from a unit of the type described. It also results in a much quieter modulated control for bringing burners into operation. Other features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction and manipulation, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated:

Fig. 1 is a front end view of a gas burner unit embodying my invention;

Fig. 2 is a cross section view on lines 2-2 of Figs. 1 and 3;

Fig. 3 is horizontal section taken on line 3-3 of Fig. 2;

Fig. 4 is a vertical section taken on line 4-4 of Fig. 2;

Fig. 5 is a plan view of Fig. 2 but showing certain burner heads removed;

Fig. 6 is a fragmentary detail plan view of several burner heads;

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Fig. 7 is a vertical section taken on line 7-7 of Fig. 6; and,

Fig. 8 is a wiring diagram.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

While the present invention is described for burners in an insertable unit used in connection with steam heating boilers, it will be understood that the invention is useful for hot water boilers and also for warm air heating furnaces.

In most prior heating systems employing gas burners, all burners were brought into action at the same time, which caused a considerable concussion and vibration as all of the burners became lighted, particularly in cases of large capacity burners. One solution to the problem has been the provision of slow-opening supply valves. These supplied all burners at once and were used for controlling the volume of gas not only for starting but modulating for load requirements. In the latter connection, such valves were unsatisfactory because the range of change in control was extremely limited. For example, by reducing gas pressure from four ounces to one ounce (an extreme for most burners) a reduction of capacity of only 50% can be attained, which under many circumstances results in waste. In some cases sequentially ignited groups of burners have been employed with air supplies which were individual to the groups, but these were not built into units for convenient application to various furnaces and required a substantial amount of special installation work. By means of the present invention, a convenient unit is provided having the ability to be applied to match various load requirements of any of a wide variety of heating plants. Moreover, the present invention may be used either without or in conjunction with slow-acting valves, thereby extending its field of usefulness.

Referring now more particularly to Figs. 1-5, there is shown at numeral 1 an enclosed rectangular base which forms an air box unit adapted to be placed under any of a wide variety of boilers. This box has a flat top 3 and by means of baffles 5 and 7 is divided into three plenum chambers 9, 11 and 13, which receive air through forward control doors 15, 17 and 19, respectively. The top 3 is provided with longitudinal outlet slots 21 for issuance of secondary air. Each slot 21 transverses all of the plenum chambers 9, 11 and 13. Thus a part of each slot 21 forms an outlet for secondary air from one of the plenum chambers. Between the slots 21 in the top 3 are located socket-forming openings 23 for the reception of burner assemblies 25. The

character of each burner assembly is shown in Figs. 6 and 7, and comprises a top manifold 27 having outlets 29 with passages 31 for rising secondary air. Each manifold 27 is on the top of a mixing pipe 33 having a Venturi inlet 35. This inlet is adapted to receive gas from nozzles 37 and also primary air which sweeps into the venturi with the gas from these nozzles. The burner assemblies 25 are removable and interchangeable with respect to the socket-forming openings 23. The entire number of manifolds 27 of the burners 25 may be considered to be a removable firing platform, removable burner by burner, and held in position by gravity above the top 3, sectionalized according to the groups of associated plenum chambers 9, 11 and 13, into which their lower ends extend. Thus (Fig. 2), all of the air for the section A of burners is supplied through the plenum chamber 9; all of that for section B through the plenum chamber 11; and all for section C through the plenum chamber 13. One advantage of this construction is that no group of burners becomes starved of air, since all of the air cannot short-circuit through any one group of burners.

The gas supply for the burner groups is also sectionalized. This is done by sectionalizing the nozzles 37 into groups *a*, *b* and *c*. The group *a* of nozzles 37 is located in branched manifold pipes 39, extending from a lateral header 41 supplied by an inside leader 43. The group *b* of nozzles 37 is located in branched manifold pipes 45, extending from a lateral header 47 supplied by an inside leader 49. The group *c* of nozzles 37 is located in branched manifold pipes 51, extending from a lateral header 53 supplied by an inside leader 55. All of the leader pipes 43, 49 and 55 are supplied from a main gas line 57 to which they may be conveniently attached. As shown in Fig. 5, a pilot line 59 from the main supplies two pilot burners 61 for the section A; pilot line 63 supplies two pilot burners 65 for the section B; and a pilot line 67 supplies two pilot burners 69 for the section C. This arrangement allows for convenient insertion of the headers 41, 47 and 53 and manifold pipes 39, 45 and 51 in the respective plenum chambers 9, 11 and 13 and convenient application of the burner heads above these chambers. Grouping of the heads is automatic, even when applied indiscriminately.

In the pipes 43, 49 and 55 are manual shut-off cocks 71 and suitable pressure regulators 73; also electrically operated gas valves 75, 77 and 79, respectively. These valves 75, 77, 79 are under control of boiler-pressure-operated switches 81, 83 and 85 (see Fig. 8). The switches 81, 83 and 85 are opened and closed in response to predetermined pressures of the heating boiler which the burners serve. Thus, for example, when the boiler pressure drops to a small differential under 5 p. s. i., switch 81 will close, thus energizing valve 75 to open; when it drops to a small differential under 4½ p. s. i., switch 83 will close and energize valve 77 to open; and when it drops to a small differential under 4¼ p. s. i., switch 85 will close and energize valve 79 to open. When one of the switches 81, 83 or 85 closes, it energizes the respective gas valve 75, 77 or 79 which opens promptly, although these valves may be of the slow opening type if desired. In conventional gas fired systems any gas valve control used for controlling a set of burners is commonly arranged to shut off the air damper door for such burners when the gas valve is closed, so as to prevent undue cooling of the heating surfaces between

firings. That practice is followed in the present construction so that door 15 closes when valve 75 is closed; door 17 closes when valve 77 is closed; and door 19 closes when valve 79 closes. Means for this purpose being common and of a wide variety of forms further details are unnecessary.

A typical wiring diagram is shown in Fig. 8, in which 87 indicates a thermostat in a main line circuit 89. It is by means of this thermostat 87 that calls are made automatically for heat. When the thermostat 87 is satisfied, the circuit 89 is broken; otherwise it is closed. Circuit 89 serves a circuit 90 through a transformer 101. This circuit 90 supplies a circuit 91, which includes the pressure-controlled switch 81 and electrically operated gas valve 75 controlling section A and also the motoring elements of a time delay switch 93. Thus if the circuit 91 has been prepared by previous closing of the pressure switch 81, valve 75 for section A will open when the thermostat 87 closes in response to a predetermined reduction in temperature in the space being heated. This also energizes the time switch 93 which, after a suitable interval, closes in a circuit 95. This circuit 95, if previously prepared by closing of pressure switch 83, energizes gas valve 77 to open in section B. Thus section B will come into operation automatically a predetermined short interval after section A comes into operation, provided section B has been prepared. The circuit 95 also energizes a branch circuit 96, which energizes the motoring elements of a second time delay switch 97, serving to close in a control circuit 99. Therefore the circuit 99, if prepared by the pressure-controlled switch 85, causes valve 79 to open a suitable interval of time after valve 77 has opened.

In the circuit 91 are pilot safety switches 103, which are closed as long as pilots 61 are burning; in the circuit 95 are pilot control switches 105 which are closed as long as the pilots 65 are burning; and in the circuit 99 are pilot control switches 107 which are closed as long as the pilots 69 are burning.

Operation is as follows:

Assume that all pilot lights 61, 65 and 69 are burning and that thermostat 87 calls for heat, thus closing circuit 89 and energizing circuit 90.

If upon a call by the thermostat 87 the pressure is under a suitable differential below 4½ p. s. i., all of the pressure-controlled switches 81, 83 and 85 have prepared their circuits 91, 95 and 99, respectively. Valve 75 for section A opens immediately, thus lighting section A. Since time switch 93 is energized, it energizes circuit 95 after a suitable interval, at which time the prepared circuit 95 is energized and valve 77 opened, thus lighting section B. This also energizes the time switch 97, which after a suitable interval energizes the prepared circuit 99, thus opening valve 79 of section C.

In the event that the call made by the thermostat 87 is under pressure conditions above a small increment over 4½ p. s. i., circuit 99 will not be prepared by any closure of the pressure-controlled valve 85. Hence valve 79 will never open. This means that the heating load under the prevailing conditions can be supplied without all burners being in operation and it is taken care of by lighting of sections A and B in sequence.

In the event that the call made by the thermostat 87 is under pressure conditions above a small increment over 4¼ p. s. i., circuit 95 also will not be prepared by any closure of the pressure-con-

trolled switch 83. Hence valve 77 will never open. This means that the heating load under the prevailing conditions can be supplied by operation of section A only.

When the thermostat 87 ceases to call for heat, all circuits become deenergized and all of the valves 75, 77 and 79 close, thus turning off all burners at the same time. Since no condition of concussion or vibration is associated with turning all burners off at once, no sequential operation is used in this connection.

Thus it will be seen that a double modulation control is obtained. First, the burner sections light in sequence, regardless of how many sections are required to carry the load. Second, only such a number of sections is called upon to light as are required to carry the load. Moreover, each section when lighted receives its independent supply of primary and secondary air, unaffected by the requirements of any other section. The result is that the burners operate to start quietly and to supply the load efficiently under all conditions.

It may be noted that the air box 1 is installed with the air inlets 15, 17, 19 located at the front end of the boiler served, that is, the end farthest from the flue connection. Thus when less than all of the burner groups are ignited practically all of the boiler heating surfaces are reached by the resulting hot gases. It is also clear from the drawing that the box 1 with the contained and attached parts is in its construction independent of any furnace walls or settings, being in the form of a self-contained unit which may be factory-assembled and shipped for simple insertion in any of various furnaces.

It is to be understood that, although the invention has been described as built for a triple-grouped arrangement, it also may be built for other group multiples, such as two, four, five etcetera.

Reference is hereby made to my copending U. S. patent application, Serial No. 206,438, filed January 17, 1951, for Modulating Gas Burner, containing claims directed to the control system set forth but not claimed herein.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. An integrally built burner unit for insertion in furnaces comprising an enclosing air box having a top and inside baffles dividing the box into separate plenum chambers connected individually with openings through one end wall of the box, individual draft controls in said openings, a fuel header in each plenum chamber communicating with the outside of the box, pipes branching from the headers and located by groups in the respective plenum chambers and having fuel outlets, said top of the box having socket-forming openings above said fuel outlets, removable gravity held burners having mixing pipes insertable into said socket-forming openings for cooperation with said fuel outlets and arranged to accept

primary air from the plenum chambers along with fuel from said outlets, the burners having abutting top manifolds including secondary air passages, said top having additional openings for the release of secondary air from the plenum chambers through said passages in the manifolds to combustion regions of the burners above the box, said abutting manifolds forming a sectionalized firing platform held by gravity in spaced position above said top, said burners being individually removable by lifting from said platform.

2. Apparatus made according to claim 1, wherein said openings in the top for the secondary air are constituted by slots each of which traverses all of the plenum chambers, and wherein the remainder of the socket-forming openings are located in the top between said slots.

3. An integrally built burner unit for insertion in furnaces comprising an enclosing rectangular air box having a top and inside baffles dividing the box into separate plenum chambers which extend laterally of the box and are connected individually with openings through one end wall of the box, individual draft controls in said openings, a laterally extending fuel header in each plenum chamber communicating with the outside of the box through the end wall having said draft controls, pipes having fuel outlets and branching from the headers and extending longitudinally of the box and located by groups in the respective plenum chambers and having fuel outlets, corresponding branches in the various plenum chambers being collinear whereby said fuel outlets are arranged in rows, the top of the box having rows of socket-forming openings above the rows of fuel outlets, removable interchangeable rows of gravity held burns having mixing pipes insertable into said socket-forming openings for cooperation with said fuel outlets arranged to accept primary air from the plenum chambers along with fuel from said outlets, the burners having abutting top manifolds including secondary air passages, said top having additional openings for the release of secondary air constituted by longitudinal slots each of which is located between rows of burners and traverses all of the plenum chambers, said abutting manifolds being in rows parallel to said slots and forming a sectionalized firing platform held by gravity in spaced position above said top, said burners being individually removable by lifting from said platform.

VERNON S. BECK.

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