United States Patent

Fichter et al.

[15] **3,694,137**

[45] **Sept. 26, 1972**

[54] **SEQUENTIALLY FIRED SINGLE PILOT MULTI-SECTION GAS BURNER AND AIR SUPPLY STRUCTURE**

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[22] Filed: **Oct. 26, 1970**

[21] Appl. No.: **83,859**

[52] **U.S. Cl.**.....**431/283,** 431/60

[51] **Int. Cl.**.....**F23q 9/08**

[58] **Field of Search**.....431/12, 60, 281, 283

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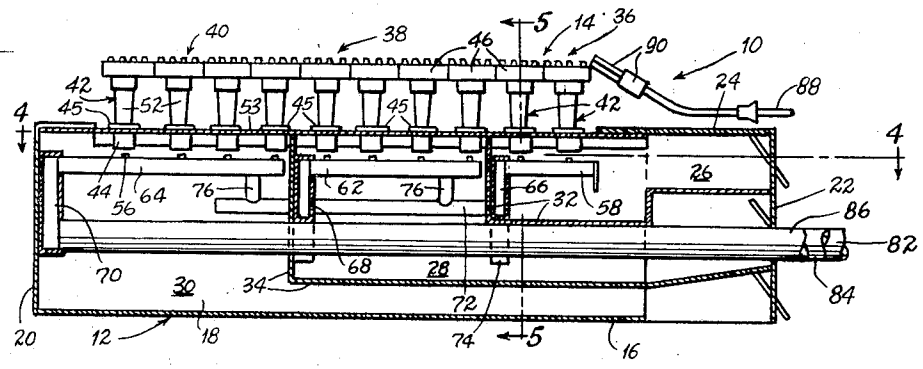
Primary Examiner—Carroll B. Dority, Jr.

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[57] **ABSTRACT**

There is disclosed an integral three section gas burner construction and controls including automatic sequential lighting of the sections on demand and air supply structure. A pilot unit ignites a first burner section when gas is supplied. The first burner section includes some burners adjacent to a second and a third burner section, said second burner section and said third burner section being ignited from said respective adjacent burners of said first burner section on demand for more heat and supply of gas. Each burner section has a separate compartment for the supply of secondary air to the burners.

2 Claims, 8 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

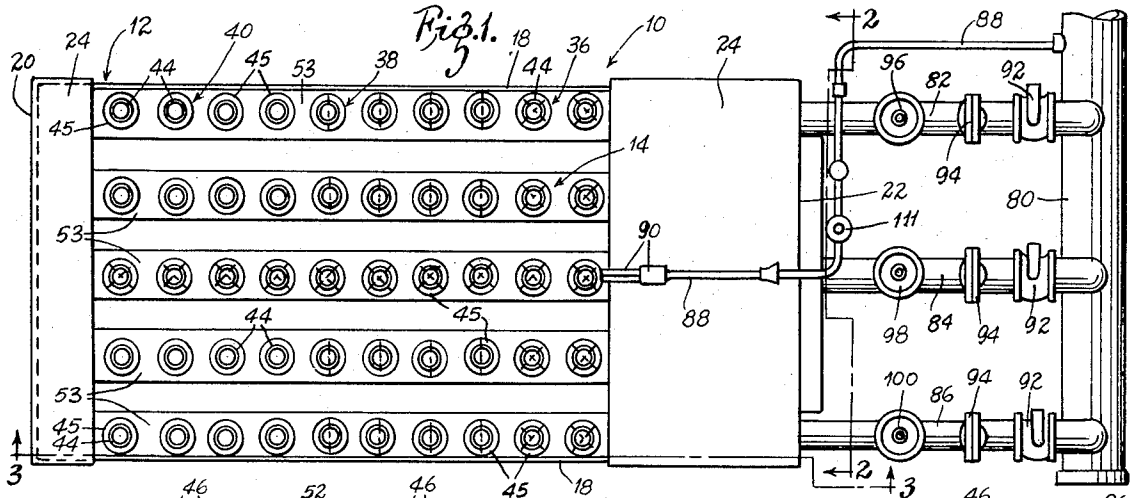


Fig. 5.

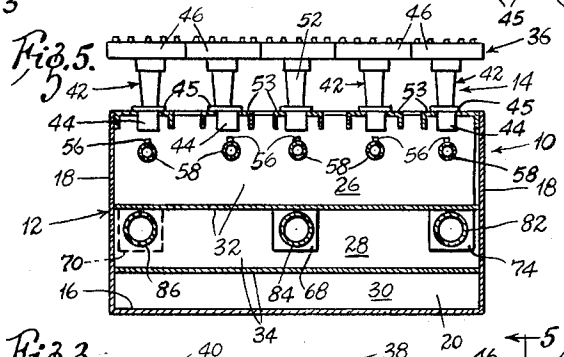


Fig. 2.

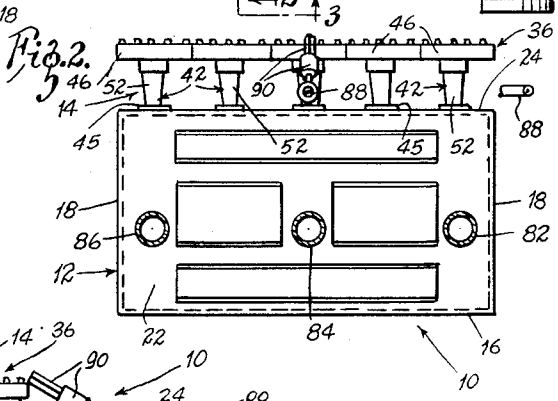


Fig. 3.

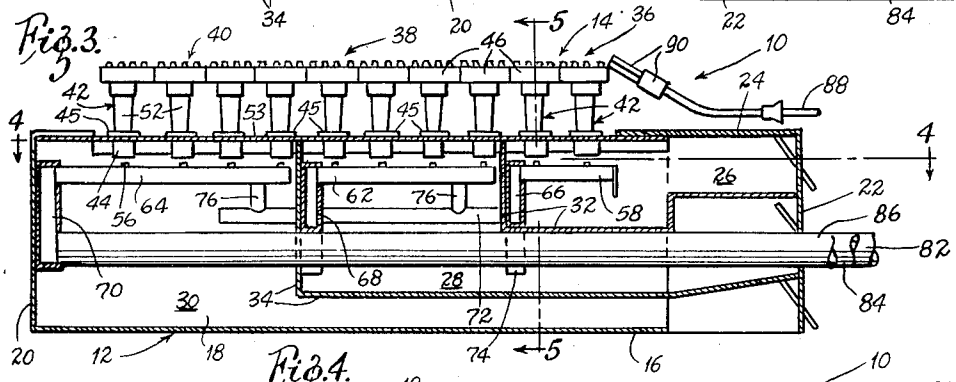
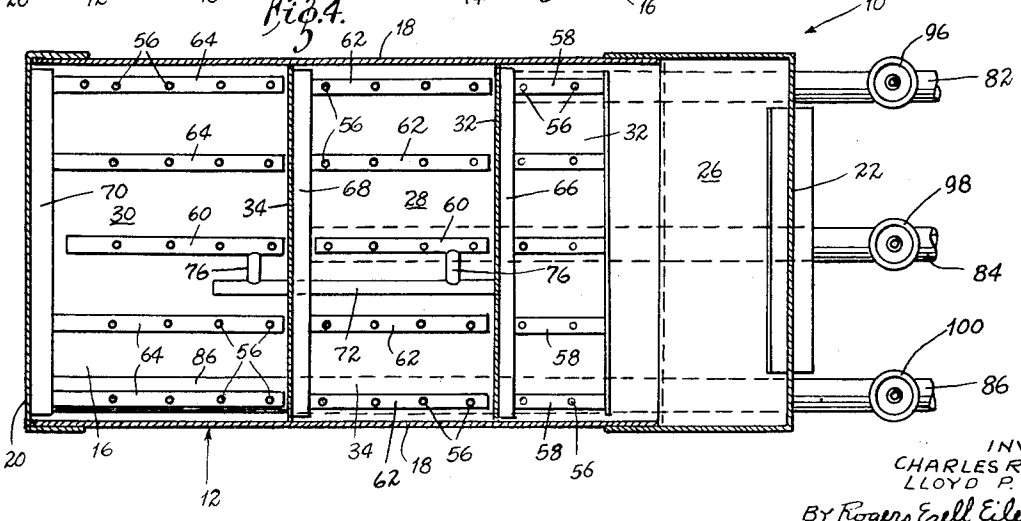


Fig. 4.



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Fig. 6.

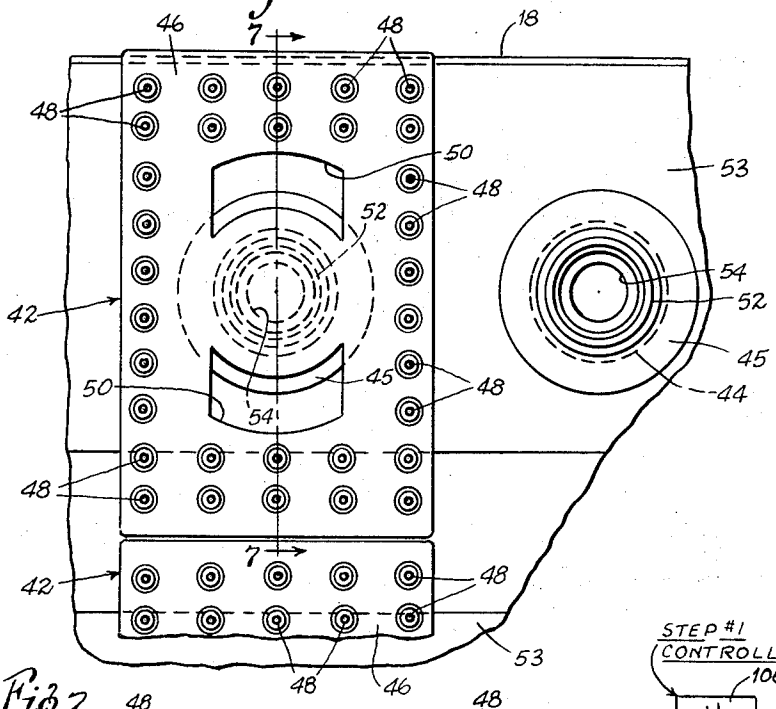


Fig. 7.

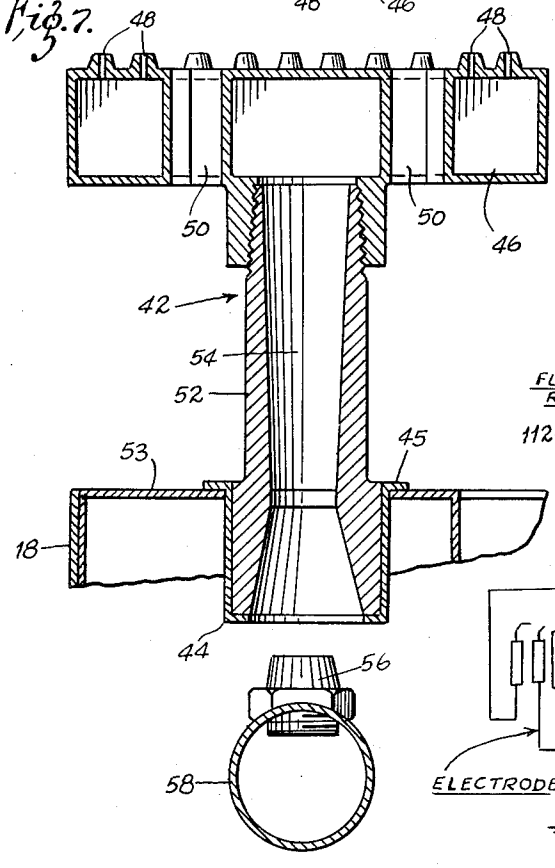
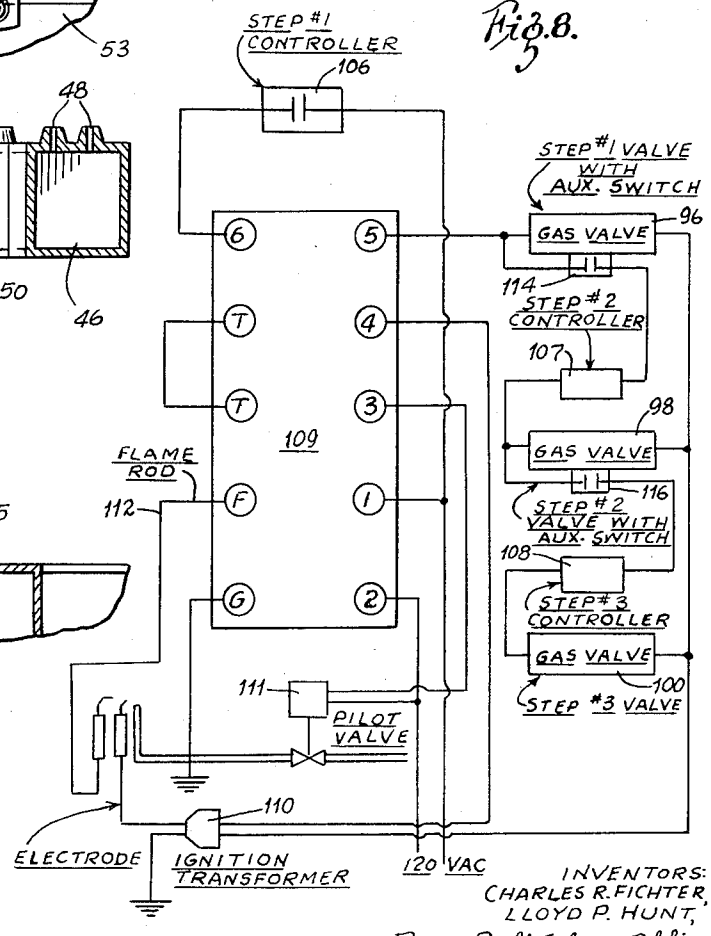


Fig. 8.



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SEQUENTIALLY FIRED SINGLE PILOT MULTI-SECTION GAS BURNER AND AIR SUPPLY STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

the present invention relates generally to industrial and commercial gas fired steam and hot water boilers and warm air heating furnaces, and more particularly to a novel integrated automatically sequentially fired multi-section gas burner including air supply structure for firing industrial and commercial boilers and furnaces.

2. Description of the Prior Art

Gas fired boilers and furnaces of all kinds have been in use for many years. Numerals patents have been granted directed to gas burners, controls therefor, and other parts, for firing such boilers. However, there has long been the need for an improved integrated automatically, sequentially fired multi-section gas burner and air supply structure for firing industrial and commercial steam and hot water boilers and hot air furnaces.

SUMMARY OF THE INVENTION

In brief, the present novel integrated automatically, sequentially fired multi-section gas burner and air supply structure as disclosed includes first, second and third gas burner sections which are automatically, sequentially fired on demand. A pilot light ignites the first section on supply of gas, the first section being of a configuration including some burners adjacent burners of the second and third sections. The second and third sections are ignited sequentially from the adjacent burning burners of the first section on demand for heat and supply of gas. A separate secondary air chamber structure is provided for each burner section. A suitable automatic electric control system is provided for effecting the desired sequential firing.

Objects of the present invention are to provide an integrated gas burner construction as aforesaid which reduces the required number of pilot lights to one, and ignites sections two, three, etc., from section one or other ignited section, which is ignited by the one pilot light to achieve greater safety and better control, which is of extremely sturdy construction adapted to function indefinitely without repair or maintenance, which is an effective package type unit, and which otherwise fulfills the objects and advantages sought therefor.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of an integrated burner structure with all burner assemblies removed incorporating the teachings of the present invention;

FIG. 2 is a transverse vertical cross-sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a longitudinal vertical cross-sectional view taken on substantially the line 3—3 of FIG. 1;

FIG. 4 is a horizontal cross-sectional view taken on substantially the line 4—4 of FIG. 3;

FIG. 5 is a transverse vertical cross-sectional view taken on substantially the line 5—5 of FIG. 3;

FIG. 6 is an enlarged fragmentary top plan view of a mounted burner head assembly;

FIG. 7 is a longitudinal vertical cross-sectional view taken on substantially the line 7—7 of FIG. 6; and

FIG. 8 is a wiring diagram of an appropriate automatic electric control system for the present burner construction.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings more particularly by reference numerals, **10** indicates generally an integrated burner construction including the principles of the present invention. Broadly, the burner construction **10** comprises a secondary air supply defining and gas burner structure supporting box **12**, and a multi-section gas burner structure **14** mounted to the box **12**. Integrating elements and automatic electric control means are incorporated, as appears below.

The box construction **12** is generally rectangular, as illustrated, including a bottom panel **16**, side panels **18**, end panels **20** and **22**, and front and rear partial top panel segments **24**. The interior of the box **12** is divided into air chambers **26**, **28** and **30** by baffles **32** and **34**, as is clear from FIGS. **3** and **5**, for independent supply of secondary air to each of the sections of the burner structure **14**. The panels and baffles are integrated by welding, bolts, or otherwise, as desired.

The gas burner structure **14** includes a first section **36**, a second section **38**, and a third section **40** of burner assemblies **42**, the latter two being automatically sequentially ignited in the use of the burner construction **10**. Additional sections may be employed, if needed, or two sections may be used. To assist in readily locating the burner assemblies **42** of each burner section, in FIG. **1** each mounting cup **44** receiving a burner assembly **42** of the first burner section **36** is marked with a dotted line X. Each mounting cup **44** receiving a burner assembly **42** of the second section **38** is marked with a dotted vertical line. Each mounting cup **44** receiving a burner assembly **42** of the third section **40** is unmarked. It will be noted that the burner assemblies **42** of the burner section **36** are disposed in the shape of a "T." Manifestly, other operative layouts may be employed.

A burner assembly **42** is shown in detail in FIGS. **6** and **7** and includes a top manifold **46** having outlets **48** with passages **50** for secondary air. A vertical mixing pipe **52** having a Venturi inlet **54** supports the manifold **46**. The inlet **54** is adapted to receive gas from a nozzle **56** and primary air which is drawn into the Venturi with the gas in well-known manner. The mixing pipe **52** stands removably in a mounting cup **44**, which, in turn, extends downward through a round hole in and is supported through a flange **45** by a long flanged or U-cross section plate **53**. The major portion of the bottom of the cup **44** is open to permit passage of gas and primary air. It will be noted from FIGS. **1** and **5** that there are five parallel flanged plates **53** which are welded or otherwise secured to the top panel segments **24** for support. More or less plates **53** may be used.

The nozzles **56** are mounted in branch manifolds **58**, **60**, **62** and **64** (FIGS. **3–5**). The branch manifolds **58** and **60** supply gas to the first burner section **36**, the former being connected into and the latter to a transverse header or manifold **66**. The branch manifolds **62** supply gas to the second burner section **38** and are connected into a transverse header or manifold **68**. The branch manifolds **64** supply gas to the third burner section **40** and are connected into a transverse header or manifold **70**.

A longitudinal gas pipe **72** is connected at one end to the header **66** by a depending connector **74** and to the tandem branch manifolds **60** by angularly disposed connectors **76** (FIGS. 3 and 4). It will be understood that all manifolds **58**, **62**, **64** and the gas pipe **72** are closed at their ends remote from the headers **66**, **68** and **70**. The manifolds **60** are closed at both ends.

In FIG. 1 is shown a main gas line **80** to which are connected three leader gas pipes **82**, **84** and **86** supplying gas to the transverse headers **66**, **68** and **70**, respectively, see FIG. 4. A pilot line **88** tapped into the main gas line **80** furnishes gas to a single pilot light **90**, which may be of flame rectifier type, disposed in position to ignite the burner assemblies **42** of the first section **36** (FIGS. 1 and 3). Each of the leader gas pipes **82**, **84** and **86** is equipped with a manual shut-off cock **92** and a suitable pressure regulator **94**. Additionally, the leader gas pipes **82**, **84** and **86** have electrically operated gas valves **96**, **98** and **100**, respectively, operatively installed thereon.

With particular reference to FIGS. **1** and **8**, the electrically operated gas valves **96**, **98** and **100** (FIG. 1) are under control of boiler-pressure operated controllers **106**, **107** and **108** (FIG. 8). The controllers **106**, **107** and **108** are set for ascending order of operation and are open and closed in response to predetermined pressure settings of the heating boilers which the burner construction **10** serves. The pressure operated controllers **106**, **107** and **108** are set at small pressure differentials, as is conventional, with controller **106** governing step 1, controller **107** governing step 2, and controller **108** governing step 3.

FIG. **8** is the wiring diagram of a typical automatic electric control system for the burner construction **10**, being essentially the Honeywell RA890F Protectorelay solid state primary control modified to eliminate control of second and third pilot lights. Step 1 controller **106** calls for heat automatically, powering terminal **6** of relay **109** upon a demand. A load relay thus activated pulls in terminals **4** and **3** of relay **109**, energizing ignition transformer **110** and pilot valve **111**. Pilot is proven through flame rod **112**, if flame is present and sensed. A flame relay pulls in terminal **5** of **109**, energizing the gas valve **96** of step 1. After the gas valve **96** is fully open, assuming more heat is required, a built-in switch **114** of gas valve **96** energized the gas valve **98** of step 2. After the gas valve **98** is fully open, assuming still more heat is required, a built-in switch **116** of the gas valve **98** energizes the gas valve **100**. The burner construction **10** is now fully fired on all steps at the heat demand of boiler-pressure controllers **106**, **107** and **108**. It will be readily understood that the present controlled structures will fulfill the various load requirements of any of a wide variety of heating plants.

Since each step is governed by its predetermined pressure controllers **106**, **107** and **108**, the gas valves **98** and **100** cannot open until the gas valve **96** is energized, and the gas valve **100** cannot open until the gas valves **96** and **98** are energized. As is detailed above, upon opening of the gas valve **98**, the burners **42** of section **38** are ignited from adjacent burners **42** of section **36**. Similarly, upon opening of the gas valve **100**, the burners **42** of section **40** are ignited from adjacent burners **42** of section **36**.

It is clear that there has been provided a burner construction which fulfills the objects and advantages sought therefor.

It is to be understood that the foregoing description and the accompanying drawing have been given by way of illustration and example. It is also to be understood that changes in form of the elements, rearrangement of parts, and substitution of equivalent elements, which will be obvious to those skilled in the art, are contemplated as within the scope of the present invention which is limited only by the claims which follow.

What is claimed is:

1. In combination, a burner construction comprising supporting means, a plurality of burner sections supported thereby, each burner section including at least three burner assemblies, pilot means for igniting the burner assemblies of a first burner section, and means for igniting the burner assemblies of a second burner section directly from a burning burner assembly of the first burner section, said means comprising at least one burner assembly of said first burner section positioned closely adjacent to at least one burner assembly of the second burner section for ignition of gas from the latter by flame from the former on demand and means for igniting sequentially predeterminately the second burner section and the third burner section directly from predetermined burning burner assemblies of the first burner assembly, the burner assemblies of the first section being disposed generally in the form of a "I" with the stem thereof intermediately positioned and closely adjacent to the burner assemblies of each of the second and third sections, said third burner section bounding said second section and ignitable by it as well as by the burner assemblies in the stem of said first section.

2. The combination of claim **1** and including a supported transverse header for receiving gas from a gas line, a first set of branch manifolds communicating said header and the first section burner assemblies forming the head of the "T," a second branch manifold communicating said header with a predetermined number of burner assemblies of the stem of the "T," and a third branch manifold communicating said header with another predetermined number of burner assemblies of the stem of the "T."

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