

- [54] **FURNACE BURNER ARRANGEMENT**
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 [51] Int. Cl. **F22b 21/02**
 [58] Field of Search .. **122/235, 235 B, 333, 356, 479; 110/28 R, 28 F, 28 I**

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[57] **ABSTRACT**

In a furnace in which the combustion air, fuels and combustion products travel through a furnace section having a generally rectangular cross-section, maximum efficiency is assured by providing a large flame length and thorough mixing of fuel and air. The burners are placed in the corners so that the flames extend diagonally in the furnace and tilted either upwardly or downwardly and are positioned in a spiral configuration with respect to one another.

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6 Claims, 3 Drawing Figures

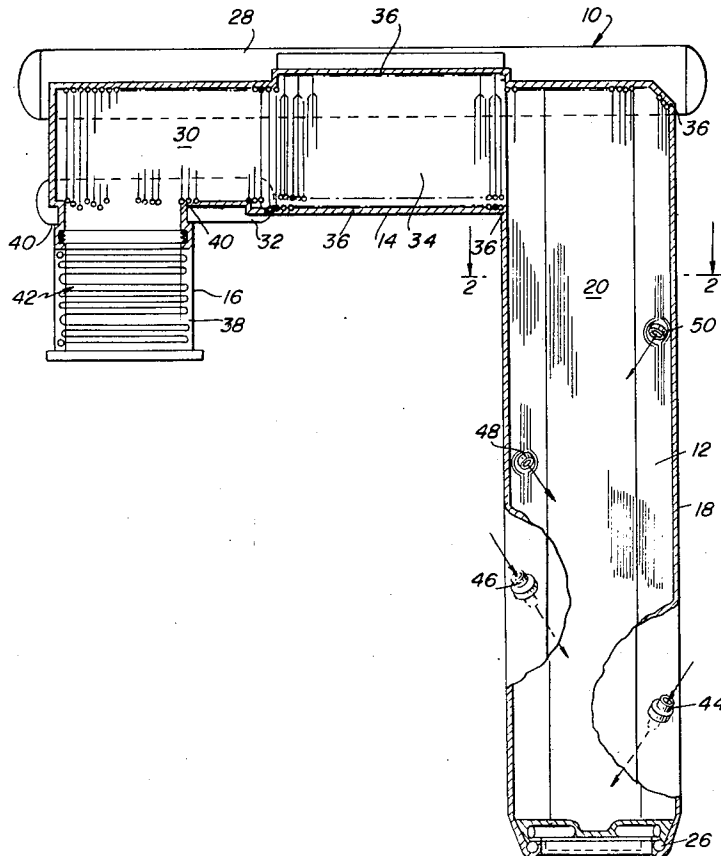


FIG. 1

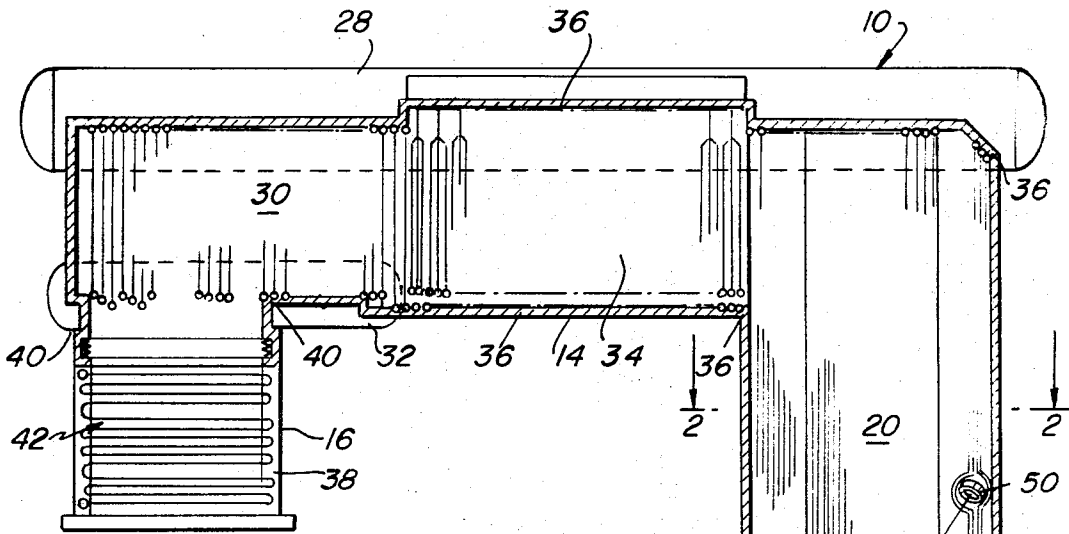


FIG. 3

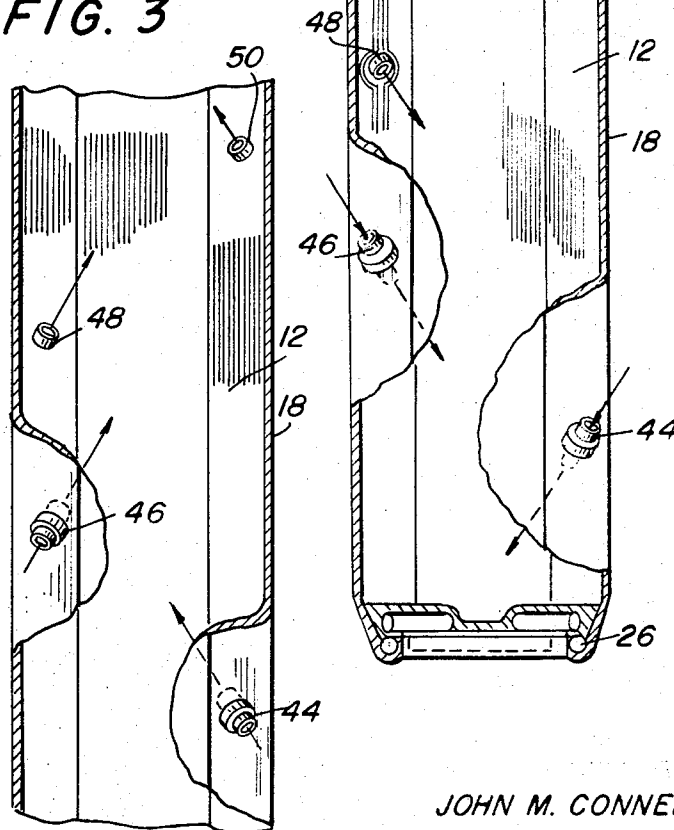
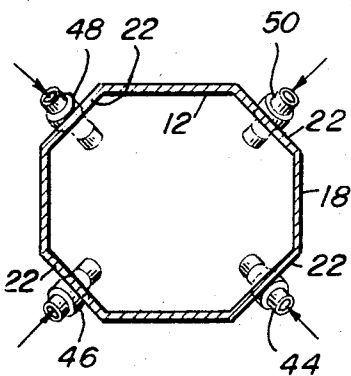


FIG. 2



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FURNACE BURNER ARRANGEMENT

BACKGROUND OF THE INVENTION

In the manufacture of small boilers, several problems are found which are not present in larger boilers.

For one, the furnace section is often small enough so that the flame length is not sufficient to assure substantially complete combustion. Further, the furnace section is shorter than in a larger furnace and consequently there is apt to be incomplete mixing of fuel and air. This factor also makes for incomplete combustion.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome drawbacks found in the prior art such as those discussed above. Accordingly, the furnace section of a small steam generator which section is essentially rectangular in cross-section is provided with burners which are in the corners thereof, tilted upwardly or downwardly and arranged spirally with respect to one another.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation partly in section of a steam generator made in accordance with the present invention;

FIG. 2 is a view partly in section taken substantially along the line 2—2 of FIG. 1; and

FIG. 3 is a fragmentary view partly in section of a portion of the steam generator shown in FIG. 1 with the burners pointing upwardly rather than downwardly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, a steam generator 10 is shown with a furnace section 12, a horizontal convection section 14 and vertical connection section 16. In the furnace section, fuel is burned to create much radiant heat and the flue gases pass out through the convection sections 14 and 16. The furnace section 12 has an outer wall 18 which is lined interiorly with a water wall 20 that is, a wall comprising many parallel water tubes joined together. Water walls are well known in the art and commonly have fins between adjacent tubes for optimum transfer of radiant heat to the water passing through the tubes.

The furnace section 12, which is defined generally by the outer wall 18 and water wall 20 which more or less covers the inside of the outer wall 18 is essentially rectangular in cross-section with angled corners 22 so that in effect the cross-section is eight sided. Included in the furnace section 12 adjacent to the lower end thereof are headers 26 which feed water to the water wall 20. The water wall extends upwardly to a steam drum 28. The horizontal convection section 14 has water tubes 30 extending downwardly to a water drum 32. Lines (not shown) direct water from the water drum down to the headers 26 to assure that all of the water tubes, that is, the tubes of the water walls 20 as well as tube 30 will have a constant supply of water to permit proper cooling and promote thermal efficiency.

The convection section 14 also has a superheater 34 which is made up of tubes extending into the convection section 14 and which passes steam from the steam drum 10 through the convection section 14 to indirectly exchange heat from flue gases.

The convection section 14 has an outer wall 36 which envelops the water tubes 30 and superheater 34 and portions of the steam drum 28 and water drum 32. The outer wall 36 is joined to the outer wall 18 of the furnace section 12 by a weld at 36.

After passing through the superheater 34 and water tubes 30, the flue gas passes downwardly through the convection section 16 which has an outer wall 38. The convection section 16 is joined to the convection section 14 as at weld 40 and has an economizer 42 which transfers heat from flue gas leaving the convection section 14 with feedwater. After leaving the convection section 16, the flue gas may be passed to an air heater.

The present arrangement is one which provides a boiler which can be made of three prefabricated sections which are welded together at the site. This feature lowers considerably the time and expense of construction.

The furnace section 12 and convection sections 14 and 16 are necessarily of small cross-section and length in order to permit transportability to the job site. This can create problems in the design of the furnace section where a short section does not permit the fuel and air to mix as thoroughly as a long section. Further, because a furnace section of small area cannot allow for as long a flame length at the burners as a large furnace section incomplete combustion is a problem. This limits the efficiency with which the furnace can operate.

The present invention solves these problems by the manner in which the burners are arranged in the furnace. As shown in FIG. 2, burners 44, 46, 48 and 50 are arranged in plan in a rectangular configuration, the burners being positioned in the corners of the rectangle so that the flames will reach out diagonally into the furnace. In addition, the burners are tilted so that they point either downwardly (FIG. 1) or upwardly (FIG. 3) to further increase the flame length possible in the furnace section 12.

Efficiency of combustion is increased still further by positioning the burners on a spiral. Thus, burner 44, the lowest burner, is in the corner to the right of FIG. 1 which is closest to the viewer. The next lowest burner 46 is at the left corner closest to the viewer while the next higher burner 48 is in the left corner behind it. The highest burner 50 is on the corner to the right of FIG. 1 farthest from the viewer. This configuration allows the burners to be at different locations along the length of the furnace section 12 so that the flames will not impinge on each other but will each extend uninterrupted through the furnace section. The spiral configuration is also advantageous in that it promotes severe turbulence which assures a thorough mixing of fuel and air and thus substantially complete combustion. Further, it forces the air and flue gas flowing upwardly to traverse a long path which will be essentially spiral in configuration to make for efficient use of the hot flue gases in generating steam in the water walls 20.

A latitude of modification, change, and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

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1. In the furnace section of a comparatively small steam generator, a plurality of burners arranged in plan in a rectangular configuration with respect to each other, each of said burners being aimed generally toward the center of said furnace and tilted with respect to the horizontal so that the flame length of said burners is longer than would otherwise be possible, said burners being arranged in a spiral configuration with respect to one another.

2. The furnace section defined in claim 1, said section being substantially vertical, further comprising a substantially horizontal convection section, said convection section joined at one end thereof to the top of said furnace section.

3. The furnace section and convection section

defined in claim 2 wherein each of said sections has an outer wall, and said sections are joined together by welds between the outer wall of said furnace section and the outer wall of said convection section.

4. The furnace section and convection section defined in claim 3 further comprising a substantially vertical convection section said vertical convection section having an outer wall and being joined at the top thereof to the other end of said substantially horizontal convection section.

5. The furnace section defined in claim 1 wherein said burners are tilted upward.

6. The furnace section defined in claim 1 wherein said burners are tilted downward.

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