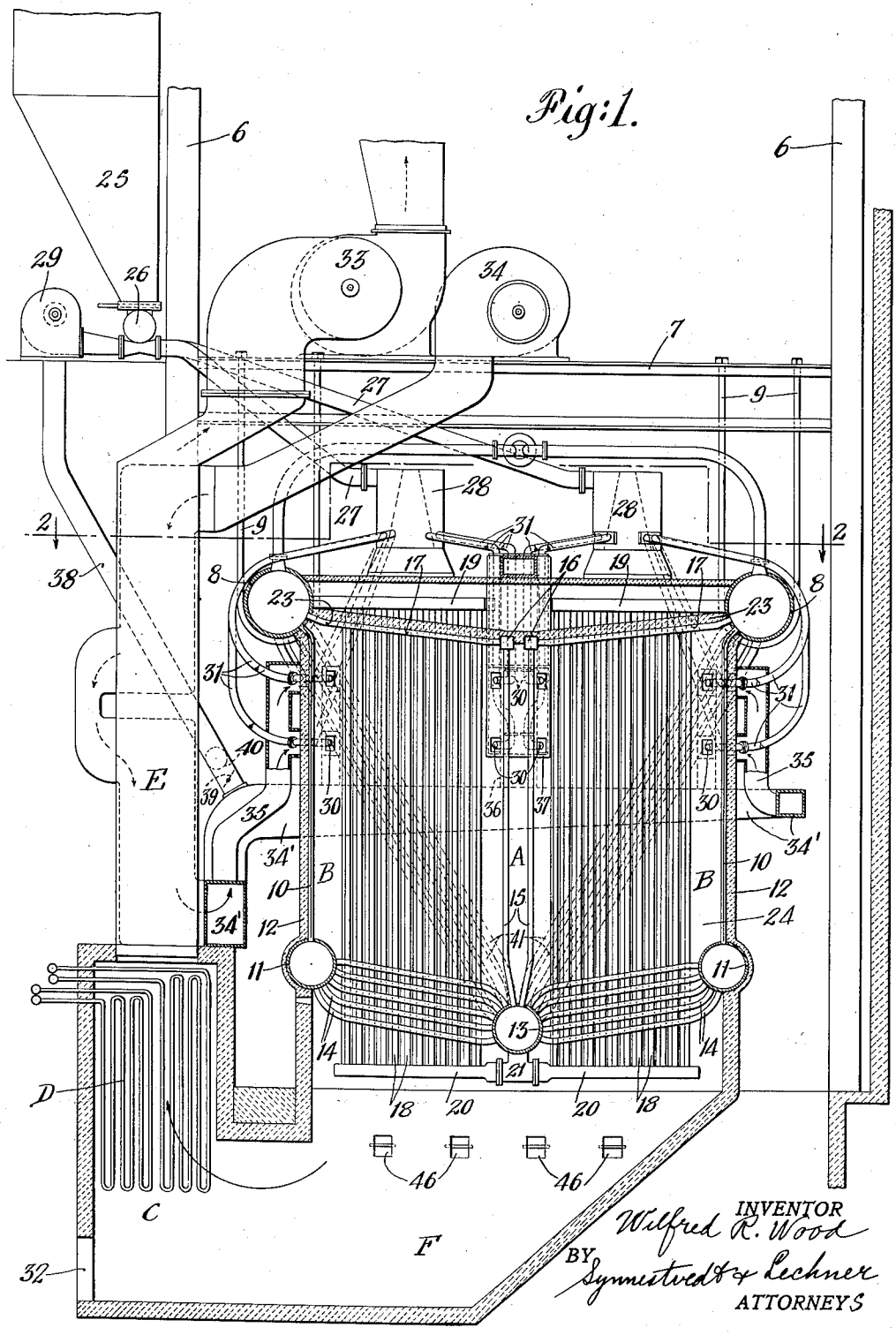
Sept. 9, 1930. W. R. WOOD 1,775,336

MULTIPLE UNIT BOILER

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Fig. 1.



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MULTIPLE UNIT BOILER

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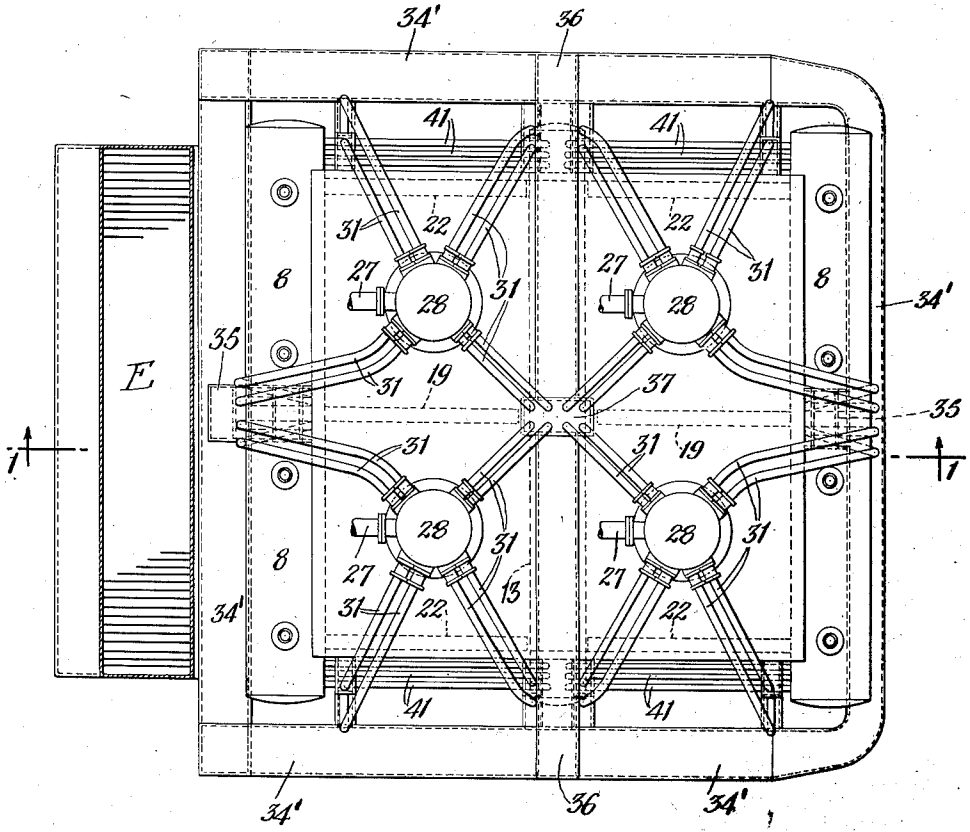


Fig. 2.

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Fig: 3.

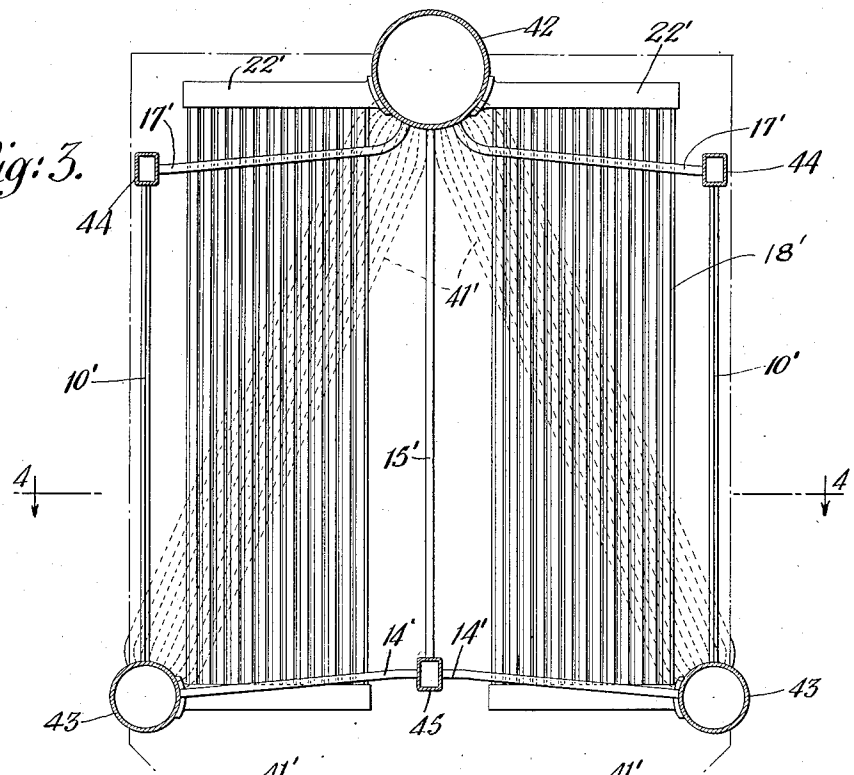
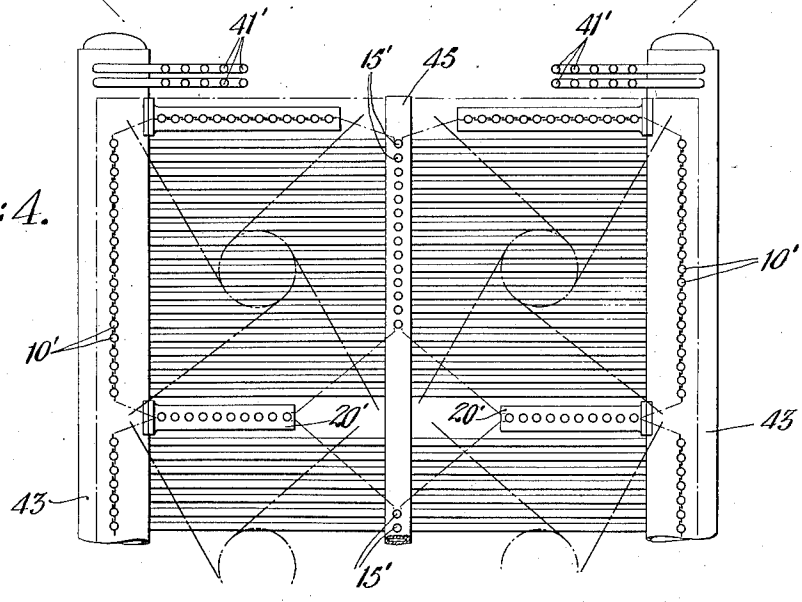


Fig: 4.



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1,775,336

UNITED STATES PATENT OFFICE

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MULTIPLE-UNIT BOILER

Application filed November 26, 1926, Serial No. 150,697, and in Great Britain December 10, 1925.

This invention relates to steam generators of a type similar to that illustrated in my copending application, Serial No. 3,921, filed January 22, 1925, patented Nov. 19, 1929, Patent No. 1,736,423.

It is one of the primary objects of my invention to provide a steam generator made up of a number of smaller units of standard design, so that a generator of large or small size and capacity may be made up of an assembly of any desired number of units without the necessity of having new designs for each installation. The various parts which go to make up each individual unit, e. g., tubes, headers, drums, etc., are also, for the most part, of standard size and shape, and each individual unit will, therefore, be easily and cheaply assembled.

It is a further object of my invention to provide a steam generator wherein a number of generator units may be placed in one setting, thus obviating the need of many parts and much construction which would be required if each unit were placed in an individual setting.

A still further object of the invention lies in the provision of a furnace shaped boiler constructed with one or more partitions, so that the interior of the furnace is divided into a plurality of combustion chambers, each of which is of a capacity suitable for being fired, preferably in the tumultuous or turbulent manner described in my copending application above referred to.

It is a further object of my invention to provide, in a steam generator, a combustion space beyond the boiler elements proper, with means for utilizing the heat generated therein in the operation of the generator.

How the foregoing, together with such other objects as may hereinafter appear, or are incident to my invention, are realized is illustrated in preferred form in the accompanying drawings, wherein—

Fig. 1 is a sectional elevation of a steam generator embodying my improvements.

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1.

Fig. 3 illustrates a modified arrangement of boiler elements, and is more or less diagrammatic.

Fig. 4 is a fragmentary plan section taken on the line 4—4 of Fig. 3.

Referring now to Figs. 1 and 2, the combustion chamber, as a whole, is indicated by the reference letter A. This large chamber A is composed of four smaller combustion chambers B in the form of steam generator illustrated. The buckstays 6 support the cross beams 7 from which the upper drums 8 are suspended by means of the straps 9. Rows of vertical finned tubes 10 connect the upper drums 8 with lower drums 11, the tubes 10 also serving to form side walls of the combustion chamber A. Refractory sheathing 12 covers these tubes on the outside.

The drums 11 are connected to a central drum 13 by means of the tubes 14 which are spaced to permit free passage of the products of combustion. These tubes 14 define the bottom of the combustion space.

Two rows of tubes 15 extend vertically upward from the drum 13 to headers, and are connected at their upper ends into headers 16 which are, in turn, connected into the drums 8 by means of the single rows of tubes 17 which define the top of the combustion space.

It will be seen that the tubes 15 form, in effect, a partition in the large combustion chamber A dividing it lengthwise into two smaller combustion chambers, each of which is further divided by means of the rows of vertical finned tubes 18 connected at the top into headers 19 extending at right angles to, and in turn connected to the drums 8. At their lower ends the tubes 18 are connected to the headers 20 which are connected into the drums 13 by means of the T 21. These headers 19 and 20 are connected to the drums 18 and 13, respectively, about midway between the ends thereof, and it will be seen that the rows of tubes 15 and 18 further divide the large combustion chamber A into the four smaller substantially independent combustion chambers B.

The two end walls of the large combustion chamber A are defined by rows of finned tubes connected similarly to the tubes 18 into

lower headers which lead to the drum 13 and into upper headers 22 (see Fig. 2) which are connected to the drums 8.

A refractory sheathing 24, similar to the sheathing 12, covers the tubes defining the ends of the combustion chamber.

The tubes 17 support the refractory roof 23 of the combustion chamber A. Downcomers 41, outside the ends of the combustion chamber A, connect drums 8 with drums 13.

It will be observed that the headers 19 and 22 extend above the roof 23, and the lower headers 20 lie below the bottom of the combustion chamber A, and these headers are, therefore, protected from the heat of the combustion chamber in a very simple and inexpensive manner, and without the necessity of bending the tubes to get the headers outside.

Pulverized coal is supplied from bins 25 by means of feeders 26 to the lines 27 which lead to distributor boxes 28. Air to carry the coal is supplied by blower 29.

There are two pulverized fuel burners 30 at each corner of each of the smaller combustion chambers B, which are connected to the distributors 28 by means of the pipes 31.

The settling chamber F lies below and is common to all four of the combustion chambers B. The offtake C leads from the settling chamber, and is, therefore, the common offtake for the chambers B.

The steam superheater D is located in the offtake, and the air heater E is connected to the offtake just beyond the superheater D.

The blower 33 is connected to the air heater E and draws the gaseous products of combustion through it where the heat of these gases is imparted to the air which is forced through the heater by means of the blower 34.

The heated air passes from the lower end of the heater into the conduit 34′ which has branches 35 leading to the burners at the sides and corners of the combustion chamber A. The four sets of burners in the center of the combustion chamber A are supplied by means of branches 36 leading to the air box 37 which extends down into the combustion chamber.

There is also a branch 38 leading from the conduit 34′ to the blower 29 by means of which heated air is supplied for transportation of the fuel. The branch 38 is controlled by damper 39 which regulates the amount of air in accordance with the rating at which the furnace is being run. Cooler air for dilution may be supplied by means of pipe 40, if desired.

The burners 30 are set to deliver the fuel and air into each combustion chamber B in a stream, the direction of which is substantially tangential to the circle indicated at the center of the chamber (see Fig. 4). The main portion of the preheated air is blown into the combustion chambers adjacent the entering fuel streams.

In Figs. 3 and 4 a modified arrangement of boiler elements is illustrated. In this construction there is one upper drum 42 and two lower drums 43. Vertical finned tubes 10′ extend upwardly from drums 43 and are connected at the top into headers 44 which are connected to drum 42 by means of tubes 17′.

A row of tubes 15′, extending from the drum 42 to lower header 45, forms a partition lengthwise of the combustion chamber. Header 45 is connected to drums 43 by means of tubes 14′. Upper headers 22′ are connected to and extend at right angles from drum 42 near each end thereof, and rows of vertical finned tubes 18′ are connected at the top into these headers 22′ and at the bottom into corresponding headers which are, in turn, connected to drums 43. Headers 20′ and vertical tubes are connected in like manner to the drums at the center, and form a partition which further divides the combustion chamber into four smaller chambers.

The downcomers 41′ connect drum 42 with drums 43.

In so far as the boiler arrangements thus far described are concerned, it will be noted that I have provided multiple boilers arranged in the same general setting, which, of itself, tends to reduce size, number of parts, and cost. In the next place, it will be noted that each boiler is comprised of more or less standard parts from which multiple boiler arrangements may be constructed with a minimum number of parts which might be termed "special parts", the size and dimensions of which will vary with the number of boiler units in the particular installation.

The standardization of parts tends to reduce cost. Furthermore, certain parts are common which tends to reduce cost.

In addition to the foregoing, the boilers are primarily of the radiant heat type, and, consequently, may be made of relatively smaller size and may be made with less number of parts than the ordinary boiler, and such radiant heat type of boiler lends itself most readily to the construction of a multiple unit boiler, making it possible to realize many of the advantages above set forth.

In so far as circulation is concerned, it will be seen that in all forms the downcomers lead from the high point to the low point of the boiler units, the circulation in the parts defining the combustion chambers being upward and very rapid by reason of the employment of so many upright tubes.

If the boiler units are designed of a size such as to have capacity to supply all demands efficiently from the standpoint of combustion of the fuel, substantially all of the air required for combustion will be admitted into the combustion space or spaces defined by the tubes. If, however, it is desired to still fur-

ther decrease the size of the boilers—which is desirable—I propose decreasing the evaporating area of the boiler units, and, consequently, the size of the combustion spaces defined by the units to the point where each unit will have capacity to meet only normal demands efficiently. Such a boiler is desirable from the standpoint of smallness of size, and, consequently, plant investment. To make such a boiler meet peak load demands, I intentionally operate it, during peak load periods, inefficiently from a combustion standpoint, but with a higher flame temperature, so as to increase the rate of heat transfer, and thus develop the capacity required for peak demands. To this end, during peak periods, I increase the rate of feed of fuel to the desired point, but admit a deficiency of air for combustion in the combustion space defined by the boiler, intentionally operating to obtain very high CO_2 percentage and consequent high flame temperature.

Under such conditions of operation, there will be combustibles in the gases leaving the combustion spaces defined by the boiler, and I, therefore, admit the additional air required for combustion to the settling chamber F which is provided with damper controlled air inlets 46 for this purpose. By thus admitting air these combustibles are consumed before the gases reach any of the economizer devices located in the offtake.

Any increase in temperature of the gases leaving the boiler will not necessarily manifest itself in any unduly high temperature of the final exit gases because, at times of peak demands, there are larger quantities of steam flowing through the superheater elements and larger quantities of combustion air flowing through the air heater, and, therefore, more heat units are required in the offtake to heat the larger quantities of steam and air.

The preheated combustion air supplied increases the temperature head in the combustion space.

It will be understood, of course, that the blower 34 delivers the gaseous products of combustion, after they have been drawn through the air heater E, to a stack (not shown).

I claim:—

1. In combination, in a boiler, two upper drums, two lower drums one under each of the upper drums, drumlike means located substantially midway between and on a different level than the two upper drums, tubes leading from the said means to each upper drum and defining the top of the combustion space for the boiler, upright substantially vertical tubes connecting each pair of upper and lower drums and defining sides of the combustion space, drumlike means located substantially midway of the lower drums and on a different level, tubes connecting the same with each of the two lower drums and defining the bottom of the combustion space, upright substantially vertical tubes defining the remaining sides of the combustion space connected for circulation, and upright substantially vertical tubes connecting the intermediate drumlike means and operating to split the combustion space into two independent combustion spaces, together with an outlet chamber common to both said combustion spaces and an offtake for the waste gases from said chamber.

2. In combination, in a boiler, two upper drums, two lower drums one under each of the upper drums, drumlike means located substantially midway between and on a different level than the two upper drums, tubes leading from the said means to each upper drum and defining the top of the combustion space for the boiler, upright substantially vertical tubes connecting each pair of upper and lower drums and defining sides of the combustion space, drumlike means located substantially midway of the lower drums and on a different level, tubes connecting the same with each of the two lower drums and defining the bottom of the combustion space, upright substantially vertical tubes defining the remaining sides of the combustion space connected for circulation, and upright substantially vertical tubes connecting the intermediate drumlike means and operating to split the combustion space into two independent combustion spaces, together with an outlet chamber common to both said combustion chambers and an offtake for the waste gases from said chamber and a superheater located in said offtake.

In testimony whereof I have hereunto signed my name.

WILFRED R. WOOD.