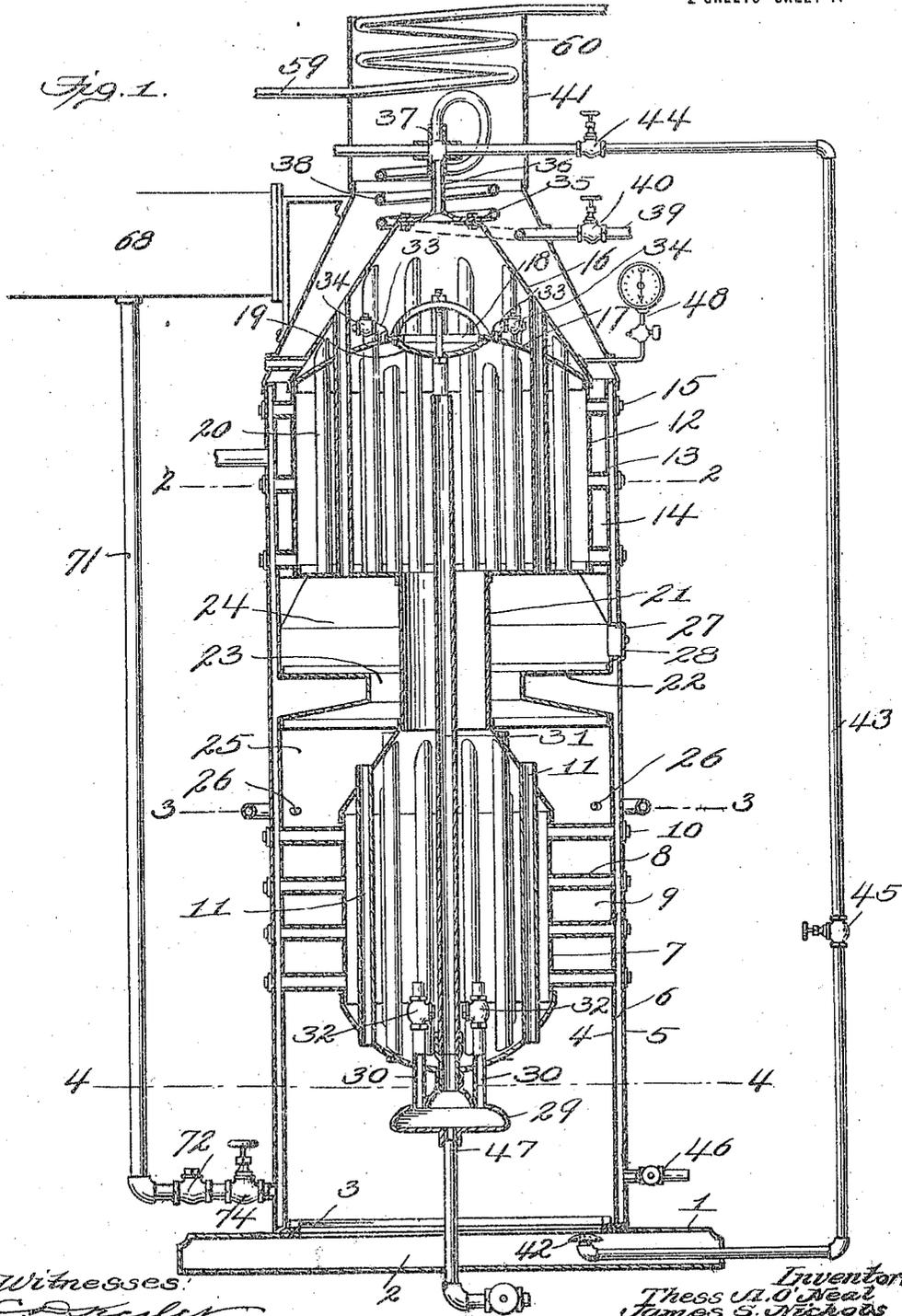


T. A. O'NEAL & J. S. NICHOLS.
 STEAM BOILER.
 APPLICATION FILED OCT. 18, 1915.

1,234,073.

Patented July 17, 1917.
 2 SHEETS—SHEET 1.



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Fig. 2.

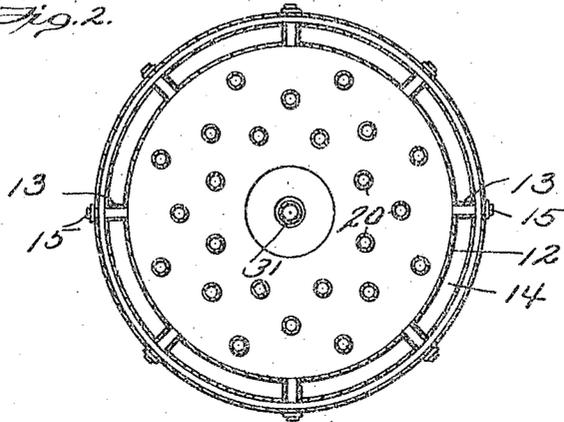


Fig. 3.

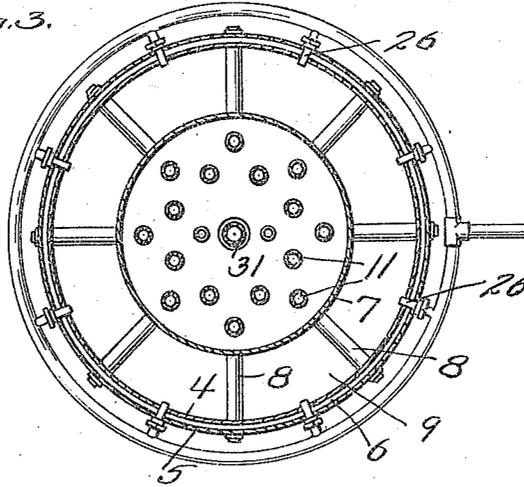
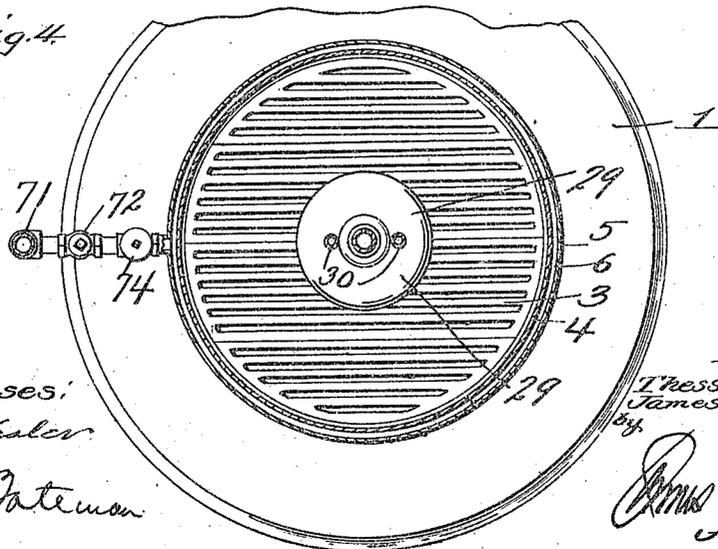


Fig. 4.



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UNITED STATES PATENT OFFICE.

THESS A. O'NEAL AND JAMES S. NICHOLS, OF ATLANTA, GEORGIA.

STEAM-BOILER.

1,234,073.

Specification of Letters Patent. Patented July 17, 1917.

Application filed October 18, 1915. Serial No. 56,473.

To all whom it may concern:

Be it known that we, THESS A. O'NEAL and JAMES S. NICHOLS, citizens of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

Our present invention relates to improvements in steam boilers and one of the primary objects thereof is to provide efficient means for automatically feeding hot water to the boiler to replenish that evaporated off as steam, the water so fed to the boiler being heated by gases or products of combustion the heat energy of which would otherwise be partially or wholly wasted, and this feed water is fed to the boiler at or near the boiling point and in condition to be quickly converted into steam in the boiler.

Another object of the invention is to provide a boiler construction which presents an extensive and efficiently arranged heating surface to utilize to the maximum the heat energy of the gases for converting water in the boiler into steam and, when desired, to superheat the saturated steam.

Another object of the invention is to provide means for subjecting water in the boiler to a high degree of heat and to then project this highly heated water into the steam space of the boiler to there liberate its steam.

A further object of the invention is to provide a blower for forcing the superheated steam and air heated thereby into the burning fuel in the firebox of the boiler, thereby promoting the combustion of the fuel and avoiding the disadvantages of leaving open a draft door as heretofore practised, to aid in the combustion of the fuel.

To these and other ends the invention consists in certain improvements and combinations and arrangements of parts all of which will be hereinafter more fully described, the novel features being pointed out particularly in the claims at the end of the specification.

In the accompanying drawing:—

Figure 1 represents a central vertical section of a steam boiler constructed in accordance with one embodiment of the invention;

Figs. 2, 3 and 4 represent transverse sections on the lines 2—2, 3—3 and 4—4, respectively, of Fig. 1.

Similar parts are represented by the same reference characters in the several views.

The present invention is applicable generally to steam boilers of various types. It is shown in the present instance as applied to a stationary boiler. It is to be understood, however, that the invention is not restricted to this particular application of the invention nor to the precise construction shown, as modifications and changes may be made in adapting the invention to boilers of different types and equivalent constructions are contemplated within the scope of the claims.

In the present embodiment of the invention, 1 designates a base on which the boiler rests, this base being preferably hollow to form an air chamber 2 from which air may be fed to the burning fuel on the grate 3 to aid combustion of such fuel. The boiler provides a space or chamber through which the hot gases or products of combustion pass and in so doing transfer their heat to the water heating and steam generating surfaces of the boiler. Preferably, however, and as shown, the boiler comprises inner and outer shells 4 and 5 which are arranged in close relation and form an annular space 6 between them for the water in the lower portion of the boiler and the steam in the upper portion thereof. This exterior water and steam chamber will receive a portion of the heat from the hot gases or products of combustion, thereby increasing the steaming capacity of the boiler and reducing the loss of heat by radiation.

Preferably, and as shown, the boiler contains upper and lower water heating and steam generating units. The lower water heating unit comprises a shell 7 which is of a diameter smaller than that of the outer boiler shell and it is supported within the boiler shell and at an appropriate height above the fuel by a number of tubes or pipes 8, leaving an annular space 9 between it and the outer shell for the passage of hot gases or products of combustion from the burning fuel. These tubes or pipes 8 not only support the heating unit 7 within the boiler, but they also provide communication between the interior of the heating unit 7 and the annular water space 6 of the boiler. Plugs 10 may be fitted into the outer shell 5 at points in alinement with the respective tubes or pipes 8 to aid in the construction, repair or cleaning of the boiler. The heating unit 7 contains a number of vertically extending tubes or flues 11, these tubes or

flues being open at the top and bottom of the heating unit 8 and providing passageways for the heated gases or products of combustion whereby the heat of these gases or products of combustion is uniformly distributed throughout the body of the water contained within the shell 7 of the lower heating unit. The upper heating unit comprises a shell 12 which is also of a diameter less than that of the outer boiler shell and the interior of this outer shell 12 is connected to the space 6 between the shells 4 and 5 of the boiler by a suitable number of tubes or pipes 13, an annular space 14 being provided between the shell 12 and the outer boiler shell for the passage of the heated gases or products of combustion. The plugs 15 may be fitted into the outer shell 5 at points in alinement with the respective tubes or pipes 13 to aid in the construction, repair or cleaning of the boiler. A hood 16 surmounts the upper heating unit 12, a septum or plate 17 dividing the interior of the hood 16 from the interior of the upper heating unit 12. A manhole 18 may be provided in this septum or plate to permit access to the interior of the upper heating unit 12 during the construction, cleaning or repair of the boiler. A manhole cover 19 closes this manhole when the boiler is in condition for operation. A number of tubes or flues 20 extend vertically through the upper heating unit 12 and the hood 16, these tubes or flues being open at the bottom of the upper heating unit and at the top of the hood, permitting the heated gases or products of combustion to pass through these elements and to thoroughly distribute their heat to the body of water contained in the upper heating unit and the steam contained in the upper portion of this upper heating unit and the hood 16.

Preferably, the upper and lower heating units have direct water communication. In the construction shown, a large tube or conduit 21 connects the top of the lower heating unit to the bottom of the upper heating unit. In order to utilize to the fullest, the action of the heated gases or products of combustion on the water contained in the tube or conduit 21, an annular offset 22 extends inwardly from the inner boiler shell 4, this offset bringing a portion of the water contained in the outer boiler shell into a position above the annular passage 9 for the heated gases or products of combustion, thereby increasing the heating action upon the water in the outer space of the boiler, and the inward offset 22 provides a restricted passageway 23 which brings the heated gases or products of combustion into close action upon the water in the tube or conduit 21. The chambers 24 and 25 above and below the offset 22 provide combustion spaces, and in order to insure more complete burning of the partially consumed gases reaching this

combustion space, oil burners 26 or equivalent means may be provided to aid in the combustion of the imperfectly or incompletely consumed gases. A manhole 27 may be provided in the outer casing of the boiler to facilitate construction, repair and cleaning of the boiler, this manhole being normally closed by a cover 28.

The present invention provides means operative automatically to agitate the water in the boiler to insure efficient circulation thereof and liberation of steam from the boiler water and which subjects a relatively small volume of water to a relatively high degree of heat and projects this highly heated water into the steam space of the boiler wherein the steam from this highly heated water is liberated. In the construction shown, a water heating chamber 29 is provided, it being preferably situated directly above the fuel on the grate and it is connected by a suitable number of pipes 30 to receive the water from the lower heating unit 7 and discharge highly heated water therefrom through a pipe 31 which extends upwardly through the lower heating unit 7, the conduit 21, and into the upper portion or steam space of the upper heating unit 12. In order to prevent back flow of water from this firebox water heating chamber 29 into the heating unit 7 through the pipes 30, check valves 32 may be provided, these check valves acting to admit water from the lower heating unit 7 to the chamber 29 and permitting the highly heated water in the chamber 29 to discharge from the latter only by way of the pipe 31. The relatively small volumes of water received in the chamber 29 are heated to a very high temperature owing to the location of the chamber 29 in the hottest part of the firebox or combustion chamber, and the steam generated in the highly heated water passing from the chamber 27 is liberated directly in the steam space of the boiler. Also, the flow of water into the chamber 29 induces a circulation of the water in the boiler.

As previously stated, the upper portion of the upper heating unit 12 and the hood 16 comprise the steam space of the boiler. In the present instance the boiler is constructed to supply superheated steam, the upper portion of the upper heating unit 12 containing the saturated steam, and the hood 16 containing the superheated steam. Saturated steam from the upper portion of the upper heating unit 12 passes into the hood 16 by the pipes 33, these pipes being shown as provided with check valves 34 to prevent back flow of superheated steam from the hood 16 into the upper heating unit 12. The top of the hood 16 is closed by a head 35 which is provided with a superheated steam outlet pipe 36. In the present construction, this pipe 36 leads to a fitting 37 and a steam superheating coil 38 is con-

5 nected at one end to receive steam from the fitting 37, and its opposite end provides a superheated steam outlet from which the superheated steam may be drawn and used
 10 as desired. A valve 40 controls the superheated steam outlet. A stack 41 incloses the hood 16 and the steam superheating coil 38, the heated gases or products of combustion passing from the boiler through this stack
 15 and in so doing they transfer their heat to the hood 16 and the coil 38 of superheated steam therein.

20 The present invention also provides an improved blower for promoting combustion of the fuel on the grate. It comprises means for inducing a flow of air into the space beneath the grate by dry or superheated steam, the superheated steam heating the air so induced and promoting and increasing the efficiency in combustion of the fuel. As shown, a blower nozzle or head 42 is placed in an opening in the base 1, which opening is of a size sufficient to admit air under induction of the current of steam escaping
 25 from the blower nozzle, superheated steam being supplied to the blower nozzle by a pipe 43 which leads from the fitting 37 and may be provided with suitable controlling valves 44 and 45. To facilitate draining and cleaning of the water space of the boiler, a valve-controlled blow off pipe 46 may be connected to the outer shell 5 of the boiler, and a valve-controlled blow-off pipe 47 may also be connected to the firebox superheater chamber 29. 48 represents a steam pressure gage which may be of the usual construction.

30 Feed water is supplied to the boiler from a tank 68 through a pipe 71 and suitable valves 72 and 74. Preferably, a feed water supply pipe 59 is provided to receive hot water from a water heating coil 60 which is in connection with a source of water supply. The water heating coil 60 is preferably
 35 placed in the stack 41 at a point above the steam superheating coil 38 in order that the products of combustion before escaping from the stack will give up heat to the water in this coil.

40 Having thus described our invention, what we claim is:

1. In a steam boiler, the combination of an outer casing comprising inner and outer shells forming a water space between them,
 45 and a heating unit arranged within said casing and spaced therefrom for the passage of products of combustion between said unit and outer casing, said unit comprising saturated steam and superheated steam chambers, and means extending through the space between said outer casing and heating unit to provide communication between the saturated steam chamber of said unit and the water space in the outer casing.

50 2. In a steam boiler, the combination of

an outer casing comprising inner and outer shells forming a water space between them, and a heating unit arranged within said casing having saturated steam and superheated steam chambers, flues extending
 55 therethrough for the passage of products of combustion, and means extending through the space between said outer casing and heating unit to provide communication between the saturated steam space of said unit and the water space in the outer casing.

3. In a steam boiler, the combination of an outer casing having a combustion chamber therein, spaced heating units within said casing having passages between them and the casing for the passage of products of combustion and also having flues extending
 60 therethrough for the passage of products of combustion, one of said units being divided into saturated steam and superheated steam chambers, and a conduit providing water communication between said units.

4. In a steam boiler, the combination of an outer casing to contain the products of combustion, spaced heating units within said casing and having passages between them for the passage of products of combustion, one of said units being divided to form saturated steam and superheated steam chambers, a conduit providing water communication between said units, and inwardly offset portions within said casing forming a restricted passageway for the products of combustion past said conduit.

5. In a steam boiler, the combination of an outer water jacketed casing adapted to contain products of combustion, heating units having water chambers communicating with the water jacketed casing and having spaces between them and the casing for the passage of the products of combustion, a conduit providing water communication between said units, the outer water jacketed casing having a portion offset inwardly toward said conduit to retard the flow of the products of combustion and to direct the same toward said conduit, and means located between said units for introducing a combustion supporting agent.

6. In a steam boiler, the combination of a water jacket outer casing for the passage of products of combustion, a heating unit therein spaced for the passage of products of combustion between it and the casing and having tubes connecting such unit to the water space of the outer casing and also having flues extending therethrough for the passage of products of combustion, said unit adapted to contain water in its lower portion and steam in its upper portion, and a steam superheating chamber connected to receive steam from said heating unit, said superheating chamber being spaced for the passage of products of combustion externally thereof and also having flues for the

passage of products of combustion there-through.

7. In a steam boiler, the combination of a water jacket outer casing and a stack for the passage of products of combustion, a water heating unit within the casing, a steam superheating chamber surmounting said unit, said unit and chamber being arranged for the passage of products of combustion externally thereof and also having flues extending therethrough for the passage of products of combustion, the water heating unit having lateral tubes connecting it

to the water space of the outer casing, and a steam superheating element in the stack beyond said superheating chamber connected to receive superheated steam therefrom.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

THESS A. O'NEAL.
JAMES S. NICHOLS.

Witnesses:
YOUNG A. GRESHAM,
O. B. BUSH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."