R. W. BIRCHFIELD.

BOILER.

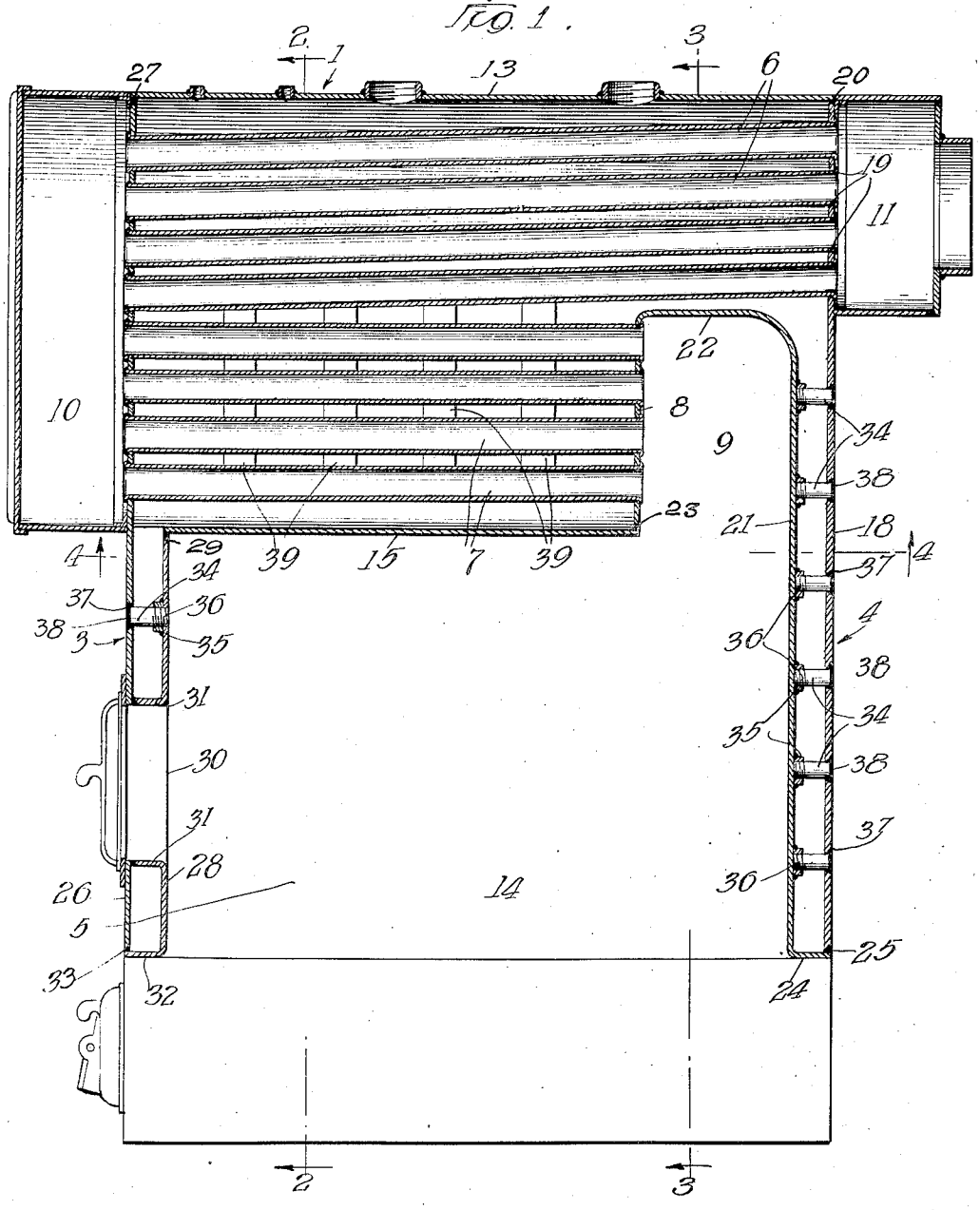
APPLICATION FILED JULY 30, 1920.

1,393,741.

Patented Oct. 18, 1921.

3 SHEETS—SHEET 1.

FIG. 1.



Witnesses:

Harry B. L. White.

W. P. Kilroy

Inventor:

Robert W. Birchfield

By Murray Lotz & Wilson Attys.

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3 SHEETS—SHEET 2.

FIG 2.

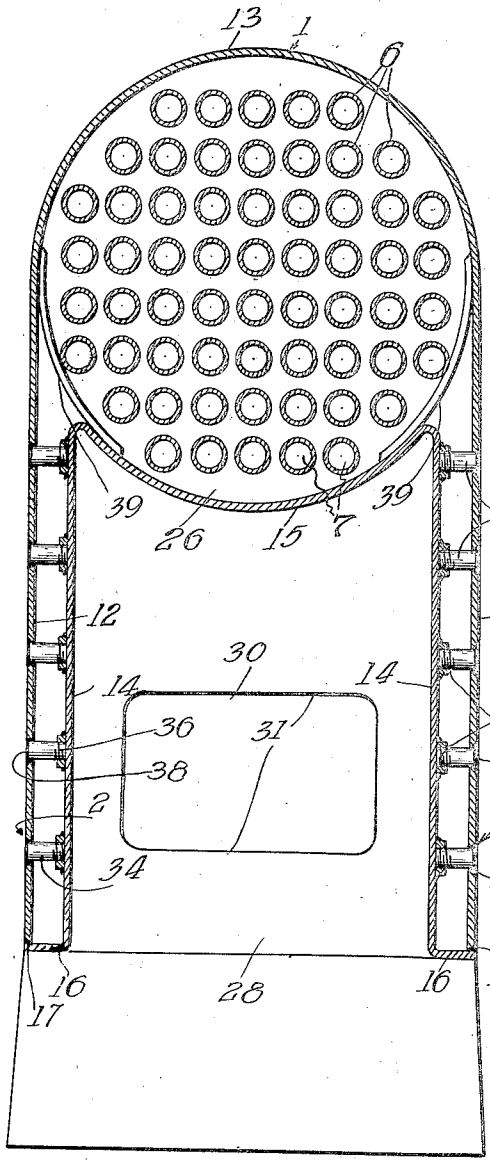
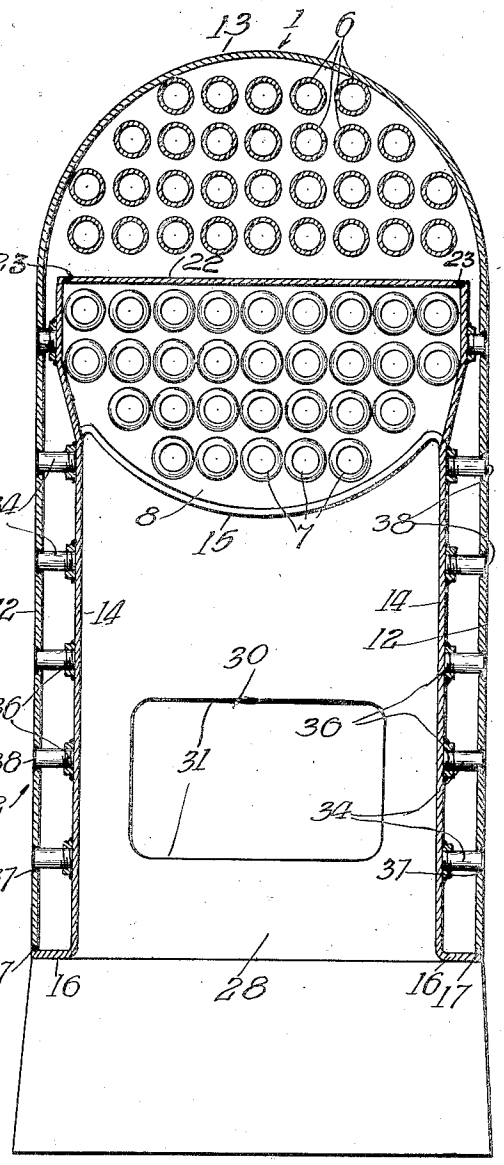


FIG 3.



Witnesses:
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Inventor:
Robert W. Birchfield
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R. W. BIRCHFIELD.

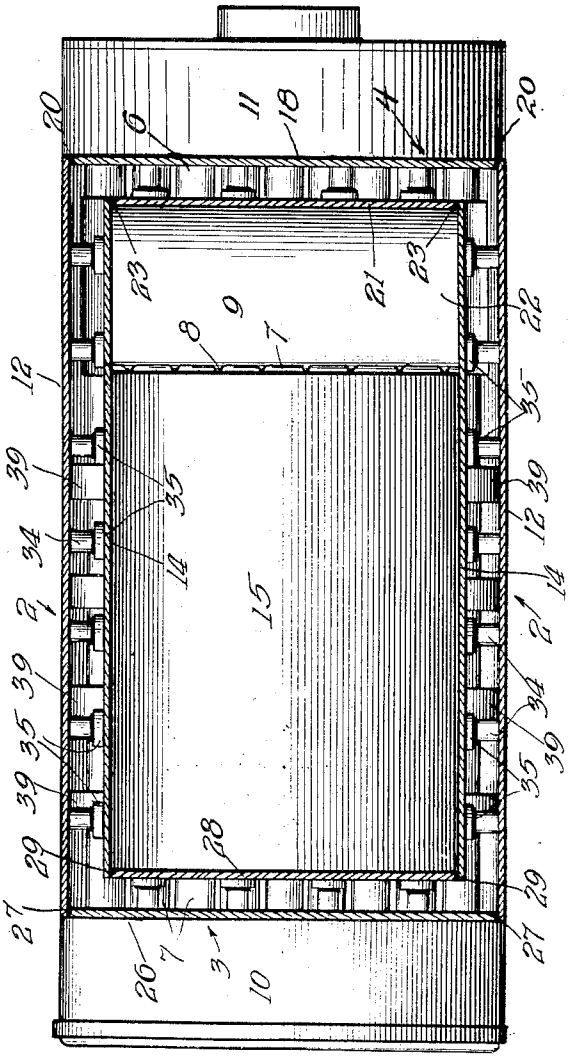
BOILER.

APPLICATION FILED JULY 30, 1920.

1,393,741. Patented Oct. 18, 1921.

3 SHEETS—SHEET 3.

FIG 4



Witnesses
Harry R. Lewis
W. P. Kilroy

Inventor:
Robert W. Birchfield.
By Murray Lotz & Wilson
Attys.

UNITED STATES PATENT OFFICE.

ROBERT W. BIRCHFIELD, OF WAUKEGAN, ILLINOIS.

BOILER.

1,393,741. Specification of Letters Patent. Patented Oct. 18, 1921.

Application filed July 30, 1920. Serial No. 399,999.

To all whom it may concern:

Be it known that I, ROBERT W. BIRCHFIELD, a citizen of the United States, and a resident of Waukegan, in the county of Lake and State of Illinois, have invented certain new and useful Improvements in a Boiler, of which the following is a specification.

My invention relates to improvements in boilers and has special reference to an improved boiler and boiler construction.

The object of my invention is to provide a steam or hot water boiler preferably constructed of steel plates and in the construction of which all rivets and calked joints, except the flue ends, shall be eliminated; in which the skin wall or shell of the boiler shall be substantially a continuous metallic plate; which boiler shall be of the horizontal return flue type provided with water legs at the sides and ends of the fire box, and which shall be of relatively light weight, strong to resist internal pressure and easily built.

I accomplish my purpose by forming an exterior sheet to provide substantially the upper half of the cylindrical part of the boiler and the outer walls of the side water legs, and an inner main sheet which forms the lower part of the cylindrical shell and the inner walls of the side water legs. These two plates are joined together at their edges by welding.

The boiler is completed by suitable end plates joined to the two main plates by welding closing the ends of the boiler and forming front and rear water legs.

The simplicity of the novel construction is made possible by the development of improved methods of welding the plates together. My invention also involves improved means of staying the inner and outer sheets of the water legs whereby I avoid all external joints which are not metalized or welded.

An important feature of my improvement resides in the novel manner in which I form the connections at the lower ends of the water legs, between the inner and outer sheets, viz: I provide a horizontally projecting flange preferably on the inner sheets and projecting outwardly and I join the edge of this flange to the lower edge of the outer sheet by welding.

At the rear end of the boiler the inner sheet of the rear water leg extends up substantially to the middle of the cylindrical shell, then forward to form the roof of the auxiliary fire space, then down to form the flue sheet for the lower shorter flues, and this is joined at its edges to the edges of the main inner sheet by welding.

The completed boiler consists of a horizontally return flue boiler having the fire space or furnace completely inclosed in water legs and every joint therein welded so that in effect the whole boiler shell is a continuous integral sheet of steel.

Furthermore no longitudinal welded connection of the sheets is exposed to the fire and the more important of the welded joints are arranged at the external surface of the boiler where the fire cannot possibly reach them.

While I have, in the accompanying drawings, forming part of this invention, illustrated a boiler of the horizontal return tube type constructed in accordance with my invention, it should be understood that all of the features of my invention are not limited or confined to this particular type of boiler but are capable of application to and embodiment in other types.

In said drawings:—

Figure 1 is a vertical central longitudinal sectional view of the boiler;

Fig. 2 is a vertical cross section on the line 2—2 of Fig. 1;

Fig. 3 is a vertical cross section on the line 3—3 of Fig. 1; and

Fig. 4 is a horizontal section on the line 4—4 of Fig. 1.

The boiler illustrated in said drawings has an upper horizontal cylindrical body portion 1 from which depends side water legs 2, and forward and rear end water legs 3 and 4 respectively inclosing a fire space or furnace 5. The cylindrical body portion contains return flues 6 in its upper half which extend from end to end thereof and shorter flues 7 in its lower half which extend from the forward end of the boiler to a rear auxiliary flue sheet 8 arranged at the forward side of an auxiliary fire space 9 and through which the fire gases escape from the furnace space 5. The gases flow from the furnace space 5 through the auxiliary space 9 then through the shorter flues 7 to the forward end of the boiler where I provide a smoke box 10 connecting the upper and lower flues and causing the gases to return through the upper flues to the rear end of

the boiler where they escape into a rear smoke box or flue 11 to be carried to the chimney.

The boiler, without the smoke boxes, is so built and constructed that its walls are, to all practical intents and purposes, a continuous sheet of uniform thickness and homogeneous throughout and without any rivets or riveted or calked joints.

In order to produce such a construction I provide a main outer sheet 12 formed of U-shape, the middle portion forming the upper, cylindrical side 13 of the body 1 and the sides of the U extending down and forming the outer walls of the side water legs 2, the inner wall of the boiler is formed of a second sheet 14 which is also formed into a general U-shape preferably with this distinction, however, that the bend of the U is reversed to form the lower part 15 of the cylindrical body portion 1 of the boiler. The sides of the inner U-shaped sheet 14 form the inner walls of the side water legs 2. For completing the side water legs at their lower ends I provide one of the main sheets, preferably the inner sheet 14 with horizontal outwardly extending flanges 16 at their lower edges which project outwardly to contact with the lower edges of the outer seat, and I join the contacting edges by welding, as shown at 17. At the rear part of the main inner sheet 14 the side walls extend up to about the middle line of the cylindrical part 1 of the boiler to form the sides of the auxiliary fire space 9.

The rear water leg 4 is built up of a rear flue sheet 18 which is cut to conform to and contact with the rear edge of the outer main boiler sheet 12 and is provided in its upper part with suitable holes 19 for receiving the rear ends of the return flues 6. The edges of this outer sheet are metallically joined to the rear edge of the outer sheet 12 by welding, as shown at 20.

The inner wall of the rear water leg 4 is preferably formed of a sheet 21 which extends upwardly from the lower edge of the rear water leg to the top of the auxiliary furnace space 9 substantially parallel with the outer rear sheet 18. The upper part of this inner sheet extends forwardly to form the roof 22 of the auxiliary fire space 9 and is then bent downwardly to form the said auxiliary rear flue sheet 8. The edges of this inner sheet are metallically joined by welding as shown at 23, to the adjacent edges of the inner main sheet 14. The auxiliary rear flue sheet 8 is provided with suitable openings for receiving the rear ends of the lower shorter tubes 7.

The lower edges of the rear sheet 18 and 21 are joined together to close the lower end of the rear water leg, the inner sheet being provided with a horizontal outwardly extending flange 24 which is metallically joined at its outer edge to the lower edge of the outer sheet by welding, as shown at 25.

The forward water leg 3 is constructed similarly to the rear water leg 4. I provide an outer front sheet 26 which is cut to fit within the forward edge of the outer U-shaped sheet 12 and is metallically joined thereto by welding as shown at 27. I also provide an inner front sheet 28 which is cut to conform with the transverse shape of the inner main sheet 14, and is metallically united therewith at its edge by welding as shown at 29.

To provide a fire door opening 30, I preferably form a forwardly projecting flange 31 integral with the inner sheet and defining said opening and welded at its forward edge to the outer sheet at the edge of a similar opening therein.

As with the other water legs, I preferably close the front water leg 3 at its lower end by means of a flange 32 projecting forwardly from the inner sheet into contact with the lower edge of the outer sheet and metallically joined thereto by welding as shown at 33.

For the purpose of strengthening the several water legs so that they will properly withstand the pressure to which the boiler is subjected in use, I connect the inner and outer sheets in each water leg by means of a plurality of stay bolts 34.

In order to avoid any exposed calked or unmetallized joints between the stay bolts and the several sheets I provide threaded sockets 35 welded to the inner side of the inner sheets and adapted to receive the inner threaded ends 36 of the stay bolts 34.

The bolts project through alined openings 37 in the outer sheets, their outer ends being, preferably substantially flush with the outer surfaces of the outer sheets. I make the openings 37 countersunk and larger at the outer sides of the outer sheets so as to facilitate the welding of the outer ends of the bolts to the outer sheets as indicated at 38.

To strengthen the cylindrical body portion 1 of the boiler I provide a plurality of stays 39 within the boiler and connecting the inner sheet 14 to the outer sheet 12. These stays are arranged across the side water legs and form substantial continuations of the cylindrical shell formed of the U-portions of the two sheets 12 and 14. I provide enough of these stays to retain the cylindrical body portion 1 in true shape as against the internal pressure and I connect these strap stays to the sheets by welding their ends thereto.

It will now be evident that by means of my improvements I am enabled to provide a boiler suitable for power and heating purposes which has a substantially continuous outer shell which is homogeneous and which

is of substantially uniform thickness throughout; also by means of my improvement I eliminate all double thickness joints, all riveted and calked joints and that the outer skin or shell of the boiler is to all practical intents and purposes an integral shell. Furthermore, the cylindrical part of the boiler has no longitudinal seams either at the lower or the upper side.

As many modifications of my invention will readily suggest themselves to one skilled in the art, I do not limit or confine my invention to the specific structures or the specific sequence of steps herein shown and described.

I claim:

1. In a boiler of the kind described, in combination, an outer shell, flues therein, and crown and side sheets, the fire box between said side sheets including a main combustion space and an auxiliary combustion space rising above one end of the main combustion space, the sheets at the sides of said main and auxiliary combustion spaces together with the main crown sheet being formed from a single plate, and a single plate forming the back sheet, the crown sheet for the auxiliary combustion space and the flue sheet adjacent thereto.

2. In a boiler of the return-flue type and a combined fire box, in combination, an outer shell, flues therein, crown and side sheets, the fire box between said side sheets including a main combustion space and an auxiliary combustion space rising above the main combustion space, the sheets at the sides of said main and auxiliary combustion spaces together with the main crown sheet, being formed from a single plate, and a single plate forming the back sheet the crown sheet for the auxiliary combustion space and the flue sheet adjacent thereto, the joined edges being united by welding.

3. In a boiler of the return-flue type, and a combined fire box, flues therein and crown and side-sheets, the fire box between the side sheets including a main combustion space and an auxiliary combustion space rising above the main combustion space, the sheets at the sides of the combustion spaces and the crown sheet of the main combustion space being made of a single plate, and a single plate forming the back sheet the crown sheet of the auxiliary combustion space and the rear flue sheet adjacent thereto, the bend between the auxiliary crown sheet and the back sheet being on a relatively long radius and the two plates being joined at their adjacent edges.

4. In a boiler of the kind described, in combination, an outer shell, flues therein, and crown and side sheets, the fire box between said side sheets including a main combustion space and an auxiliary combustion space rising above one end of the main combustion space, the sheets at the sides of said main and auxiliary combustion spaces together with the crown sheet above the main combustion space being formed from a single plate, and a sheet metal closure for the rear end of the fire box joined to the rear edges of said single plate, said closure including the back sheet, the crown sheet of the auxiliary combustion space, and the adjacent flue sheet.

5. In a boiler of the return flue type having a cylindrical body and depending water legs inclosing a fire-box, in combination, an outer shell, flues therein, and crown and side sheets, the fire box between said side sheets including a main combustion space and an auxiliary combustion space rising above one end of the main combustion space, the crown sheet being concave and formed substantially on the radius of the cylindrical body, the sheets at the sides of said main and auxiliary combustion spaces together with the crown sheet being formed from a single plate, and a sheet metal closure for the rear end of the fire box joined to the rear edges of said single plate, said closure including the back sheet, the crown sheet of the auxiliary combustion space, and the adjacent flue sheet.

6. In a boiler of the kind described, in combination, an outer shell, flues therein, and crown and side sheets, the fire box between said side sheets including a main combustion space and an auxiliary combustion space rising above one end of the main combustion space, the sheets at the sides of said main and auxiliary combustion spaces together with the main crown sheet being formed from a single plate, and a metal sheet closure for the rear end of the fire box joined to the rear edges of said single plate by welding, said closure including the back sheet, the crown sheet of the auxiliary combustion space, and the adjacent flue sheet.

Signed at Chicago, Ill., this 28th day of July, 1920.

ROBERT W. BIRCHFIELD.