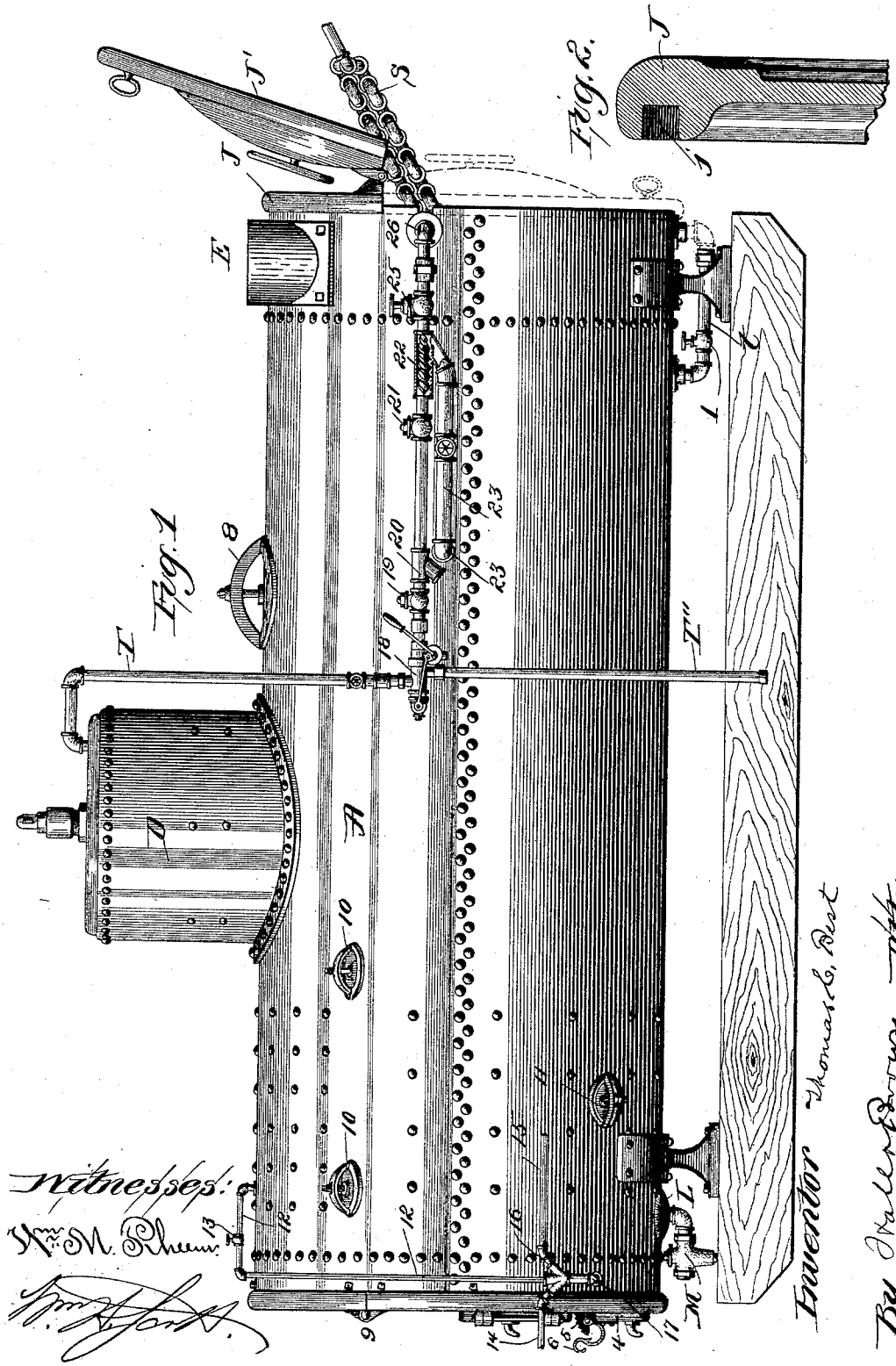
(No Model.)

4 Sheets—Sheet 1.

T. C. BEST.

STEAM BOILER.

No. 498,949. Patented June 6, 1893.



(No Model.) 4 Sheets—Sheet 2.

T. C. BEST.

STEAM BOILER.

No. 498,949. Patented June 6, 1893.

Fig. 3

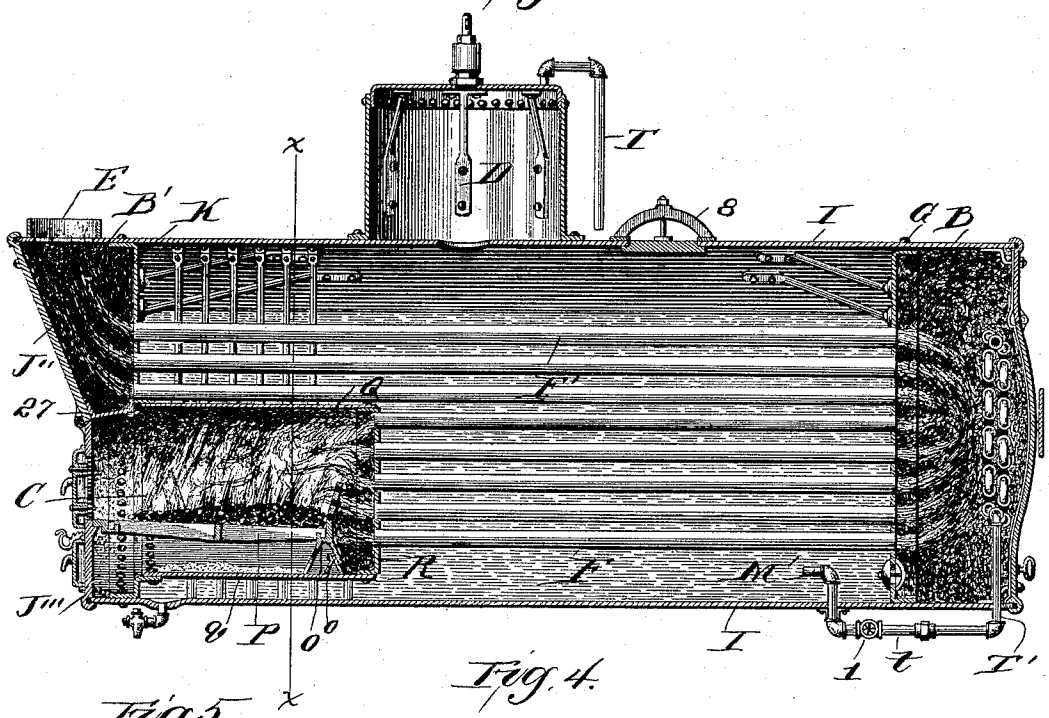


Fig. 4.

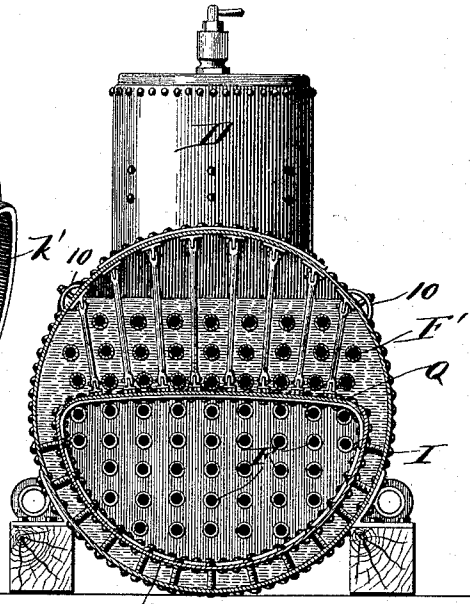
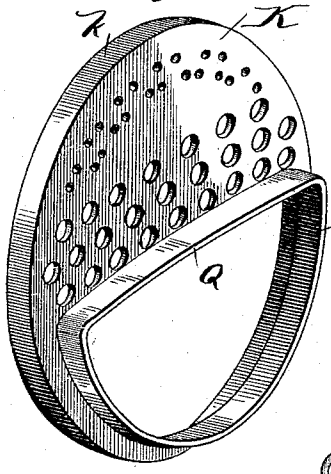


Fig. 5.



Witnesses

Wm. M. Sheem.

Inventor

Thomas C. Best

By Hall & Brown Attys

(No Model.) 4 Sheets—Sheet 3.

T. C. BEST.

STEAM BOILER.

No. 498,949. Patented June 6, 1893.

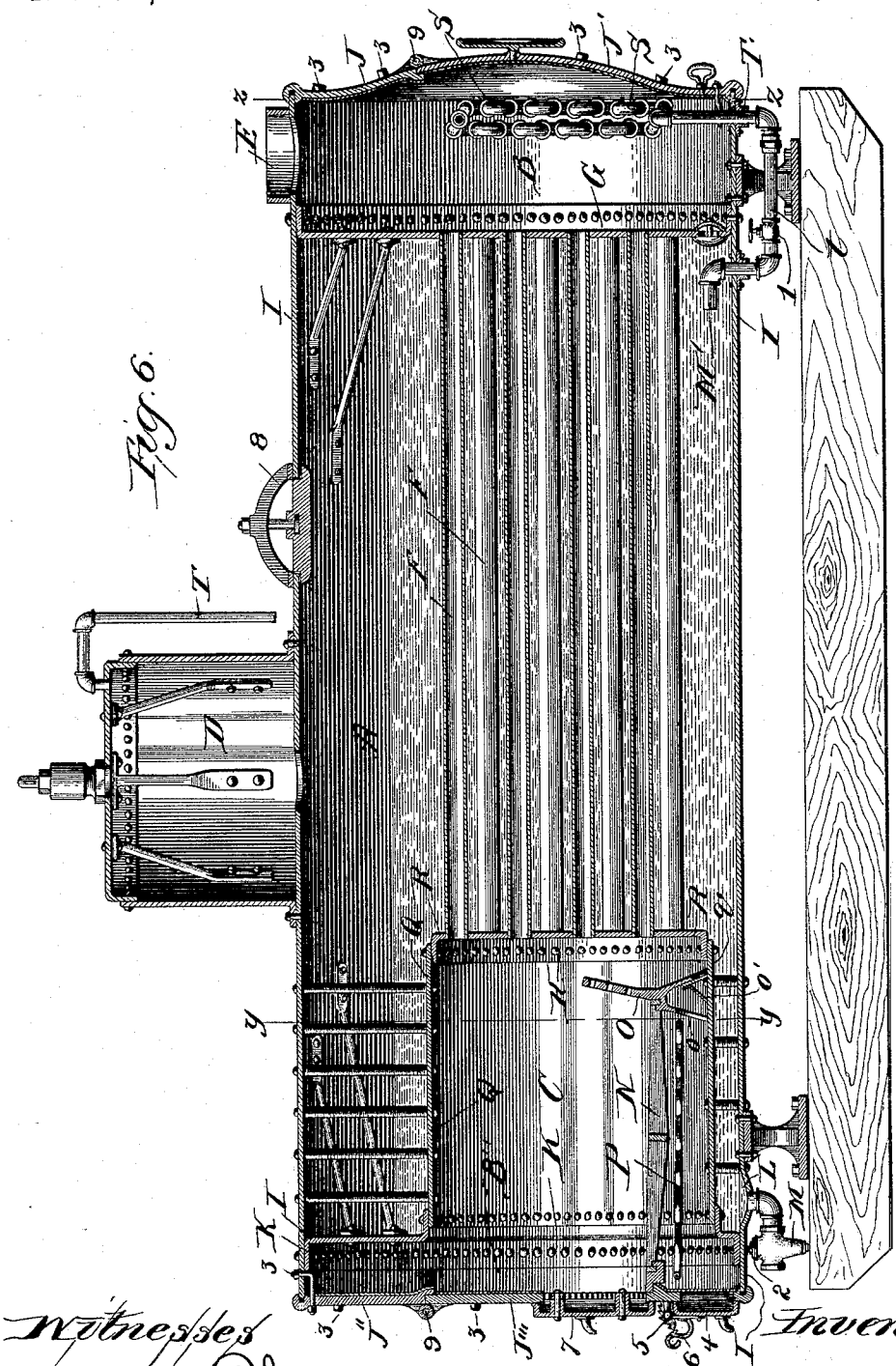


Fig. 6.

Witnesses
Wm. N. Sheem
W. A. Fox

Inventor:
Thomas C. Best
By Hall & Brown Attys

(No Model.) 4 Sheets—Sheet 4.

T. C. BEST.

STEAM BOILER.

No. 498,949. Patented June 6, 1893.

Fig. 8.

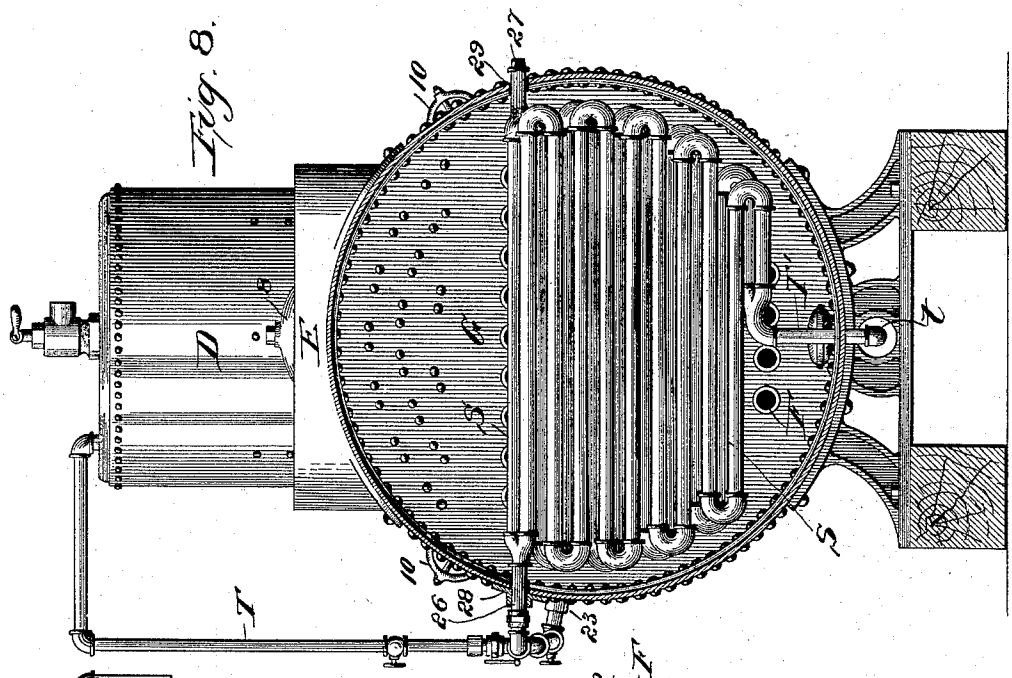
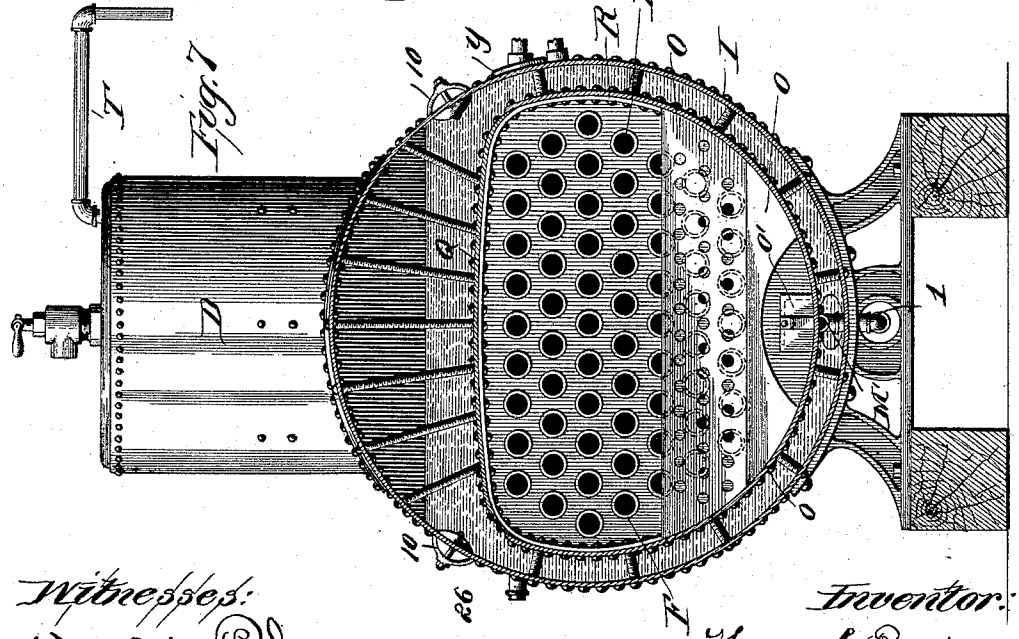


Fig. 7.



Witnesses:
Wm. M. Sheem
W. A. Fraser

Inventor:
Thomas C. Best
By Hall & Brown Attys

UNITED STATES PATENT OFFICE.

THOMAS C. BEST, OF CHICAGO, ILLINOIS.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 498,949, dated June 6, 1893.

Application filed January 8, 1892. Serial No. 417,420. (No model.)

To all whom it may concern:

Be it known that I, THOMAS C. BEST, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention relates to improvements in steam boilers, and its objects are: first, to provide means for the more complete circulation of the water in the boiler, and increase the generation of steam in locomotive, stationary, marine or any other class of boilers; second, to provide more efficient means for supplying the boiler with water, preventing the deposit of sediment, keeping the interior of the boiler clean, and free from incrustation, and for blowing out any accumulating sediment; third, a more complete and perfect construction of steam boiler, dispensing with what are termed legs, square fire boxes used in fire box boilers and other similar devices the construction of which are not only very costly, but they are continually liable to collect sediment, become incrusted and to burn out; fourth, to provide means for a more perfect combustion of fuel in the fire chamber and to prevent waste in the escape of smoke. I accomplish these objects by means of the mechanism illustrated in the accompanying drawings in which—

Figure 1 is a side elevation of my improved steam boiler with its various connections, and with the lower section of the head of the rear end of the boiler and the water supply and steam heating coil elevated upon their respective hinges. Fig. 2 is a detail view of a fragmentary section of the rim of the head of the boiler showing the groove into which the extension of the boiler is fitted. Fig. 3 is a longitudinal vertical section of one form of my improved boiler which is provided with return flues leading from the combustion chamber proper to a chamber leading to the smoke stack. Fig. 4 is a cross sectional view of my improved boiler upon the line *x*—*x* of Fig. 3. Fig. 5, illustrates a novel construction of plate sheet or the end of the boiler which contains the furnace chamber. Fig. 6 is a longitudinal vertical sectional view of my improved steam boiler in which there are no return flues but all the flues lead directly from the fire chamber to the combustion chamber. Fig. 7 is a cross sectional view of my improved boiler upon the line *y*—*y* of Fig. 6; and Fig. 8 is a cross sectional view of my improved boiler upon the line *z*—*z* of Fig. 6.

Like letters and numerals refer to the same parts in the several figures of the drawings.

I have heretofore filed an application for Letters Patent for an improvement in steam boilers in which are shown some of the features which are illustrated in my present application, but I do not make claim herein to any of the subject matter therein described and claimed.

The letter A represents the shell of the boiler which at both ends is extended beyond the ends or sheet plates of the boiler proper.

B is the combustion chamber formed by the end sheet of the boiler, the extension of the shell thereof and the head plate, J, J′.

In Fig. 3 I have shown a combustion chamber B having flues T′ which enter a second combustion chamber J″ immediately beneath the smoke stack E. This second combustion chamber is separated from the fire chamber C by a partition plate which is rigidly attached to the end plate J″ and is connected with the end plate or sheet plate K so as to prevent the escape of any smoke, flame or heat from the fire chamber C into the combustion chamber B′.

D represents the ordinary steam dome or steam chamber which may be located upon the top of the boiler.

E represents the smoke stack.

F represents the flues passing from the end plate R in the fire chamber to the end plate G in the combustion chamber, Fig. 6.

F′ represents return flues located above the fire chamber and connected with the end plates or sheet plates K and G, Fig. 3.

G represents the flanged end plate at the rear of the boiler forming the front wall of the combustion chamber.

I represents the shell of the main boiler.

K represents the flanged end or sheet plate at the front end of the boiler the external flange of which is connected by rivets to the crown sheet and wall of the fire chamber forming with the extended portion of the main shell and the heads of the boiler J″, J‴, a superheating chamber exterior to the

fire chamber. It will be observed in Fig. 5 that this flanged end K is constructed of one solid piece having a flange upon its outer periphery and a flange upon the opposite side extending downwardly to which the crown sheet and circular portions of the wall of the fire chamber may be riveted.

L represents a depressed pocket formed in the bottom of the shell of the boiler at or near the front end thereof immediately beneath the fire chamber. This depression or sediment pocket may be formed integral with the shell of the boiler by any well known means, or it may be formed of a plate riveted to the boiler; but I prefer to have it formed by a depression in the boiler shell itself. Extending from this pocket outwardly is a pipe provided with a stop cock M through which the water of the boiler and any sediment in the boiler may be blown out.

N represents the ordinary grates located within the fire chamber and partly within the superheating chamber, and supported by any ordinary well known means. I prefer to have, however, the interior end supported upon a deflector O whose upper plate is provided with perforations and whose lower plate *o* is of semilunar form as shown in Fig. 7, and the rear plate is provided with an opening and an adjustable door so that by adjusting this door more or less draft may pass behind this plate as may be desired.

P represents a series of cross pipes or a coil of pipes having perforations in their upper surfaces which are located immediately below the grates N so that air forced into said cross pipes or coil of pipes and escaping through said perforations may produce an upward blast through the grates into the fuel laid thereon.

Q represents the crown sheet of the fire chamber and *q* represents the lower wall of such fire chamber.

R represents the rear end or sheet plate forming the interior wall of the fire chamber and into which the front ends of the flues F are introduced.

S represents a bifurcated or duplicated set of feed water steam generating pipes which are located in the rear portion of the combustion chamber, and are supported by bearings 28, 29 in the extended shell of the boiler by means of the pipe 26 upon one side and the projection 27 upon the other.

T is a pipe proceeding from the steam dome or chamber of the boiler provided with a stop cock and connecting with this bifurcated or duplicated coil of pipes in the combustion chamber by a series of pipes 18, 20, 22 provided with ball check valves 19 and 21; the coupling 18 with which the pipe T is connected also having a pipe T″ connected therewith which is attached to any ordinary force pump for forcing the water into the boiler. The enlarged portion of these connections 22 is provided internally with a spiral core and connects with the pipe 23 which proceeds out of the boiler A below the hot water line, and forms an angular connection 24 with the enlarged portion 22, and then passes through the globe valve 25, through the shell of the boiler at 26 and connects with the series of bifurcated or duplicated pipes S. The bifurcated or duplicated pipes constituting the coil in the combustion chamber are united again at the lower portion thereof and connected with the pipe T′ which passes out through the extension of the shell of the boiler, and proceeds as illustrated by *t* to a point at or near the rear end of the boiler proper where it re-enters the boiler and is provided with a bent nozzle M′ through which the heated water is introduced into the boiler. This pipe *t* is provided with a stop cock *l* by which the flow of water can be cut off or regulated. The series of cross pipes or coils P Fig. 6, are connected exterior to the boiler at 17, 17, with a pipe having three separate connections, viz., the pipe 12, which proceeds from the top of the boiler and is provided with a stop cock 13. A second pipe 15 which is connected with the exhaust of the engine and has a stop cock 16, and 14 which is connected with the ordinary air or blow fan by means of which air may be forced into the series of cross pipes or coils so that when the engine is operating the coil or cross pipes P are supplied with a blast of air reinforced by the steam of the exhaust and by steam directly from the boiler through the pipe 12.

My boiler is provided with hand holes 10, 10, upon each side of the boiler just above the line of the flues and the crown sheet, and also with hand holes upon opposite sides of the boiler at or near the sediment pocket which may be opened from time to time as occasion may require for the purpose of inspecting and cleaning out the boiler. The heads of the boiler both rear and front are formed in sections J, J′, J″, J‴ and are held in normal position by means of bolts and rivets 3 the ends of the rivets being provided with screw threads and nuts adjusted thereto, and it is evident that the upper section may be lowered or the lower section elevated as may be required. The peripheral edge of the heads are provided with a recess or groove *j* as shown in Fig. 2 corresponding to the size of the lip of the boiler, and into which the edge of the shell of the boiler is inserted. This groove is partially filled with any plastic incombustible material, such as asbestus which hardens and forms an air tight joint with the edge of the shell. The front head of the boiler is furnished with the ordinary ports and doors and a port and door are provided for the ash pit, the door being represented by the numeral 4 which is hinged at its upper edge and is provided with a catch spring 6 and engages with the teeth of the permanent ratchet 5 so that this door may be opened adjustably, regulating the volume of air which may be admitted into the ash pit below the grates N.

Having thus described the various parts and the construction of my improved boiler, I now proceed to describe the manner in which my improvements operate.

First. By means of the feed water pipe and the coil S the water before introduction into the boiler is subjected to the intense heat proceeding from the flues F and in passing through the bifurcated or duplicate portions of the coil it is retarded in its movement and exposed a greater length of time to this heat and is consequently heated up to practically the temperature of the water in the boiler. The pipe T then carries the water outside of the combustion chamber and introduces it at the bottom of the boiler proper where it flows in a direction toward the fire chamber or front end of the boiler. I prefer to have the nozzle of this pipe M′ turned in the direction of the fire chamber. The consequence is that a continuous current of water from the feed water pipe assists materially in creating a constant current in the water in the boiler. The more intense heat in the fire chamber operating upon its walls which are located entirely within the shell of the boiler, naturally produces a current of the water toward the surface of the water in the boiler, above the crown sheet, flowing thence backward and descending between the flues of the boiler at or near the nozzle M′, thence forward again to the region of the fire box. The production of a constant and regular current is an important matter in the successful operation of a boiler where steam must be generated with great rapidity. The flow of the water from the feed water pipe reinforces this natural tendency of the water in the boiler to form a current and creates a positive flow, the water descending from the upper portions and the water flowing from the nozzle M passing from the lower portion of the boiler underneath the fire chamber has a direct tendency to carry all the sediment deposited by the water down beneath the fire chamber toward and into the sediment pocket L, and when the pipe M which proceeds from the sediment pocket is opened and the water is allowed to blow off, the current is much increased and all the sediment in the bottom of the boiler and in the sediment pocket is blown out and by these means a better and constant circulation of the water in the boiler is produced and the whole kept free from deposit and incrustation. Heretofore the blow off pipe has been located at or near the center portion of the boiler without reference to any circulation in the water and generally the pipe through which the blow off of the sediment is formed slightly above the shell of the boiler, thus producing an abutment around which sediment can settle and form incrustations and which the blow off pipe was unable to remove.

Second. It will be seen that my improved boiler is provided with a chamber at each end of the boiler inclosed by the end sheet or sheet plate, the extension of the shell of the boiler and the end plates. One of them B, shown in Fig. 6 being the combustion chamber proper and B″ which is embraced within the end plate or sheet plate of the boiler and the extension of the shell of the boiler proper and the end plate constituting what I term a superheating chamber which lies between the end of the boiler proper and the head of the boiler. I employ a novel form of end plate or sheet plate for this end of the boiler which I have illustrated in Fig. 5. It will be seen that this plate is provided upon one side with the flange *k* which is riveted to the shell of the boiler proper and upon the opposite side with the flange *k′* to which are riveted the crown sheet and surrounding peripheral walls of the fire chamber. This fire chamber thus constructed is entirely surrounded by a water chamber; and the end plate or sheet R is also provided with a flange H which in like manner is riveted to the crown sheet and the peripheral walls of the fire chamber, and into which, as shown in Fig. 6 the flues of the fire chamber are introduced.

Third. The deflector O which in cross section is somewhat chair-shaped, is provided with perforations through its upper deflecting plate. The lower front plate has a semi-lunar opening through which heated air may pass into the chamber formed by the two lower plates and the adjustable door *o′* enables the quantity of air which may rise up in front of the flues in the fire chamber to be regulated and controlled. The coil or series of pipes P located beneath the grates and having perforations in their upper surfaces force a blast of air commingled with steam up through the grates upon the fuel and assist in intensifying the heat in the furnace chamber. This blast is effected by means of the novel construction shown in Fig. 1 where steam from the upper portion of the boiler through the pipe 12, and steam from the exhaust in the engine through the pipe 15 and air from the ordinary fan passing through the pipe 14 unite and are forced into the coil or series of cross pipes by means of the pipe 17.

Fourth. It is evident that the volume of air entering the ash pit may be regulated and controlled by the door 4 and the ratchet device 5 and 6.

It is evident that there may be many variations in the construction and arrangement of the several parts of my invention, and therefore I do not wish to be understood as limiting myself to the exact form of construction and arrangement shown and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A steam boiler constructed of a cylindrical shell provided with flues and end sheets; having a furnace chamber located within said shell whose crown sheet and peripheral walls are surrounded by a water chamber and also having a superheating chamber between the

front opening of said furnace chamber and the front end of said boiler, and the head thereof, which said superheating chamber is surrounded by the extension of said boiler shell; all substantially as shown.

2. A steam boiler provided with a combustion chamber at the end opposite the furnace chamber, a feed water pipe bifurcated or duplicated located within said combustion chamber whose lower main pipe connection enters the chamber of said boiler at the bottom at or near the extreme rear end of said boiler; a sediment pocket in the shell of said boiler at the bottom thereof and at or near the front end of said boiler; and a blow off pipe attached to said sediment pocket and provided with a stop cock; all substantially as shown.

3. A steam boiler provided with a furnace chamber located wholly within the shell thereof, also provided with a combustion chamber formed of the rear end or sheet plate of said boiler, the rear head of said boiler and the extension of said boiler shell; a series or coil of bifurcated or multiple divisions of a feed water pipe located in the rear portion of said combustion chamber and having external connections with the water supply, the said multiple divisions of said feed water pipe united in a single pipe which enters the bottom of the boiler at or near the rear end thereof and is provided with an elbow or nozzle that discharges the feed water in the direction of the sediment pocket; all substantially as shown.

4. A steam boiler constructed of an exterior shell and provided with a furnace chamber entirely within said shell the crown sheet and peripheral walls of which are surrounded by a water chamber, a combustion chamber at the rear end of said boiler formed by the end or sheet plates of said boiler, the head thereof and the extension of said shell beyond said rear end or sheet plates; flues connecting said furnace chamber and combustion chamber and front and rear heads respectively in two sections hinged together and removably secured to the extended edges of the respective ends of said boiler shell; all substantially as shown.

5. A steam boiler constructed of an exterior shell and having a furnace chamber wholly within said shell, and whose crown sheet and peripheral walls are surrounded by a water chamber, a sediment pocket consisting of a depression or bulging in the bottom of said boiler at or near the front end thereof below the furnace chamber, said sediment pocket having a blow off pipe, and means for causing circulation in the water along the bottom of said boiler toward said sediment pocket; substantially as shown.

6. In a steam boiler constructed of an exterior shell, a furnace chamber wholly within said shell whose peripheral walls are cylindrical to the point where they meet the crown sheet, said crown sheet being flat or crowning; said exterior shell being extended beyond the ends of plate sheets in both directions thereby forming in front of the furnace chamber and the opening of the flues between the ends of plate sheets and the front and rear heads of the boiler heating chambers; all substantially as shown.

7. In a steam boiler constructed of an exterior shell; a furnace chamber whose crown sheet is flat or crowning and whose peripheral walls are cylindrical to the points where they meet the crown sheet; the rear end or plate sheet of said furnace chamber being connected with the flues of said boiler; the front ends of said crown sheet and peripheral walls being connected with the interior projecting flange of the front end or sheet plate and the exterior projecting flange of said front end of sheet plate being connected with the shell of the boiler; and a super heating chamber formed in front of said furnace chamber and the end of the boiler, by said front end or sheet plate, the head of the boiler and the extension of the boiler shell; all substantially as shown.

8. In a steam boiler constructed of an exterior cylindrical shell having a furnace chamber located wholly within said shell and a super heating chamber in front of said furnace chamber formed by the head of the boiler, the front end of the sheet plate and the extension of the boiler shell; a front end sheet or plate sheet with a peripheral flange on one side to be rigidly attached or riveted to the said exterior shell at a point within the extension of said shell; and upon the other side a flange to be rigidly attached or riveted to the front edges of the crown sheet and peripheral walls of said furnace chamber; all substantially as shown.

9. A steam boiler constructed of an exterior shell; a furnace chamber located wholly within said shell and a sediment pocket at or near the front end of said shell beneath said furnace chamber; a rear combustion chamber flues connecting said furnace chamber and said combustion chamber; a front supplementary combustion chamber; and a coil or series of multiple feed water pipes having external connections with the water supply and leading by a single pipe into the chamber of the steam boiler at its bottom and near the rear end thereof; all substantially as shown.

10. In a steam boiler constructed of an exterior shell a furnace chamber located wholly within said shell and having a fire grate located upon supports within said furnace chamber and above the bottom thereof forming an ash pit below said grate; a series or coil of perforated pipe located beneath said grate and having external pipe connections with the exhaust of the steam cylinders, the steam space of the boiler, and with a fan or blower pipe; said several external connections being provided respectively with stop cocks whereby the volume of steam exhaust and air may be regulated; all substantially as shown.

11. In a steam boiler constructed of an exterior shell a furnace chamber located wholly

within said shell; a fire grate supported within said furnace chamber the rear end thereof supported upon a projection of a deflecting flame plate said flame plate having large perforations in its upper part where it rises above the grate; and an opening through the flame plate below said grate and provided with a removable door; all substantially as shown.

12. In a steam boiler constructed of an exterior shell a furnace chamber a fire grate supported within said furnace chamber, a deflecting flame plate located at or near the rear of said furnace grate having large perforations in its upper part where it rises above the grate; also having an opening below provided with a removable door; and a coil or series of perforated pipes located beneath said grate; having external pipe connections with the exhaust of the steam cylinders, the steam space of the cylinders and with a fan or blower pipe; all substantially as shown.

13. In a steam boiler constructed of an exterior shell, which at both ends extends beyond the limits of the steam and water chambers; boiler heads adapted to each end respectively of said boiler shell in two sections hinged together; said heads being provided in their peripheries with recessed grooves adapted to be supplied with asbestus or other elastic incombustible material and to receive the edges of the respective ends of said boiler shell; and means for attaching and holding said edges of said boiler heads removably to the edges of said boiler shell; all substantially as shown.

14. In a steam boiler a head constructed in two sections hinged together; its peripheral flange or limit provided with a groove recessed therein capable of holding asbestus or other incombustible material and receiving the edges of the extension of the boiler shell; a port and door in its lower section; said door being hinged to said head, and provided with a fixed ratchet 5, and a spring catch 6 engaging therewith; all substantially as shown.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

THOMAS C. BEST.

Witnesses:
WM. J. STAPLETON,
J. LAWRENCE GERRY.