No. 861,667. PATENTED JULY 30, 1907.

S. A. MORGAN.

FEED WATER HEATER.

APPLICATION FILED JUNE 25, 1906.

2 SHEETS—SHEET 1.

Fig 1

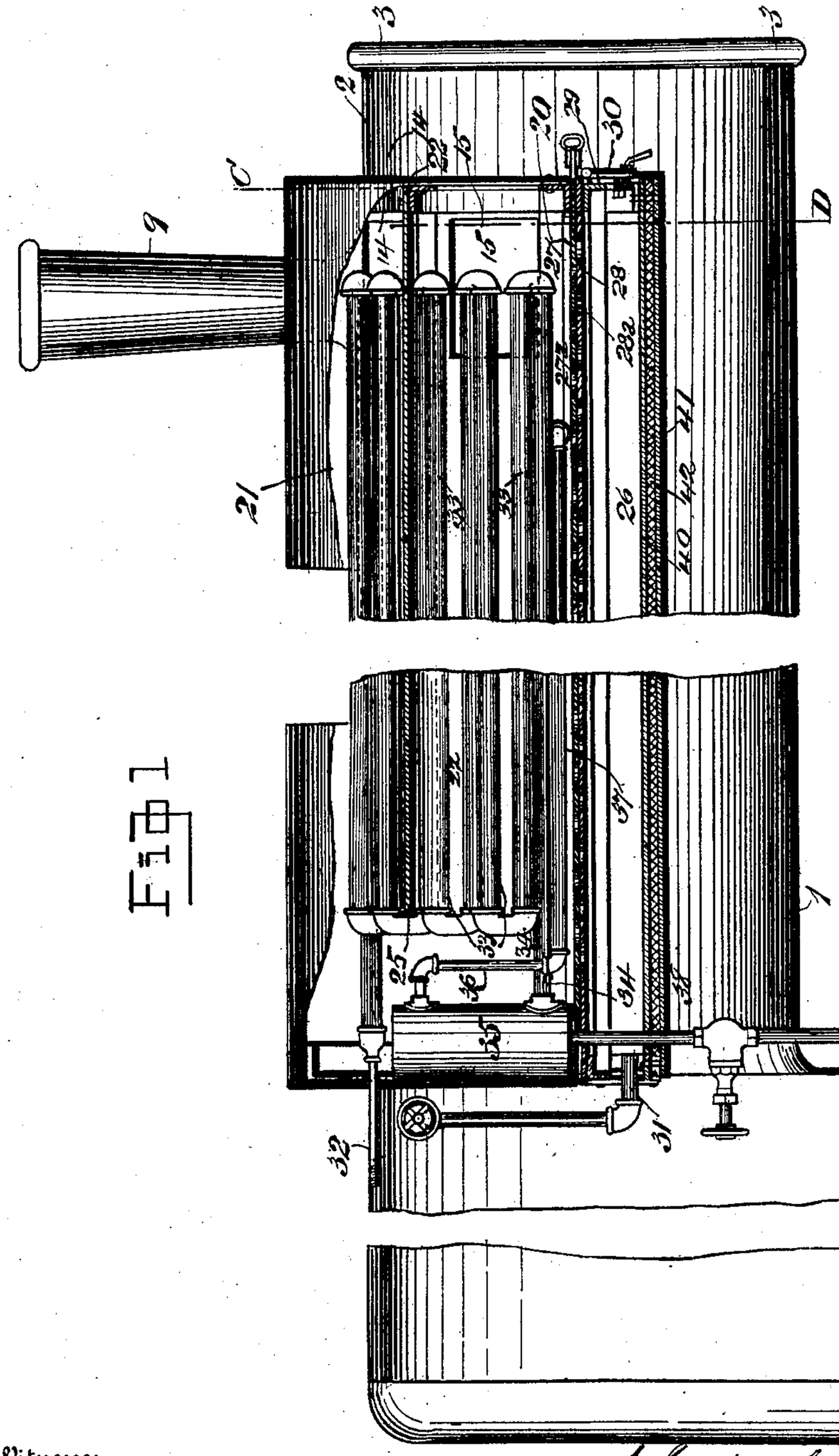
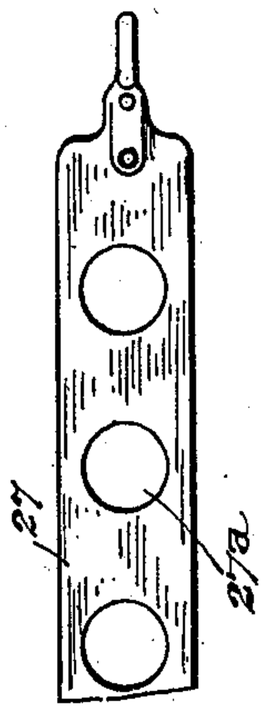
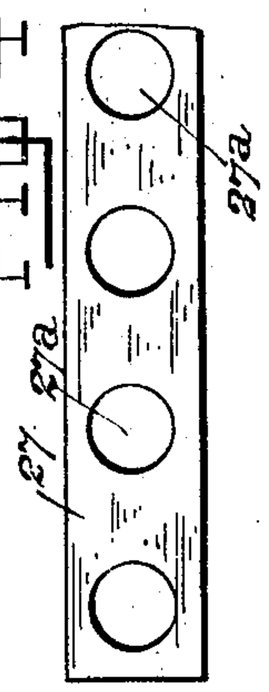


Fig 4





Witnesses

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2 SHEETS—SHEET 2.

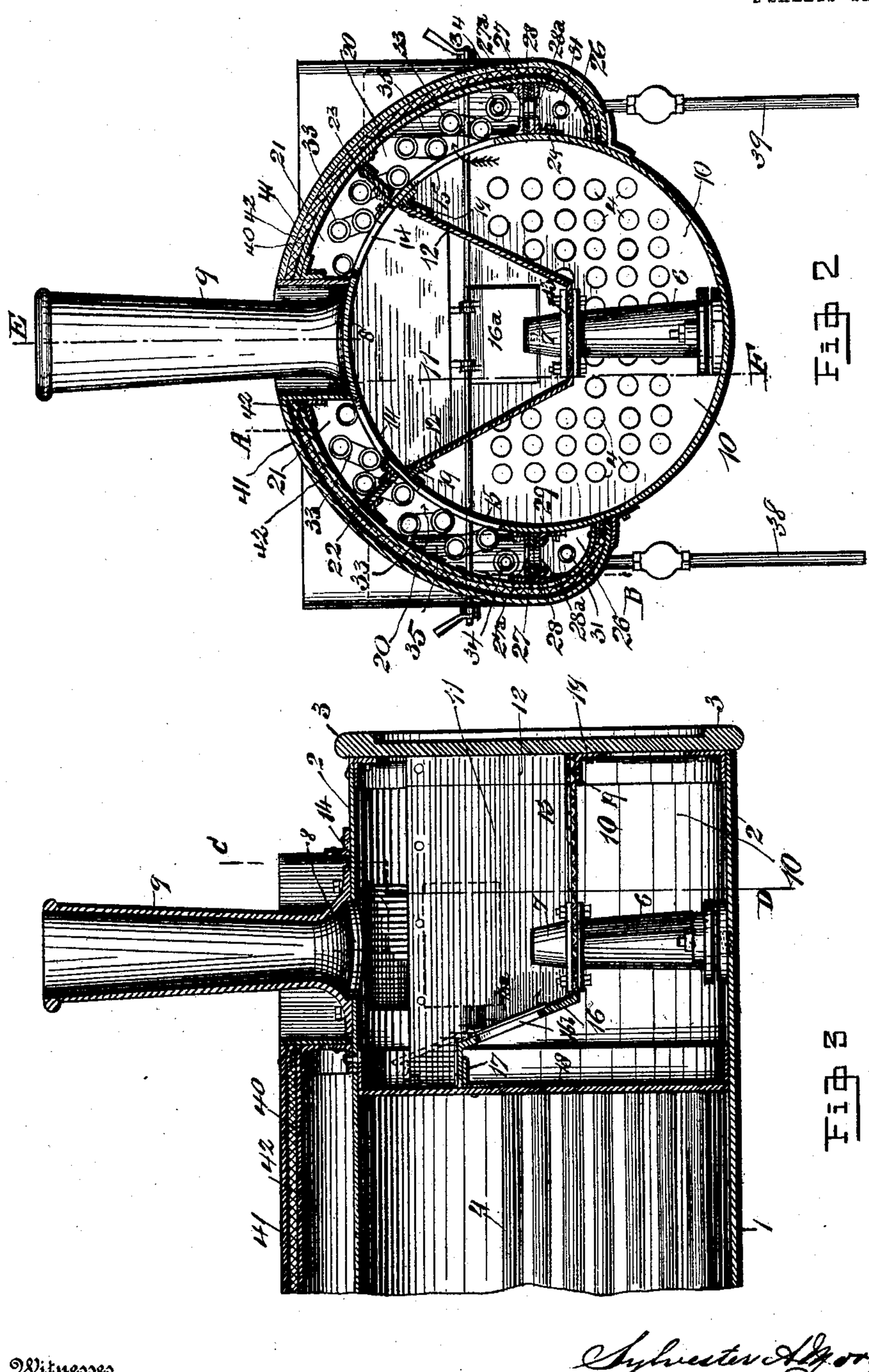

Fig 2

Fig 3

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UNITED STATES PATENT OFFICE.

SYLVESTER A. MORGAN, OF INDIANAPOLIS, INDIANA.

FEED-WATER HEATER.

No. 861,667. Specification of Letters Patent. Patented July 30, 1907.

Application filed June 25, 1906. Serial No. 323,289.

To all whom it may concern:

Be it known that I, SYLVESTER A. MORGAN, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Locomotive Feed-Water Heaters, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to means for heating feed water for locomotive boilers, and the same will be hereinafter more fully described and particularly pointed out in the claims.

The objects of my invention are: First, to divide or split the draft in its passage from the smoke arch of the locomotive and to cause the said draft thus divided or split to pass through those smoke chambers situated at the sides of the boiler and to return through a return chamber to the smoke stack of the locomotive to be discharged therefrom into the atmosphere after the gases or products of combustion have, in a great measure, given up their heat to the feed water in the feed water heating pipes situated within said chambers; second, to construct a system of feed water pipes of large diameter which is divided into two independently operated side series, each series of which is arranged to discharge feed-water into independently connected collecting or settling drums wherein the feed water slowly circulates to permit the lime and any other impurities carried by said feed water to settle and deposit in said drum, thereby providing pure feed water for the boiler to which the apparatus is attached.

I attain these objects by means of the mechanism illustrated in the accompanying drawings, in which similar numerals of reference designate like parts throughout the several views.

Figure 1 is a longitudinal broken elevational view of a locomotive boiler showing a broken sectional view of one of the side draft chambers in which the feed water heating pipes of one of the pipe series is inclosed, said view being taken through the line A—B in Fig. 2; Fig. 2 is a transverse sectional elevational view of one of the series of feed-water heating pipe draft chambers taken through the line C—D in Figs. 1 and 3; Fig. 3 is a sectional elevational broken view of a portion of the front of a locomotive boiler as it would appear if taken through the line E—F in Fig. 2; and, Fig. 4 is a detail broken plan view of one of the ash-plate valves, one of which is situated at the bottom portion of each of said draft chambers.

The boiler 1 may be of any suitable or well known type of locomotive boiler and secured to the frames of a locomotive in the usual way (not shown), and is provided with a forward smoke arch or box 2 which is closed at its front end by means of a front door 3.

The tubes 4 of the boiler are arranged in the usual manner peculiar to locomotive boilers and connect at their front ends to the smoke arch or box 2.

The exhaust pipe 6 is secured to the exhaust outlet of the steam cylinders of the locomotive situated under the smoke arch 2, and to the top end of said exhaust pipe is removably secured the exhaust tip or nozzle 7, the mouth of which is situated directly under the open base 8 of the smoke stack 9. The smoke stack 9 is securely bolted to the top portion of the arch 2 in the usual or any suitable manner.

The interior of the smoke arch 2 is divided into separate chambers or compartments (a lower chamber or compartment 10 and an upper chamber 11) by separating walls 12 and an imperforated sheet steel or wire netting partition 13. The side partitions 12 are inclined to extend upwardly so that the top edges of said sides will be adjacent to the bottom edges of the draft openings 14 or will be situated intermediate the draft openings 14 and 15 situated on the opposite sides of said smoke box 2.

The rear portion of the partition plate, or that portion situated in advance of the exhaust nozzle 7, is bent upwardly or inclined to form a deflecting plate 16 and the same has its top portion bent to extend horizontally to be secured to the angle iron 17, which latter are secured to the tube plate 18 of the boiler above the tubes 4 thereof to form an air-tight joint therewith. The forward ends of the partition plate 12 and the partition screen 13 are secured to the angle irons 19 to stiffen said plates and to form a rigid bearing against which the interior surface of the smoke arch door 3 bears to form a tight joint.

A door 16^a is provided to cover the opening 16^b formed in the deflecting plate 16, the same being provided for the purpose of permitting the draft to pass directly from the flues 4 of the boiler to and through the chamber 11 directly through said opening 16^b to the smoke stack 9 to be ejected therethrough to the atmosphere, which means are used under such circumstances as when starting the fire or when it is necessary to maintain a great degree of heat in the furnace of the boiler.

Draft chambers extend longitudinally over the top half portion of the boiler 1 (as shown particularly in Figs. 1 and 2), and the said draft chambers are divided into right and left hand sections, and each of said sections is divided into lower circulating chambers 20 and upper circulating chambers 21 by the partition plates 22 and 23 which extend longitudinally of said chambers from their forward ends to or near their rear ends

and sufficiently far from the said rear ends of said chambers to form openings of sufficient area through which the smoke or products of combustion may pass in their course from the lower chamber 20 to and through the upper chamber 21.

Bottom cinder receptacles or chambers 26 extend along the bottom portions of the chambers 20 and are separated therefrom by the valves 27 and the separating plates 28, which valves 27 rest upon the separating plates 28. The separating plates 28 extend longitudinally from the front to the rear end of each of said circulating chambers and are secured to the angle-irons 29 secured to the boiler 1, and separate the lower chamber 20 from the ash or cinder chamber 20.

The valves 27 are provided with a series of valve openings 27^a arranged in a longitudinal row, and the separating plates 28 are also provided with like openings 28^a with which the openings of the valves are adapted to register.

Doors 30 are hinged at the front ends of the cinder receptacles or chambers 26, and blow out pipes 31 are provided at the rear opposite ends of said chambers for the purpose of removing cinders that are collected in the bottoms of the lower chambers or cinder receptacles, which cinders, when so collected in the bottoms of the lower chambers 21, are transferred therefrom into the cinder chambers 26 by sliding the valves 27 till the openings 27^a register with the openings 28^a formed in the separating plates 28 to permit the cinders to pass therethrough into the ash chambers 26.

When a supply of cinders has been transferred from the bottoms of the chambers 20 into the cinder receptacles 26, the valves 27 are closed. The doors 30 are next opened and steam is turned into the blow-pipes 31 to blow the cinders to remove them from the receptacles 26 and to discharge them through the openings of the doors 30.

The feed water heating system I will now proceed to describe:—The feed-water pipes 32 are connected to the usual means whereby feed-water is supplied to a boiler, as a pump or injector, and the feed-water heating pipes 33 to which the feed-water pipes 32 are connected are preferably of much larger diameter than the feed pipes to which said heating pipes are connected for the purpose of reducing the velocity of the flow of the feed-water through said heating pipes 33 thereby subjecting the water to the action of the heat of the gases circulating around the said heating pipes for a longer period to raise the temperature of the feed water circulating through them. The said feed-water having passed through the said heating pipes, then passes through the connecting pipes 34 connected to the bottoms of the mud drums 35 into which said feed-water is discharged and wherein the circulation is so retarded that the lime or other impurities in the water are permitted to deposit therein. The feed-water, thus purified, slowly ascends the drums 35 to pass to and through the feed pipes 36 and 37 into the boiler 1.

The blow-off pipes 38 and 39 connected to the bottoms of the mud drums 35 are provided for the purpose of discharging the sediment or deposit from said drums as it is collected therein, and preventing the accumulation of the same to such an extent as to be carried over with the feed-water into the boiler.

The exterior walls of the circulating chambers are each provided with a covering composed of an inner metallic sheet 40 and an outer metallic sheet 41 between which sheets is a sheet of asbestos 42 or other similar heat non-conducting material, all of which are provided for the purpose of preventing the heat from the gases being dissipated as they pass through the said chambers. The interior metallic sheets 40 and the exterior metallic sheets 41 are provided for the purpose of protecting the asbestos from injury.

To more fully understand the operation of this invention, I will proceed to briefly describe the practice of the same. Suppose that a fire is required to be started in the furnace of the boiler; then it becomes necessary that the draft from the said furnace to the smoke stack be as nearly direct as possible. With this end in view the door 16^a is opened its full extent (as shown in dotted lines) to permit the smoke and gases flowing from the tubes 4 into the lower chamber 10 to directly pass through the opening 16^a to and through the smokestack 9 into the atmosphere. The fire in the furnace having been thoroughly started and steam at sufficient pressure having been generated in the boiler 1, the door 16^a is closed. Suppose the exhaust steam escaping through the exhaust nozzle or tip 7 in the usual way, then a vacuum is created in the upper chamber 11 of the smoke arch and the gases escaping from the tubes 4 into the lower tubes 10 separate and pass through the side openings 15 to and into the lower circulating chamber 20, thence along said chamber around the lower sections of the longitudinally extending heating tubes 33, thence around the ends of the separating plates 23 to and along the upper chambers 21, around the longitudinally extending upper sections of the heater pipes or tubes 33 through the openings 14 into the upper chambers 11, thence to and through the smoke stack 9 into the atmosphere.

This feed-water heating system is preferably divided into two sections, a right hand section and a left hand section, each of which sections are divided into upper and lower series, which series are connected together so that a continuous and unbroken flow of feed-water flows from the supplying means to and directly through said heater system of heating pipes to said drums and thence to the boiler. The object of so dividing the system into separate sections is for the purpose of providing for an emergency, such as a disarrangement of either of the means for supplying the feed water to the boiler.

I claim:—

1. In a locomotive feed water heater, the combination with a locomotive boiler having a front smoke arch and a partition wall dividing said smoke arch into upper and lower compartments, said partition provided with a door-way, and a door hinged over said door-way, of return flue-ways arranged exterior of the boiler to be connected to said lower and upper compartments of said smoke arch, and feed water heating pipes arranged to extend longitudinally of each of said return flue-ways.

2. In a locomotive feed water heater, the combination with a locomotive boiler having a front smoke arch or box and a dividing wall for dividing said smoke arch or box

into upper and lower compartments, of draft chambers situated one on each side of said locomotive boiler, each of which is divided into upper and lower flue ways, said upper flue way connected to said upper compartment of said smoke arch or box and said lower flue-way connected to said lower compartment of said smoke arch, and a series of feed water heating pipes situated within said flue ways connected to said boiler and the feed-water supplying means thereof.

3. In a locomotive feed water heater, the combination with a locomotive boiler having a front smoke arch or box, and a dividing wall dividing said smoke arch or box into upper and lower compartments, of a draft chamber situated one on each side of said boiler, each of which is divided into upper and lower flue-ways, said upper flue-way connected to said upper compartment of said smoke arch or box and said lower-flue-way connected to said lower compartment of said smoke arch or box, and an independent series of feed-water heating pipes situated within each of said flue-ways, a collecting drum situated between each of the series of heating pipes and the boiler, and means for supplying feed-water to each of the series of heater pipes.

In testimony whereof I affix my signature in presence of two witnesses.

SYLVESTER A. MORGAN.

Witnesses:

FRANCIS M. SPRINGER,

THOMPSON R. BELL.