J. C. PARKER.

STEAM BOILER.

APPLICATION FILED MAR. 21, 1907.

943,452.

Patented Dec. 14, 1909.

2 SHEETS—SHEET 1.

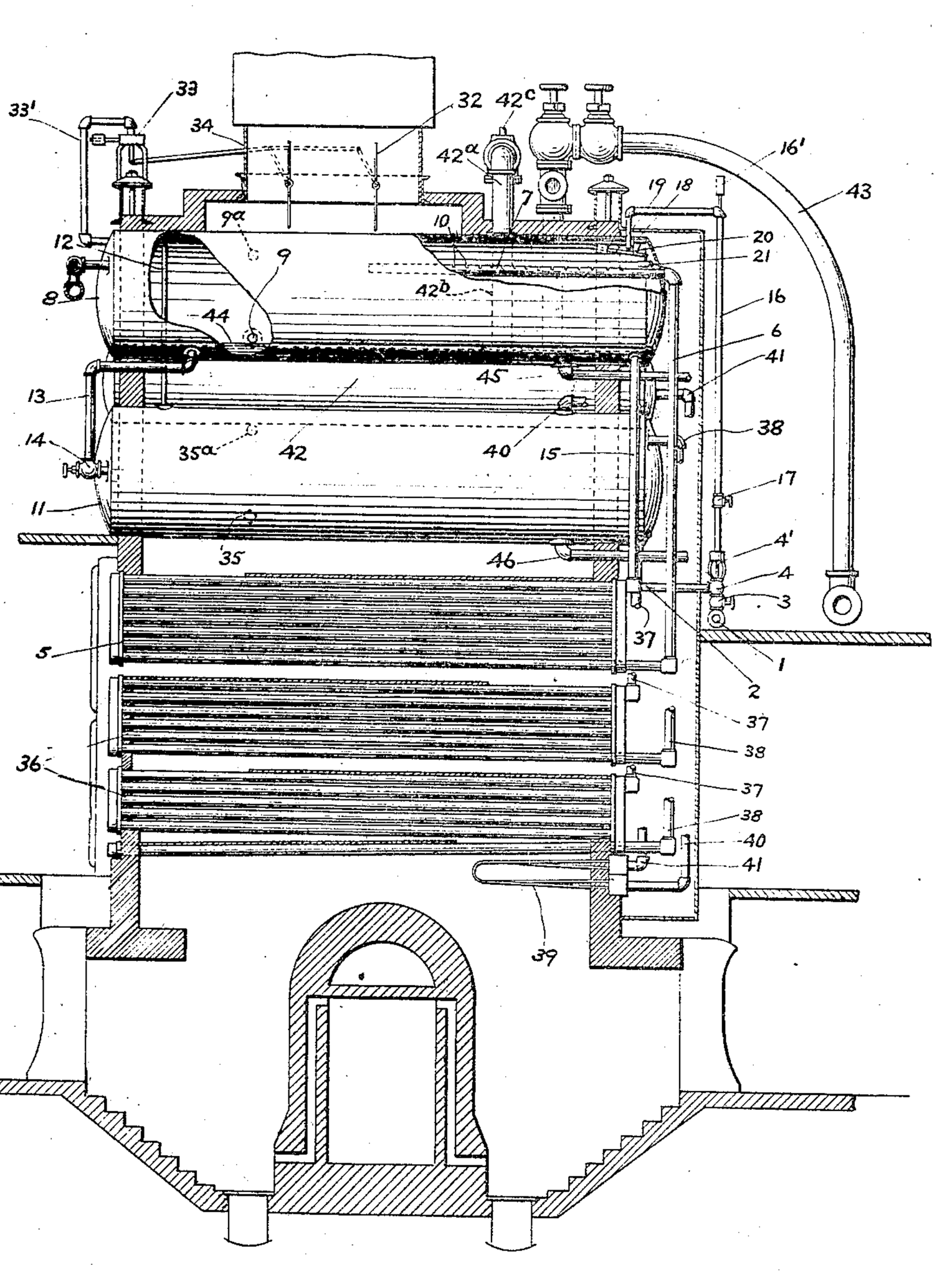

FIG. 1.

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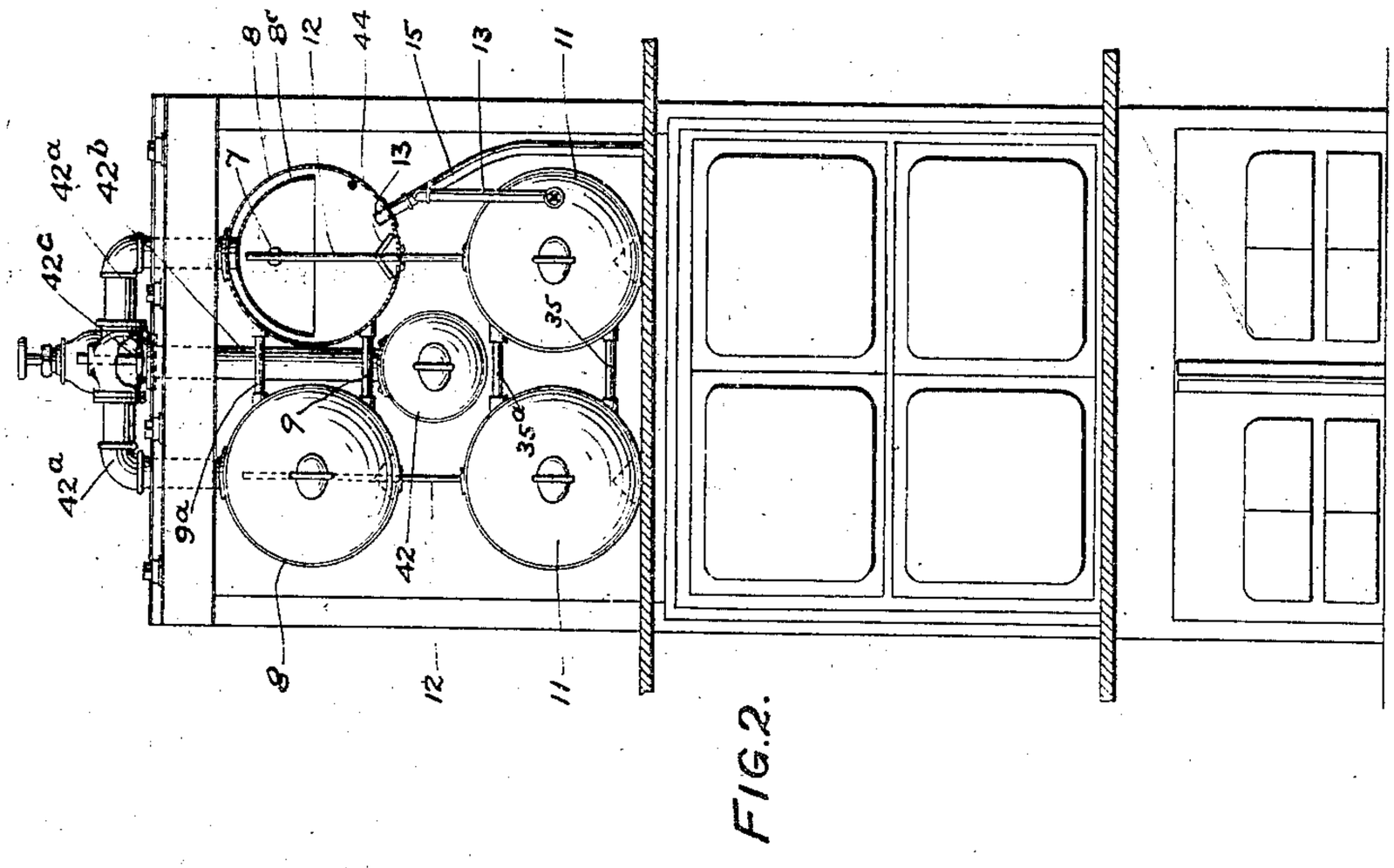

FIG. 2.

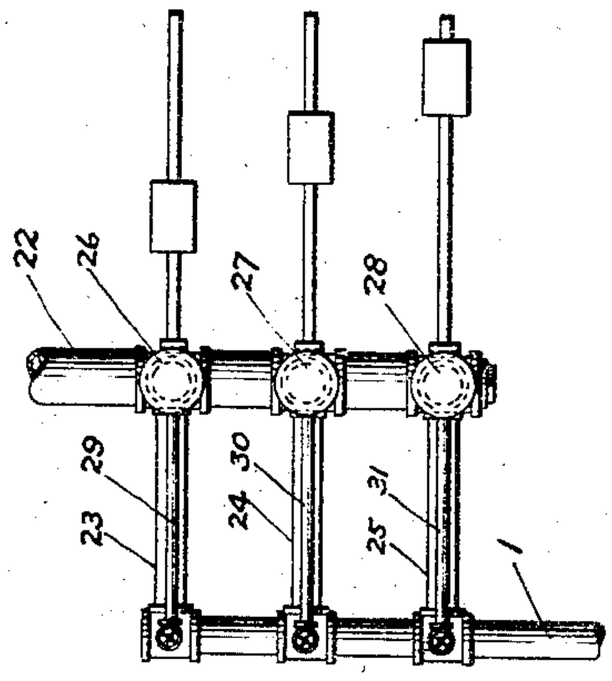

FIG. 3.

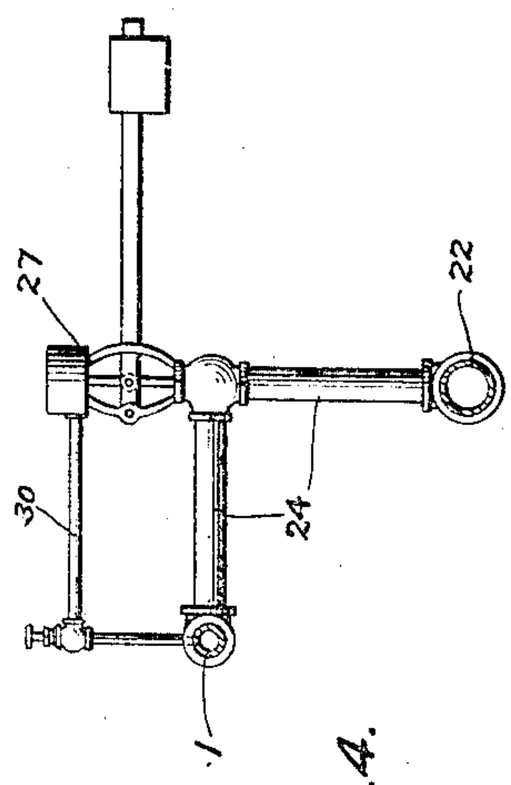

FIG. 4.

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STEAM-BOILER.

943,452. Specification of Letters Patent. Patented Dec. 14, 1909.

Application filed March 21, 1907. Serial No. 363,540.

To all whom it may concern:

Be it known that I, JOHN C. PARKER, a citizen of the United States, residing in the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain Improvements in Steam-Boilers, of which the following is a specification.

This invention is a steam boiler having a thermal storage system comprising a storage chamber connected with a feed water heater and a steam generator. In its preferred construction there are combined, in a single setting, a heat storage drum, an automatically regulated feed water heater having tubes in circuit with the storage drums, a steam generator having tubes and a drum in circuit with the storage drum, and a steam superheater having tubes and a drum connected with the generator. Water is circulated through the feed water heater and discharged into the upper part of the thermal storage drum in such manner as to condense steam discharged in the upper part of the drum from the superheater. The water is thus heated to the boiling point, and is carried from the bottom of the storage drum to the generator, the steam generated thereby being passed through the superheater and collected in the superheat storage drum, whence it is passed to the thermal storage drums or drawn off as desired.

The nature and characteristic features of my invention will more fully appear by reference to the following description and the accompanying drawings in illustration thereof, of which—

Figure 1 represents a sectional elevation of a boiler embodying the improvements; Fig. 2 is a front elevation of the same with parts shown in section; Fig. 3 is a plan view and Fig. 4 is a sectional side view of automatic feed water regulating mechanism.

Referring to the drawings, the pipes 1 and 2, under control of the valves 3 and 4, lead to the tubes 5, through which the feed water is circulated and thence carried by pipes 6 to pipes 7 in the upper parts of the storage drums 8, the drums being connected by the pipes 9 and 9^a. The pipes 7 have therein the apertures 10 by which water is discharged upwardly in small streams or spray, to avoid hammer and to effect the rapid absorption of heat from steam. Pipes 12 lead from the top of the generator drums 11 to the tops of the storage drums 8, being restricted to prevent a material flow and having the function of equalizing the pressure when a superheater is used, and otherwise having larger size to convey a sufficient amount of steam from the drums 11 to the drums 8 to heat the water when a superheater is not used.

Hot water flows from the storage drums 8 through the pipe 13, controlled by a valve 14, to the generator drums 11 connected by the pipes 35 and 35^a. A downflow pipe 15 leads from the storage drum 8 to the economizer 5 to provide a water circuit comprising the storage drums and the feed water tubes. The inlet to the pipe 13 is at a higher level than the inlet to the pipe 15 so that the former shall not drain the storage drums and prevent circulation through the feed water coils.

The admission of the feed water may be controlled manually, by the valve 3, or automatically, by the valve 4 operated by a usual form of pressure regulator 4′. To operate the pressure regulator, a pipe 16 connects it with the tops of drums 8, the pipe being controlled by the hand valve 17 and the automatic valve 18 within the drum. The valve 18 is carried by a lever 19 fulcrumed on a bearing 20 and carrying a float 21, which normally elevates the valve and closes the pipe 16. When the water in the drums 8 rises so as to lift the float 21, the valve 18 falls and steam pressure through the pipe 16 causes the regulator 4′ to close the valve 4 and cut off the flow to the economizer or feed water coils 5. A whistle 16′ relieves the pressure in the pipe 16 and permits the valve 4 to open when the valve 18 has closed the outlet from the pipe.

The feed water should be regulated in accordance with the fluctuations of the loads. When the load is light the storage drum should be filling up and when the load is heavy the feed water should be shut off and the water level in the generator maintained by hot water from the storage drums. With light loads this results in heating water by means of live steam and heavy loads can be carried with a less number of boilers using hot feed water. This leads to economy through the saving in the number of banked fires for the extra boilers which would ordinarily be required. In other words there

would be a higher boiler rating with light loads and lower boiler rating with heavy loads.

To regulate the introduction of cold feed water in accordance with the fluctuations of the load, I preferably use the method illustrated by the apparatus shown in Figs. 3 and 4. Here the feed water pipe 1 is connected with the feed water main 22, by branch pipes 23, 24, and 25 controlled by the respective regulators 26, 27 and 28. These regulators are set to open at different pressures (say 26 at 150 pounds, 27 at 152 pounds and 28 at 154 pounds) communicated from the pipe 1 by the respective pipes 29, 30 and 31. When the pressure is below 150 pounds, the feed is shut off entirely from the storage drums. This does not affect the feed to the boilers, however, unless the storage drums are allowed to get empty, which may happen without danger if the attendant has raised the water line in the boilers to the highest permissible point during light loads so that he can use the water volume between the highest and lowest permissible points in the boiler proper. When the low water is reached the regulators must of course be opened and water supplied to the storage drums.

The damper 32 is connected with and operated by a usual regulator apparatus 33 controlled by the boiler pressure through a pipe 33'. The damper regulator must be set higher than the water regulator, say at 156 pounds. As a result of the surplus boiler power the pressure runs up to say 150 and opens the regulator 26. This condenses some of the steam and if the load is sufficient stops the rising pressure without assistance from the damper. If the attendant finds that his storage drums are not filling rapidly enough to be ready for the heavy loads, he puts on another boiler or adjusts the draft. The pressure again rises and at 152 pounds opens the regulator 27 which condenses more steam and thus regulates the pressure. This operation can be repeated with any number of regulators. When the operator finds that his tanks are filling too rapidly he cuts out a boiler or cuts down the draft, the pressure falls, and one of the feed regulators shuts off. The pressure is thus maintained with less boilers and the tanks do not fill so rapidly. It will thus be seen that it will be a comparatively easy matter for the attendant, knowing his daily load conditions, to regulate to a nicety his time for filling and emptying his thermal storage tanks.

While this system aims primarily at heating a store of feed water for heavy loads by the condensation of the surplus steam of light loads, it will conduce to economy to save as much as possible of the heat from the gases on their way to the stack. It is therefore desirable to connect feed tubes to the storage drums in the path of the heated gases and pass the feed water through them to absorb as much heat as possible and thus condense the smallest practicable amount of steam for any given quantity of hot feed.

In the construction shown, I have combined the generator, economizer, thermal storage drums, and superheater in the same setting with a view to obtaining the highest practicable efficiency, economy of construction and compactness, the several elements being placed in the proper relation to each other and to the heating gases to effect the efficient, economical and most complete absorption of the heat that is practicable.

The thermal storage drums 8 are placed in the top of the boiler setting in the path of the furnace gases as they escape to the flue 34 and beneath them are placed the steam generator drums 11. The generator tubes 36, connected with the water space of the generator drums by the pipes 37 and with the steam space of the same by the pipes 38, are in the lower part of the furnace where they are subject to the higher heating action of the furnace gases; and in the lower temperature region, between the generator drums and tubes, are placed the feed water tubes 5. In the hottest part of the furnace are placed the superheater tubes 39, connected with the steam space of the generator drums by the pipe 40 and discharging by the pipe 41 into the superheated steam drum 42. The drum 42 is disposed between the drums 8 and 11, in the path of the escaping gases, and is connected with the tops of the drums 8 by the pipes 42^a and 42^b controlled by the non-return valve 42^c. Within the tops of the drums 8 are the shields 8^a, through and within which superheated steam is discharged by the pipes 42^a. The spaces between the drums and these shields contain saturated steam by which the tops of the drums as well as the shields are protected against the otherwise injurious heating effect of the superheated steam upon the metal. Steam is taken from the drum 42 by the main 43.

Extending along the bottoms of the drums 8 are the hoods 44, which cover the blow pipes 45, by which mud deposited in the drums can be drawn under the edges of the hood and removed, and in a similar manner any mud deposited therein can be removed from the drums 11 by pipes 46.

Having described my invention, I claim:—

1. In a steam boiler, a generator, a superheater connected with said generator and supplied with steam therefrom, a thermal storage chamber connected with said superheater and supplied with steam therefrom, means for supplying water to said chamber and means for conveying water from said chamber to said generator.

2. In a steam boiler, a thermal storage

chamber, a superheater having a chamber connected with and discharging into said storage chamber, a generator connected with and supplying steam to said superheater, and means for supplying water to said storage chamber.

3. In a steam boiler, a generator having a collecting chamber, a storage chamber, a passage from said collecting chamber to said storage chamber, a feed water heater delivering water to said storage chamber, and means for delivering water from said storage chamber to said generator.

4. In a steam boiler, an economizer, a storage chamber to which water is delivered by said economizer, a generator having a chamber from which steam is delivered to said storage chamber, and means for delivering water from said storage chamber to said generator.

5. In a steam boiler, an economizer, a storage chamber to which water is delivered by said economizer, a generator having a chamber connected with said storage chamber, means for delivering water from said storage chamber to said generator, and a superheater to which steam is delivered from said generator.

6. In a boiler, in a single setting, feed water tubes, a thermal storage drum to which water is delivered from said tubes, a generator comprising tubes and a drum connected therewith, a conduit leading from said generator drum to said storage drum, and a conduit for delivering water from said storage drum to said generator drum.

7. In a steam boiler, in a single setting, feed water tubes, a storage drum to which water is delivered by said tubes, a generator having a drum from which steam is delivered to said storage drum, a conduit by which water is delivered from said storage drum to said generator drum, superheater tubes to which steam is delivered from said generator drum, and a superheat storage drum to which steam is delivered from said superheater tubes.

8. In a steam boiler, a thermal storage chamber, a pipe with apertures therein for delivering water within said storage chamber, an economizer with which said pipe is connected, a generator having a steam collecting chamber, and a pipe connecting said collecting chamber with said storage chamber.

9. In a steam boiler, a thermal storage chamber, a pipe with apertures therein for delivering water in the upper part of said storage chamber, a generator having a steam collecting chamber, a pipe leading from the top of said collecting chamber to the top of said storage chamber, and a pipe for delivering water from said storage chamber to said collecting chamber.

10. In a steam boiler, a steam generator, a thermal storage drum connected therewith, a conduit for delivering water to said drum, mechanism comprising a pressure regulator for controlling the flow through said conduit, a conduit leading from said regulator to said drum, a valve for controlling said conduit, and means whereby the rise of water in said drum operates said valve.

11. In a steam boiler, a generator having a collecting chamber, a storage chamber, a conduit leading from the upper part of said collecting chamber to the upper part of said storage chamber, a conduit leading from the lower part of said storage chamber to said collecting chamber, a conduit for delivering water to said storage chamber, mechanism operated by pressure for controlling the flow through said last named conduit, a conduit for conveying pressure from said storage chamber to said mechanism, a valve which automatically closes said last named conduit, and means whereby the rise of water in said storage chamber opens said valve.

12. In a steam boiler, a generator, a thermal storage chamber connected with said generator, a feed water heater connected with said storage chamber, a conduit by which water is supplied to said heater, and a plurality of devices operated by various pressures for regulating the rate of delivery of water to said heater.

13. In a steam boiler, a thermal storage system comprising a chamber, means for delivering steam to said chamber, means for delivering water to said chamber, and pressure regulated valve mechanism for automatically regulating the delivery of water to said chamber.

14. In a steam boiler, a drum having a shield in the top thereof, means for introducing water into said drum, and means for introducing steam into said drum beneath said shield.

In testimony whereof I have hereunto set my name, this 13th day of March, 1907, in the presence of the subscribing witnesses.

JOHN C. PARKER.

Witnesses:
ROBERT JAMES EARLEY,
JAS. G. DENNY, JR.