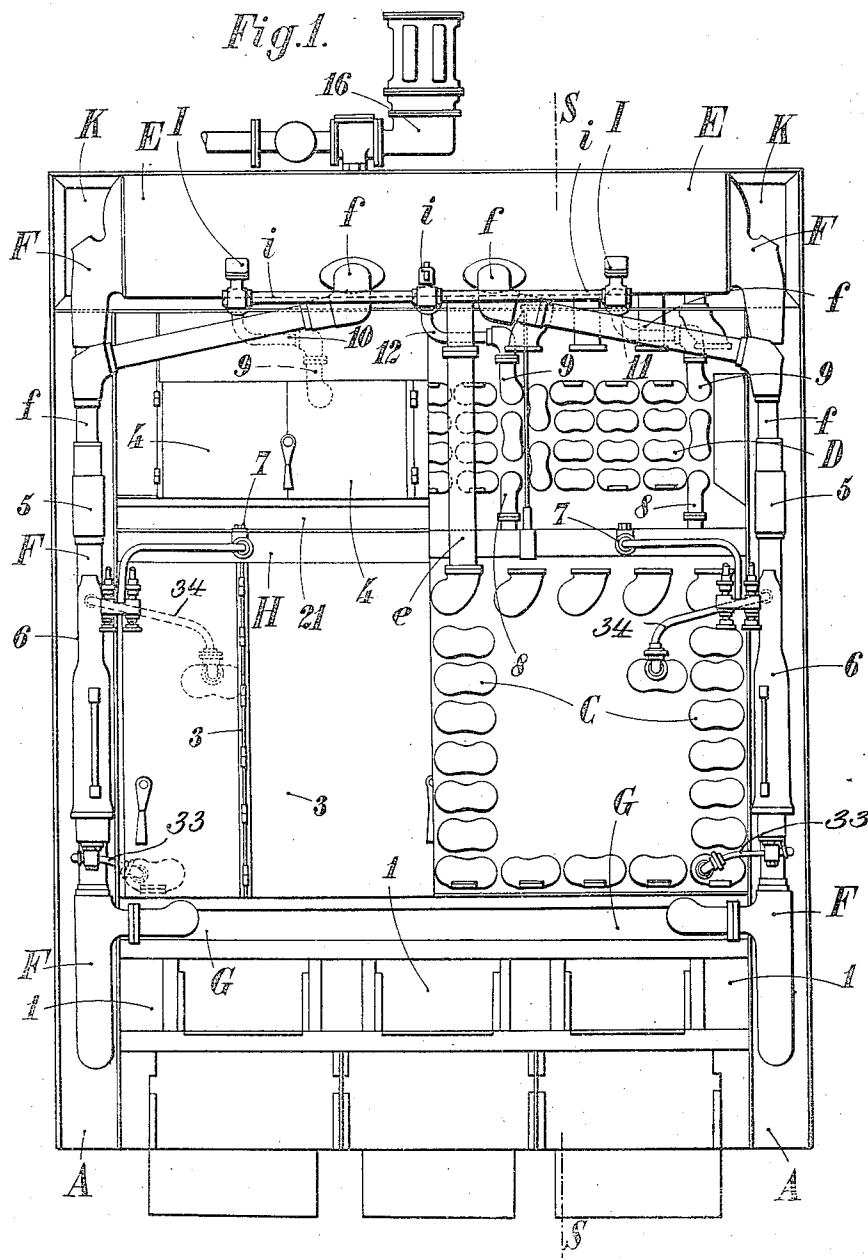


L. M. G. DELAUNAY-BELLEVILLE.
 FEED ARRANGEMENT FOR TUBE BOILERS.
 APPLICATION FILED SEPT. 30, 1907.

969,042.

Patented Aug. 30, 1910.

3 SHEETS—SHEET 1.



Witnesses:

[Signature]
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Inventor

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[Signature]

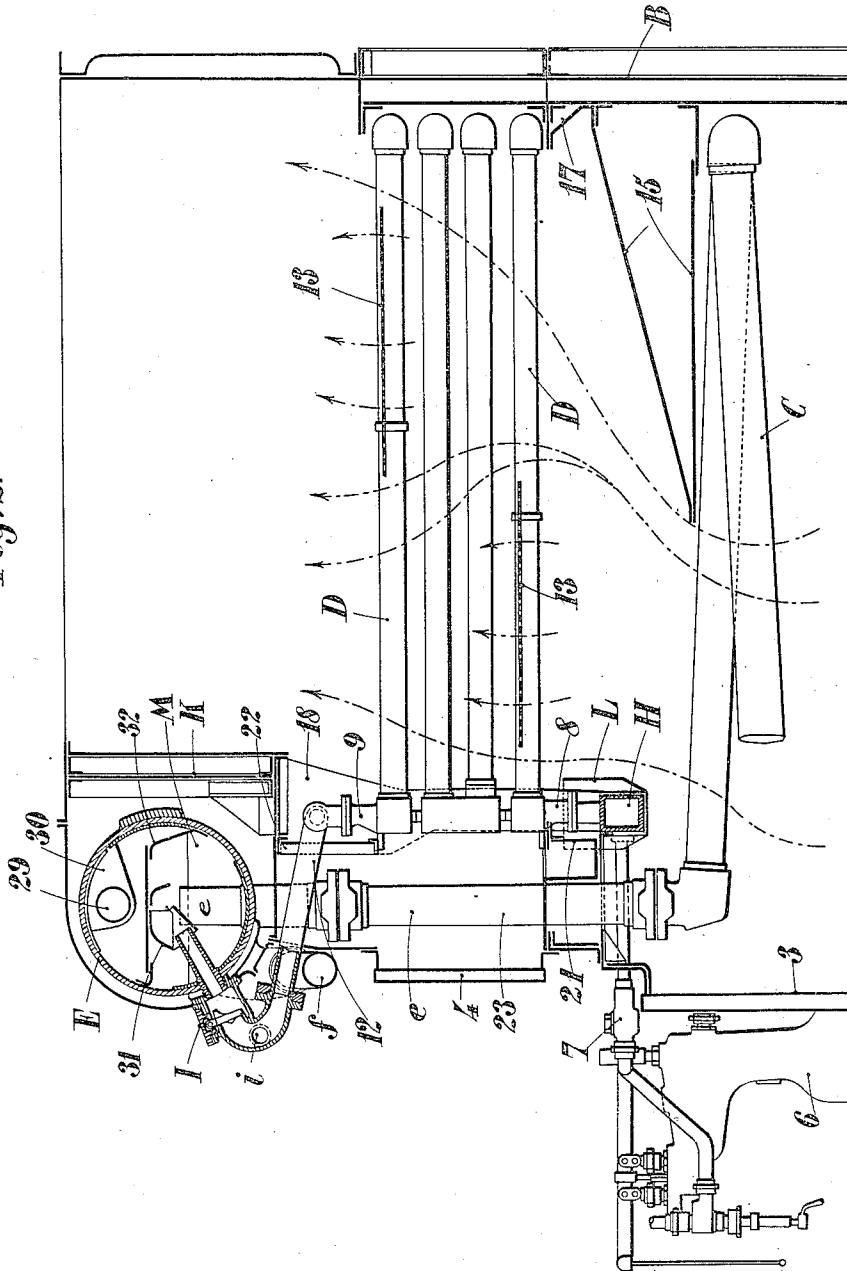
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3 SHEETS—SHEET 2.

Fig. 2.



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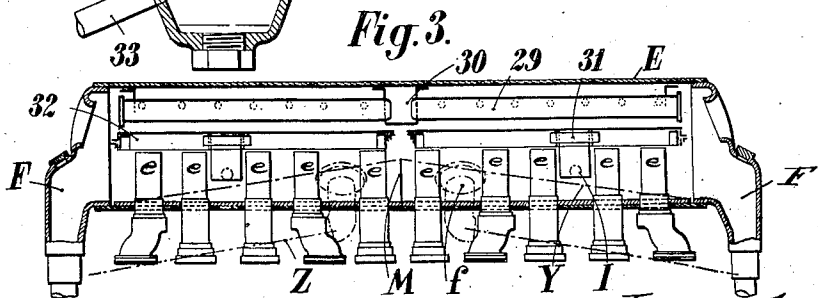
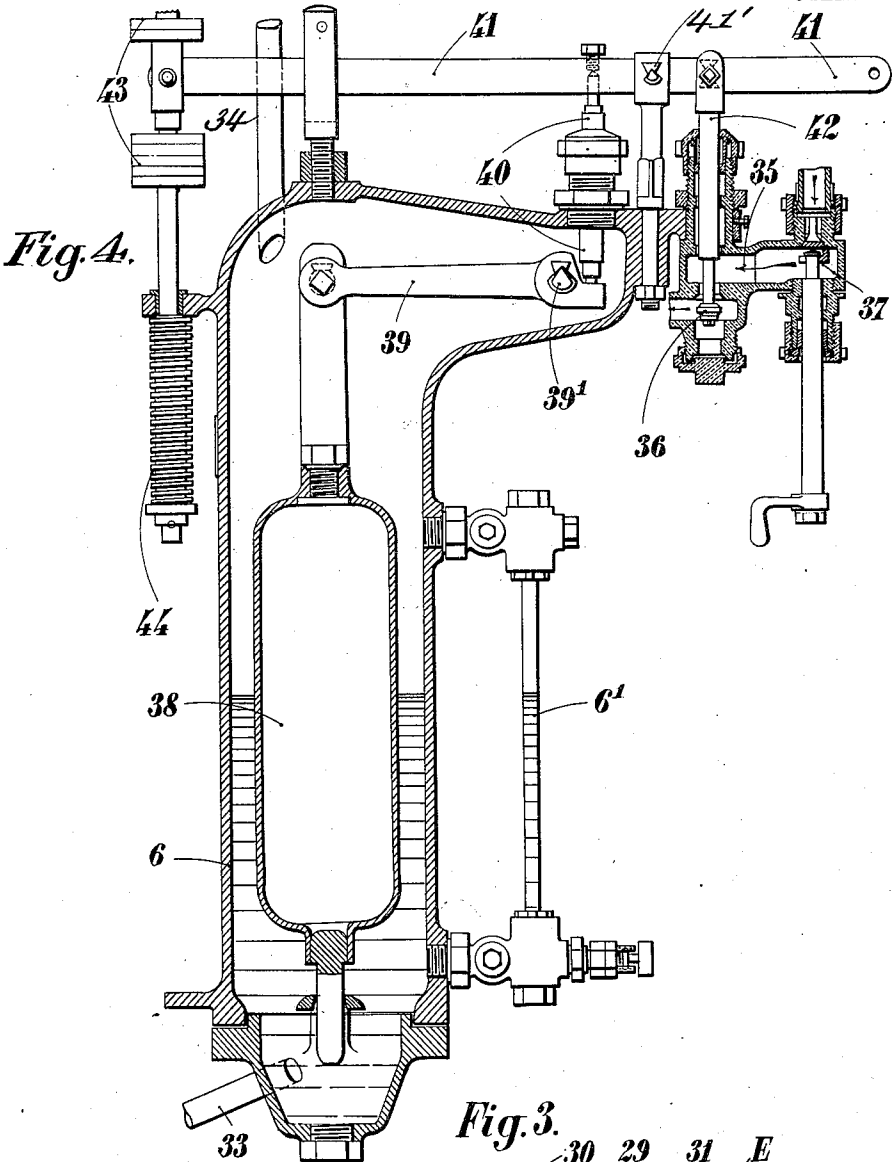
James L. Morris Jr.
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3 SHEETS—SHEET 3.



Witnesses;

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UNITED STATES PATENT OFFICE.

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FEED ARRANGEMENT FOR TUBE-BOILERS.

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Specification of Letters Patent.

Patented Aug. 30, 1910.

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To all whom it may concern:

Be it known that I, LOUIS MARIE GABRIEL DELAUNAY-BELLEVILLE, citizen of the French Republic, residing at Paris, Department of Seine, in France, have invented certain new and useful Improvements in Feed Arrangements for Water-Tube Boilers, of which the following is a specification.

The present invention relates to improvements in feed mechanism for water tube boilers and is applicable more especially to boilers when used on board ship, the object of the invention being primarily to provide means for insuring uniform distribution of the feed water at both sides of each boiler, irrespective of the tilting thereof due to the heeling of the ship.

Among the important advantages of the present invention are that the heating tubes for the feed water may be arranged as low as possible so as to render them conveniently accessible for inspection and repair and the height of the boiler may be materially reduced in those cases in which economizers for feed water heaters are arranged above the steam drum.

In marine installations, it has been the tendency to make each boiler as large as possible in order to reduce the number of units to be used, and as the length of the grates is limited by the peculiar conditions existing in such installations, it is possible only to increase the width of the boilers in order to augment the capacity thereof. By so increasing the width of the boiler, however, there is difficulty in insuring uniform distribution of the feed water and this difficulty is increased in such marine installations wherein the boiler gang-ways run transversely of the ship, the permanent or temporary inclinations of the ship causing a corresponding lateral inclination of each boiler that prevents an equal feed of the water to both sides thereof.

The present invention obviates the difficulties above mentioned and it is applicable either to generators having a vaporizing nest only, or to those which are provided with a feed water heater and with a superheater for the steam, and these applications of the invention will be hereinafter set forth.

In the accompanying drawing, the invention is shown in connection with a marine

boiler which is provided with a feed water heater, this embodiment of the invention being shown merely as an example.

Figure 1 of the drawing represents a front elevation of a boiler or generator constructed in accordance with the present invention, the doors for the tube boxes at the right hand side of the generator being removed; Fig. 2 represents a section on the line S—S of Fig. 1, this section being taken through the feed water heater and adjacent parts; Fig. 3 represents a vertical longitudinal section through the purifier-collector, showing the continuation of the supplementary return connections, and the feed water inlets; and Fig. 4 represents a detail sectional view of one of the automatic feed water regulators.

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

In the present embodiment of my invention, I have shown the same as applied to a steam generator which is especially adapted for marine purposes, it comprising generally a furnace having a front 1 and a combustion chamber, grates and ash-pans as usual, the tube chambers being provided with doors 3 for permitting access to the steam generating units, similar doors 4 being arranged above the doors 3 for providing access to the feed water heater. Mounted within the combustion chamber of the furnace is a generating or vaporizing element C which is composed in the present instance of a pair of laterally arranged units of the water tube type. Mounted above the vaporizing element is a feed water heater D composed of any suitable number of units, a set of three units being shown in the present instance which are also of the water tube type. A horizontal transversely extending steam collector and purifier E is mounted so as to extend across the top of the generator and in a direction from one side of the same to the other, a set of upright pipes *e* connecting the upper portions of the generator or vaporizing units with said collector, the upper ends of these pipes extending into the collector and discharging at a suitable distance above the bottom thereof, as shown. A pair of main water return pipes F are attached to the opposite ends of the collector E and are provided with inwardly extending

discharge pipes which enter a feed collector G, the latter communicating with the lower portions of the generator units C. A pair of supplemental water return pipes *f* are 5 connected by the junction boxes 5 to the main return pipes F, these supplemental return pipes being inclined toward those ends which discharge in said junction boxes, and their upper ends extend inwardly to points 10 in proximity to the middle of the steam collector E at which points these supplemental return pipes communicate with the steam collector. The steam collector is divided by means of a partition M which extends trans- 15 versely across the lower portion of the steam collector at a point between the entrance to the supplemental return pipes. This partition serves in effect to divide the steam collector into two water compartments, and it 20 is of such a height as to prevent all of the water contained in the steam collector from flowing to one end thereof and thus leaving the remaining return pipes uncovered when the ship has a list or inclination toward 25 port or starboard.

A feed collector H extends transversely across the generator and is connected by means of the branch pipes 8 with the several units of the feed water heater D, and feed 30 water is supplied to this feed collector through the medium of a pair of automatic feed water regulators 6 of a construction to be hereinafter described, these feed water regulators being arranged at the opposite 35 sides of the generator and are connected to a suitable source of feed water supply capable of forcing the feed water through the feed water heater and into the steam collector against the boiler pressure, a feed 40 pump being usually employed for this purpose. In the present instance, these automatic feed water regulators are duplicates, and a description of one will be sufficient for 45 both.

Each regulator comprises a casing which forms a chamber for a float 38, this float chamber being connected to the water space 50 of the boiler by means of a pipe 33 which enters the bottom thereof, and a pipe 34 which enters the top of such chamber whereby the level of water contained in the float chamber will correspond with the level of water in that side of the boiler to which the regulator is connected. In Fig. 1, these 55 pipes 33 and 34 are shown as connected to the tubes of the corresponding vaporizing element C. The float chamber may be provided with a gage-glass 6' whereby the level of water therein may be readily ascertained. 60 Guided to operate vertically within the float chamber is a float 38 the upper end of which is pivotally connected to an arm 39 which arm in turn is pivoted upon the bearing 39', the outer end of the arm 39 operating upon a 65 plunger 40 which operates through a stuff-

ing-box in the wall of the float chamber and bears upon the regulating lever 41. This lever 41 is pivoted upon a bearing 41' supported by the float chamber, and at one side of this bearing is arranged a valve-operating 70 stem 42, the latter being pivoted to the regulating lever 41. The opposite end of the lever 41 is provided with a counterweight 43 and also a controlling spring 44. One or 75 more counterweights may be used, and each may be composed of a plurality of disks whereby it is possible to adjust at will the level at which the water is to be maintained in the boiler. The spring 44 is provided for 80 the purpose of absorbing any shock or vibration due to the hydraulic recoil of the feed water pump. The valve rod 42 passes through a stuffing-box and into the feed water regulator casing 35 which communi- 85 cates with the pumps or other means for supplying the feed water to the boiler, this casing having a seat to coöperate with a valve 36 which is fixed to the valve stem 42 and serves to control the passage of the feed water into the boiler. A check or non- 90 return valve 37 may also be provided for the regulator casing 35 at a point between the valve 36 and the pumps. Each regulator casing 35 is connected to the corre- 95 sponding side of the feed collector H by means of the pipes 7, and these pipes may be provided with suitable check valves for preventing return flow of the feed water from the boiler to the regulators. These two 100 automatic feed regulators supply to the respective sides of the generator quantities of water that are regulated according to the degree of inclination of the generator, that is to say, when the generator is level, the 105 level of water in both feed regulators is the same, and the openings through the valves 36 of both regulators are open to an equal extent. Should the generator, however, be- 110 come inclined, say to the left, by reason of the listing or heeling of the ship or vessel, the water rises in the left hand feed regu- 115 lator, lifting its float 38 which operating through the arm 39, stem 40, lever 41 and valve stem 42, will cause a decrease in the opening provided by the valve 36 of this 120 feed regulator whereby the amount of water fed to the lower side of the boiler through the respective regulator will be diminished. A corresponding fall of the water level naturally takes place in the float chamber of 125 the right hand regulator whereby the area of the opening provided by the corresponding regulating valve will be increased.

It will be understood, of course that the amount of increase in the area of the aper- 125 ture of the right hand feed regulator is proportional to the decrease in the area of the aperture of the left hand feed regulator so that the sum of the apertures of the two feed regulators remains substantially con- 130

stant notwithstanding the rolling motions of the vessel, thereby insuring a proper supply of water to the generator such as is required for the generation of steam under all conditions.

A discharge pipe 9 leads from the upper portion of each unit of the feed water heater D, these discharge pipes being connected by the branch pipes 10, 11 and 12, respectively, to a manifold *i* which extends longitudinally of the steam collector E, and this manifold is provided with a pair of inlets I which lead therefrom and discharge into the steam collector E at points suitably spaced from its ends, suitable non-return valves being provided for the respective inlets as shown in Fig. 3, the collector E thus serving as a common receptacle for the feed water discharged from the several units of the feed water heater.

Any suitable devices may be employed for efficiently conducting the heated or burning gases through the vaporizing and feed water heating elements, perforated baffle plates 13 being suitably arranged between the pipes composing the feed water heater, and similar perforated baffle plates 14 are suitably arranged with reference to the pipes composing the vaporizing element, a screen 15 being preferably interposed between the vaporizing and feed water heating elements.

In the present embodiment of the invention, a pair of longitudinally extending steam supply pipes 129 are mounted in the upper portion of the collector E, the outer ends of these pipes being closed and the inner ends thereof discharge into a steam supply chamber 30 from which the steam may be drawn for use. A pair of pockets 31 are mounted in the collector E at a level below the steam supply pipes and such pockets are arranged to receive the feed water which is introduced into the collector through the inlets I. A pair of baffle plates or covers 32 are also preferably mounted so as to extend horizontally across the collector beneath the steam supply pipes and above the discharge ends of the pipes *e* which latter discharge the highly heated water from the generating element into the steam collector, and these baffle plates or covers also serve to deflect the water discharging from the pipes *e* and thus cause separation of the steam therefrom without permitting the water to enter the steam supply pipes.

During the operation of a steam generator constructed in accordance with the present invention, the water passes say, from the collector H into the elbow 8 and from the latter into the first tube of the corresponding feed water heating element, the water traversing the various tubes of this generator in a direction from front to back and rising therein until it finally reaches the

outlet 9, the water being thence conducted through the pipes 10, 11 or 12 as the case may be to the manifold *i* and from the latter the feed water thus heated is introduced into the feed collector through the inlets I. The water from the two outermost feed water heating elements passes directly to the respective inlets, while that from the middle or intermediate feed water heating element passes first to the manifold and thence to the inlets. The feed water thus supplied to the feed collector mingles with the water which enters the collector through the vertical tubes *e* which lead from the vaporizing or steam generating elements, this mingling, however, occurring after steam has been liberated from such water. The transverse partition M, as previously stated, divides the collector into separate compartments, and the lines Y in Fig. 4 indicate the angle through which the boiler may tilt before the top of this partition is level with the opposite outlet ends of the collector. In the present instance, these lines indicate an inclination of, say, 8° to the horizontal. Under those conditions, in order to insure the return of the water on the raised side of the boiler, it is only necessary that the axes Z—Z of the supplemental return pipes *f* should have an inclination exceeding by two or three degrees that of the corresponding line Y—Y. As the feed inlets are arranged between the ordinary or main return pipes F and the supplemental return pipes *f*, the ship is able to maintain a constant list equal to the inclination of the line Y—Y, as on the higher side, the water will flow through the supplemental return pipe *f* while on the lower side, the water will flow out of the collector through the ordinary or main return pipe F whereby the two sides of the generator will receive an equal feed.

It will appear from the drawing that the elements of the feed water heater are located between the vaporizing elements and the upper reservoir which serves as a purifier and collector for the steam and the feed water. This same arrangement could be used if the elements of steam superheaters or economizers were to be combined with the feed water heater in which case the elements constituting the superheater would, of course, be located below those forming the feed water heater. Among the advantages of this arrangement may be mentioned the fact that the feed water tubes are arranged as low as possible and are consequently conveniently accessible for inspection and repair and, moreover, the height of the boiler is materially reduced as compared with structures wherein the economizer or feed water heater is arranged above the steam drum.

Having now particularly described and

ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. A steam generator comprising a generating element, a steam collector extending transversely at the upper portion of the generator and communicating with the generator element, said collector being provided with means for dividing it transversely to control the flow of water toward its ends due to the transverse inclination of the generator, a lower feed collector communicating with the generator element, a pair of return pipes connecting the respective ends of the steam collector to the feed collector, and supplemental return pipes communicating with portions of the steam collector intermediate its ends and also communicating with the feed collector.
2. A steam generator comprising a steam collector extending transversely thereof and communicating with the steam generating element, said collector being provided with an intermediate transverse partition for dividing the water space thereof, return pipes leading from the respective ends of the collector, and a pair of supplemental return pipes leading from the steam collector at points intermediate its ends and having their discharge ends inclined downwardly and communicating with the return pipes leading from the ends of the collector.
3. A steam generator comprising a vaporizing element composed of a pair of units, a feed collector communicating with both units, a steam collector extending transversely of the generator and divided into a pair of compartments which communicate with the respective units of the vaporizing element, a pair of return pipes leading from the ends of the steam collector to the feed collector, and supplemental return pipes leading from points intermediate the ends of the steam collector and discharging into the return pipes first mentioned.
4. A steam generator of the class described comprising a generating element, a steam collector extending transversely of the generator and of the upper portion thereof, a feed collector also extending transversely of the generator below the steam collector, and a pair of automatic feed regulators ar-

ranged on the opposite sides of the generator and discharging into the feed collector, said regulators being connected to a suitable source of feed water supply and being provided with individually operable valves, the openings of which are controlled according to the transverse inclination of the generator, the sum of the openings of the valves remaining substantially constant.

5. A steam generator of the class described comprising a generating element, a feed water heater composed of a plurality of units, a feed collector communicating with the several units of the feed water heater, a steam collector connected to receive the water discharged from the several units of the feed water heater and having a transverse partition dividing the water space thereof, return pipes leading from the respective ends of the steam collector to the generating element, and a pair of feed water regulators located toward the lateral sides of the generator and having individual feed water connections which discharge into the respective ends of the feed collector.

6. A steam generator of the class described comprising a generating or vaporizing element, a feed collector communicating with said element, a steam collector connected to receive water discharging from the generating element, a feed water heater also connected to discharge water into the steam collector, a second feed collector communicating with the feed water heater, a pair of feed water regulators both discharging into the feed collector for the feed water heater, a pair of return pipes leading from the ends of the steam collector to the corresponding ends of the feed collector for the generating element, and a pair of supplemental return pipes leading from the steam collector at points intermediate its ends and discharging into the return pipes first mentioned.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LOUIS MARIE GABRIEL
DELAUNAY-BELLEVILLE.

Witnesses:
H. C. COXE,
EMILE KLOTZ.