

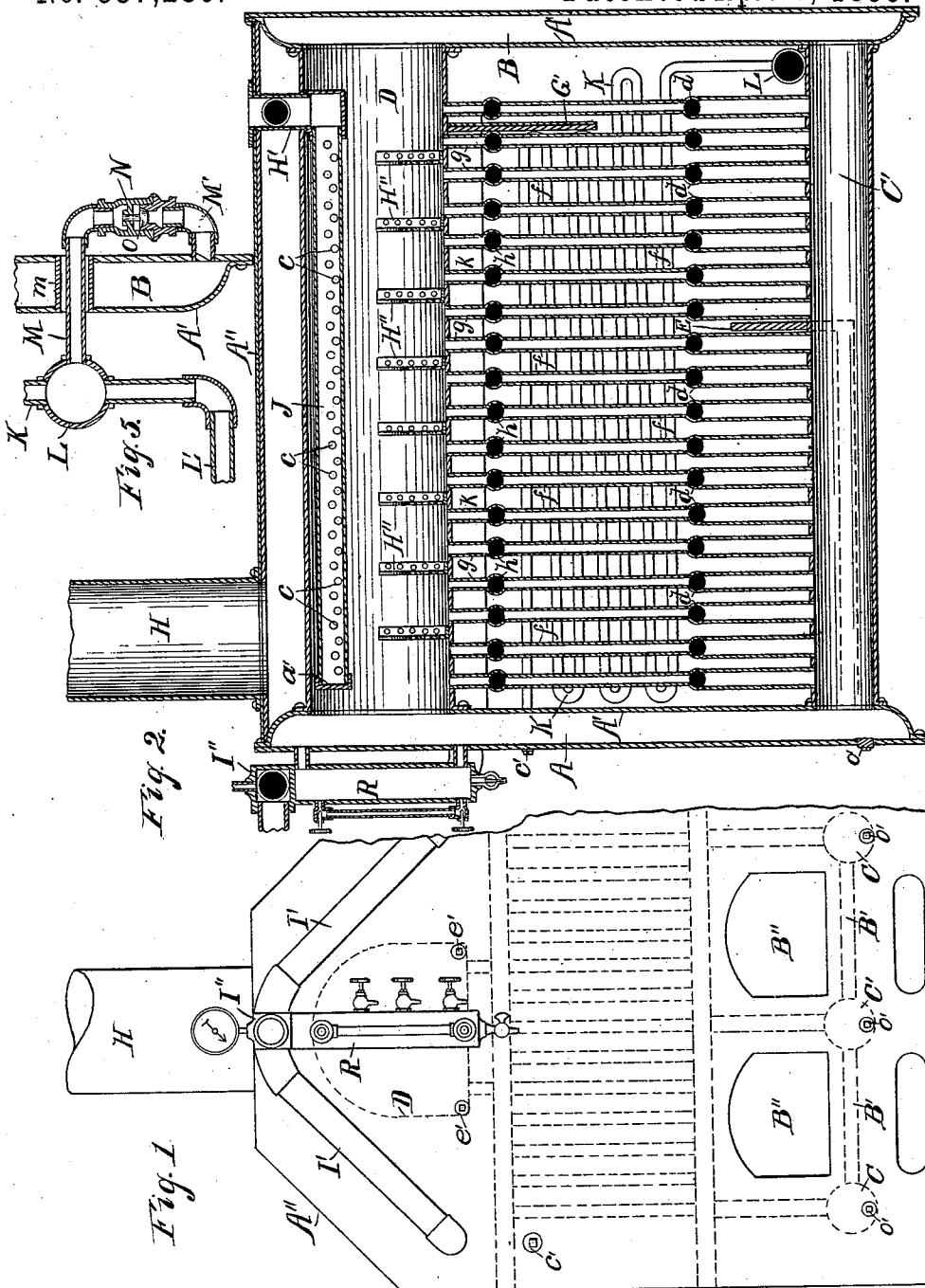
(No Model.)

2 Sheets—Sheet 1.

G. HARDEN.
STEAM GENERATOR.

No. 537,286.

Patented Apr. 9, 1895.



WITNESSES
D. S. Wheeler.
H. C. Wheeler.

INVENTOR
George Harden
By P. B. Wheeler & Co.
Attorneys.

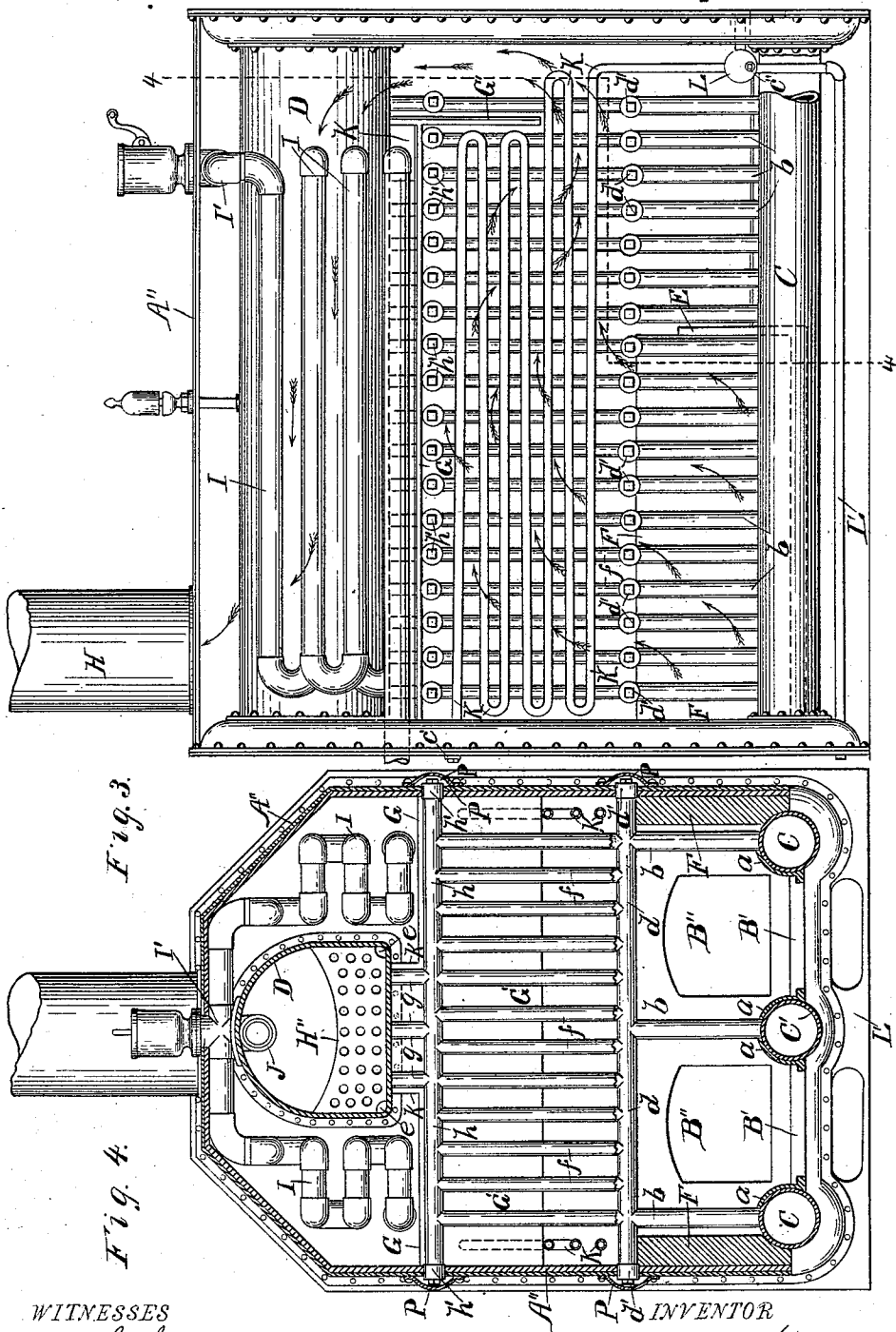
(No Model.)

2 Sheets—Sheet 2.

G. HARDEN.
STEAM GENERATOR.

No. 537,286.

Patented Apr. 9, 1895.



WITNESSES
S. S. Wheeler.
H. R. Wheeler

By

INVENTOR
George Harden
W. B. Wheeler & Co.
Attorneys.

UNITED STATES PATENT OFFICE.

GEORGE HARDEN, OF DETROIT, MICHIGAN.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 537,286, dated April 9, 1895.

Application filed April 27, 1894. Serial No. 509,263. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HARDEN, a citizen of the United States, residing at Detroit, in the county of Wayne, State of Michigan, have invented certain new and useful Improvements in Steam-Generators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to certain new and useful improvements in water tube boilers, and consists in a certain construction and arrangement of parts, as hereinafter fully set forth, and pointed out particularly in the claims.

The objects of the invention are to construct a water tube boiler having a large area of heating surface with comparatively small fire space, and in which the arrangement is such as to provide for a rapid and complete circulation of the water; to prevent the priming of the boiler; to provide for super-heating the steam; to insure a circulation through the feed pipes when the pump is not in operation and to provide for blowing out and cleaning all horizontal pipes within the boiler. These objects are attained by the construction and arrangement of parts illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of my improved boiler. Fig. 2 is a central vertical longitudinal section. Fig. 3 is a side elevation of the interior of the boiler. Fig. 4 is a section on line 4—4 of Fig. 3. Fig. 5 is an enlarged detail in section showing the connection between the mud-drum and the water leg of the boiler.

Referring to the letters of reference, A and B designate, respectively, the water front and water back of the boiler. These water spaces at the base are connected by three large horizontal pipes consisting of the side pipes C and the central pipe C', and at the top, said spaces are connected by the horizontal drum D the open ends of which are riveted to the inner plates A' respectively, forming the inner wall of said water spaces. Extending from said

base pipes for the entire length thereof, is a series of vertical pipes *b, b'*, the upper ends of which enter a series of transverse horizontal pipes *d*, from which extend a second series of closely nested vertical pipes *f*, entering at their upper ends into an upper series of horizontal pipes *h*, which are in turn connected with the drum D, by a series of short vertical pipes *g* which enter the flat bottom of said drum, by which arrangement it will be seen, that, a free and perfect circulation of water in the boiler may be maintained, which circulation, by the action of the heat of the fire space, is upward from the horizontal base pipes through the series of vertical and horizontal pipes to the drum D, thence outward through the ends of said drum and downward through the water spaces at the front and back to said horizontal base pipes and again upward through the pipes within the fire space, and so the circulation continues, the columns of water at the ends of the boiler serving as a head from which the water may be drawn in sufficient quantities to amply supply the upward flow through the smaller pipes within the fire-space preventing said pipes from becoming dry and burning out.

The furnace or fire pot extends rearward to about the longitudinal center of the boiler and is divided centrally by the base pipe C' and vertical pipes *b'*, forming the double grate surfaces B' which are fired through the respective stoke holes B''. The grates B' extend between the outer base pipes C and the central pipe C', being retained in place by the integral curved fingers *a* that extend onto said pipes, as clearly shown in Fig. 4. At the rear of the fire-pot is a bridge-wall E, and extending on each side of the fire-pot between the outer vertical pipes *b* and the casing A' of the boiler, is a wall of fire brick F.

Lying upon the upper face of the series of horizontal pipes *h* and extending longitudinally of the boiler on each side thereof, is a horizontal dividing partition or deflector G, the inner edges of the plates forming which are provided with right angled upwardly extending portions *k* the inner faces of which lie against the outer series of tubes *g* and the edges of which abut against the bottom of the drum D, whereby the boiler space is divided

horizontally but the flat bottom of said drum is exposed directly to the heat of the furnace. The forward end of this dividing partition G extends against the plate of the water-front, but the rear end thereof terminates some distance from the water back and is provided with a depending apron G' forming a space between said apron and water back for the passage of the caloric current on its way to the stack H, which is located at the forward end of the boiler, by which arrangement a return fire boiler is produced, the products of combustion passing from the grates upward around the steam generating pipes in the fire space, thence rearward along the under face of the dividing partition and drum D to the apron G' where the current is deflected downward by said apron, so as to come in contact with the rear pipes of the boiler, from whence it passes upward between said apron and the shell of the water back, and forward around the drum D, as shown by the direction of the arrows in Fig. 3.

The depending apron G' retards the passage of the products of combustion sufficiently to permit all gases to become thoroughly consumed, thereby effecting a saving in fuel, and by reason of the return draft the caloric current generated by combustion is utilized to the fullest extent.

I, designates the sinuous steam pipes through which the steam is conveyed to the engine. These pipes proceed from a coupling H' which communicates with the interior of the drum D near the rear end thereof. Said pipes extend downward on each side of said drum and run back and forth longitudinally within the heating space, their ends passing out through the front of the boiler where they are united by the oblique pipes I' through the coupling I'', as shown in Fig. 1. By reason of the steam pipes traversing the heating space within the boiler, the steam is super-heated and relieved of all water, thereby delivering it to the engine thoroughly dry and in a high state of expansion.

To prevent the condition called priming, the steam is drawn from the drum D through a pipe J which extends longitudinally of said drum just below the crown thereof communicating at its rear end with the coupling I' and having a cap a' over the forward end thereof. The lower arc only of this pipe is provided with a series of perforations c through which the steam enters the pipe from the steam space in said drum, which arrangement prevents any undue quantity of water from entering the steam pipe with the steam, and by reason of the fact that the pipe J is perforated only through its under arc, the boiling water which follows the shell of the drum when the boiler is foaming, will fall upon the unperforated upper arc of said pipe and run therefrom, thus preventing the water from entering the aperture therein.

Crossing the interior of the drum D diametrically and arranged a suitable distance apart,

is a series of perforated splash plates, H'', which are flanged and riveted to the sides and bottom of the shell of said drum. These plates extend upward into said drum to a point in line with its horizontal diameter, and serve as stays for the flat bottom thereof as well as to prevent an undue rush of water to either end of said drum when the level of the boiler is disturbed by the action of a boat in rough weather, preventing thereby, the submerging of the perforated steam in take pipe J.

The lower corners of the plates H'' are cut away as shown at e in Fig. 4, forming a series of registering apertures through the base of said plates, at the corners, and opposite said apertures are openings through the front of the boiler closed by screw plugs e', as shown in Fig. 1, which afford means for removing any dirt or deposits that may collect in the corners of said drum.

K designates the coils of the feed pipe which extend longitudinally of the boiler on each side of the fire space between the outer rows of vertical pipes f and the casing of the boiler. The lower ends of these coils are connected with the transverse mud drum L at the rear of the boiler and their upper ends discharge into the water-front A, the feed water being supplied to said mud drum through a pipe L' passing under the bottom of the boiler and with which the pump is connected, by which means the feed water is forced into the mud drum and through the coils K into the water front whereby said water becomes intensely heated before entering the circulatory system of the boiler. To provide for cleaning the feed coils, there is an opening through the outer shell of the water front opposite the discharge end of said coils, which is closed by a screw-plug c', as shown in Figs. 1, 2 and 3, whereby, by removing said plug a nozzle may be inserted in the discharge end of said coils for the purpose of flushing or cleaning them out, and for a like purpose the ends of the mud drum L are provided with a screw plug c'' by removing which said drum may be blown out or cleaned by the introduction of a scraper.

It is a matter of great importance where the feed water coils are located in the fire space that provision be made for supplying said coils with a circulation of water when the feed pump is not in operation. This I accomplish by connecting the mud drum with the base of the water back or water leg, by means of a pipe M which passes through a thimble m in the water back and extending downward on the exterior of the boiler is provided with a valve case N having a check-valve o therein, said case being connected with the water leg by means of the pipe M', as clearly shown in Fig. 5, by which arrangement, when the feed pump is in operation, the valve o remains closed and the water is forced through the feed coils K, but when said feed pump is stopped, the action of the

heat upon said coils will drive the water therefrom and from the drum L causing a vacuum therein, to supply which vacuum the water in the water back flows through the pipes M',
 5 M, into said drum, the current of water in its passage raising the valve o, whereby the feed coils are automatically supplied with water until the pump is again set in operation, when the valve o will close and the water
 10 will again be forced through said coils.

There is a serious objection to the ordinary water tube boiler, in that there is no provision for cleaning the horizontal pipes therein. To overcome this objection I extend the
 15 ends of the horizontal pipes d and h through the casing of the boiler and provide them with screw caps d' and h' respectively, which, when removed, afford a direct opening through said pipes from end to end through which a scraper
 20 or swab may be passed to thoroughly clean them out, the caps of said pipes being covered by removable curved strips P which are secured to the casing and extend longitudinally of the boiler on each side, each strip
 25 being common to all of the caps of a single series of said pipes, whereby, by the removal of one of said strips the caps of an entire series of pipes are exposed. Provision is also made for cleaning, in like manner, the base
 30 pipes of the boiler, by locating screw plugs o' in the outer shell of the water front which register with the bottom of said pipes, as shown in Figs. 1 and 2, whereby all horizontal water surfaces within the boiler may be kept perfectly clean.

R designates the ordinary water column located on the front of the boiler and which has communication with the steam and water space as is common.

40 Having thus fully set forth my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a steam generator, the combination of the casing, the water columns at the front and
 45 back, the independent horizontal base pipes connecting said water columns at the bottom, the drum connecting said columns at the top, the series of straight horizontal pipes crossing the fire space transversely, and terminating at
 50 either side the series of straight vertical pipes connecting said horizontal pipes with the base pipes and with said drum.

2. In a steam generator, the combination of the end water sections, the drum connecting
 55 said sections at the top and the three independent base pipes connecting said sections at the bottom, two of said base pipes extending on each side of the grates and one dividing the grate space centrally, the series of
 60 straight horizontal pipes crossing the fire space transversely, and terminating at either side the series of straight vertical pipes connecting said horizontal pipes with said base pipes and with the drum.

65 3. In a steam generator, the combination with the end water sections at the front and back, the drum connecting said sections at the

top, the base pipes connecting said sections at the bottom, the upper and lower series of horizontal pipes crossing the fire space, pipe con-
 70 nections between the lower series of horizontal pipes and said base pipes, pipe connections between said series of horizontal pipes, and pipe connections between said upper series of horizontal pipes and said drum.

4. In a steam generator, the combination of the base pipes, the steam drum, the water columns connecting said pipes and drum at each end, the series of horizontal pipes crossing the
 80 fire space transversely, and terminating at either side the vertical pipes connecting said horizontal pipes with said base pipes and with said drum, the ends of said horizontal pipes being provided with removable caps.

5. In a water tube steam generator, the combination with the circulatory system, of the
 85 continuous horizontal pipes crossing the fire space, the removable caps on the ends of said pipes which are accessible through the casing, for the purpose set forth.

6. In a steam generator, the combination with the circulatory system, of the feed water coils out side of said system but normally
 90 connected at one end therewith and at the other end with the source of water supply, the valve controlled coupling normally closed for automatically connecting the induct end of said coils with said system to establish a circulation therethrough, for the purpose set forth.

7. In a steam generator, the combination with the end water columns, of the circulatory system communicating therewith, the
 100 mud drum connected with the water supply, the feed water coils independent of said circulatory system but connected at one end therewith and at the other end with said drum, a normally closed pipe-coupling between said drum and one of said columns for automatically connecting said drum and feed
 105 coils with said system to establish a circulation therethrough.

8. In a steam generator, the combination with the circulatory system, of the steam and water drum communicated therewith and provided with a flat bottom and open ends, and
 115 the series of transverse perforated plates crossing the interior of said drum said plates rising from said bottom and terminating at or near the water-line therein.

9. In a steam generator, the combination with the circulatory system of the vertical and horizontal pipes communicating there-
 120 with, the horizontal drum communicating with said system, the longitudinal dividing partition lying upon said horizontal pipes and abutting against the bottom of said drum, the apron depending from the rear of said partition, whereby a return draft is provided.

10. In a steam generator, the combination
 130 of the circulatory system consisting of the vertical and horizontal pipes and the horizontal flat bottom drum located above said horizontal pipes and communicating therewith,

the longitudinal dividing plates lying upon the horizontal pipes on each side and having a right angled edge that abuts against the bottom of said drum whereby the bottom of said drum forms the complementary portion of the dividing wall at the center.

11. In a boiler, the combination with the steam generating tubes, of the steam drum communicating therewith, the longitudinal dividing partition below said drum the sinuous super-heating steam educt pipes communicating with said drum and extending longitudinally thereof on each side through the return fire space above said partition, said pipes passing out through the front of the boiler and being united by oblique pipes.

12. In a boiler, the combination of the

steam generating pipes, the steam drum communicating therewith, the perforated pipe within said drum, the longitudinal dividing partition below said drum the super-heating steam pipe traversing the heating space above said partition and coupled with said perforated pipe within the drum, said super-heating pipes passing outward through the front of the boiler and being united with the steam pipe, substantially as set forth.

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

GEORGE HARDEN.

Witnesses:

B. F. WHEELER,
E. S. WHEELER.