No. 700,066. Patented May 13, 1902.

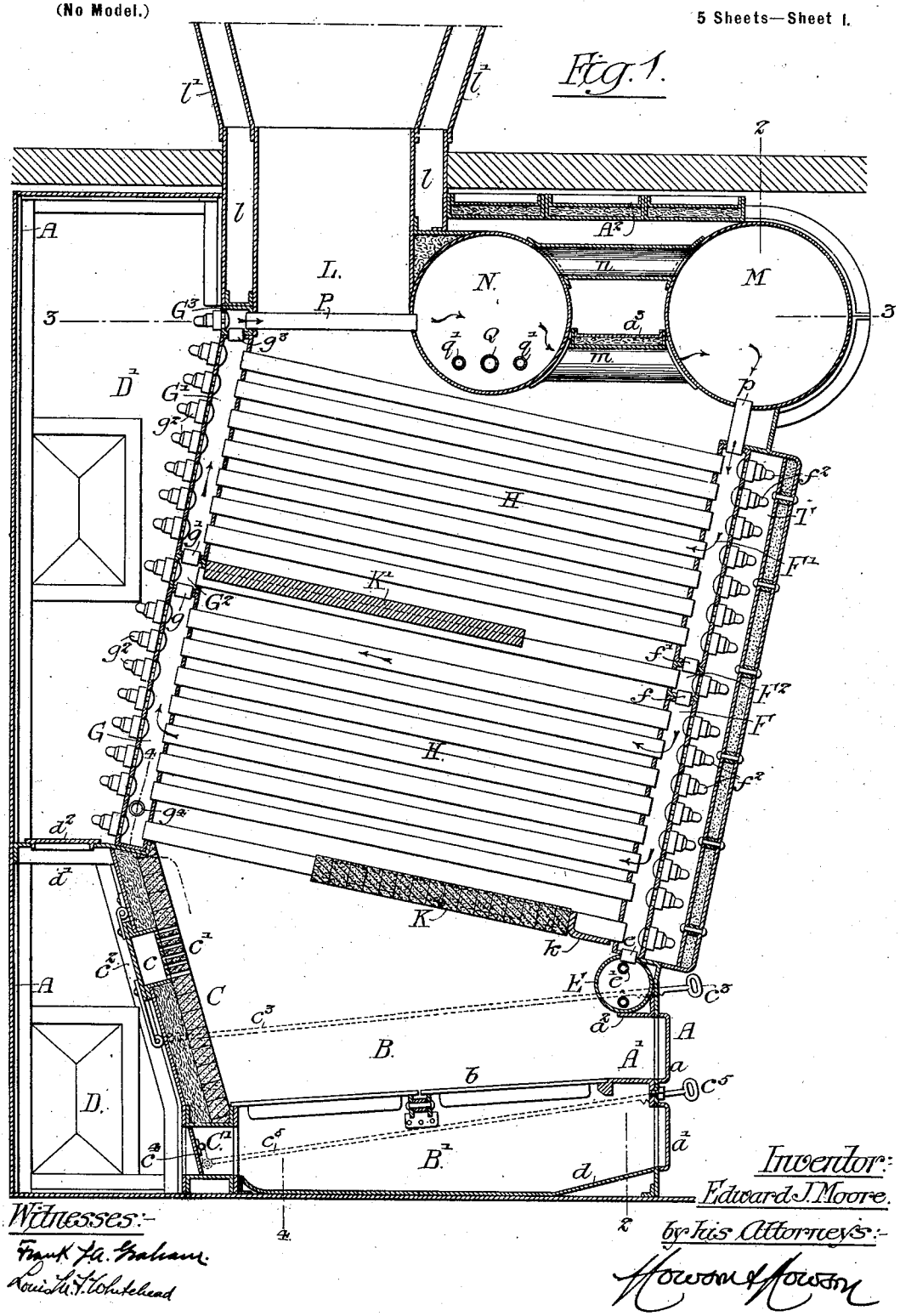
E. J. MOORE.

STEAM BOILER.

(Application filed Feb. 19, 1900.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



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Louis H. Stubblefield

Inventor:
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by his Attorneys:-
Howson & Howson

No. 700,066. Patented May 13, 1902.

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STEAM BOILER.

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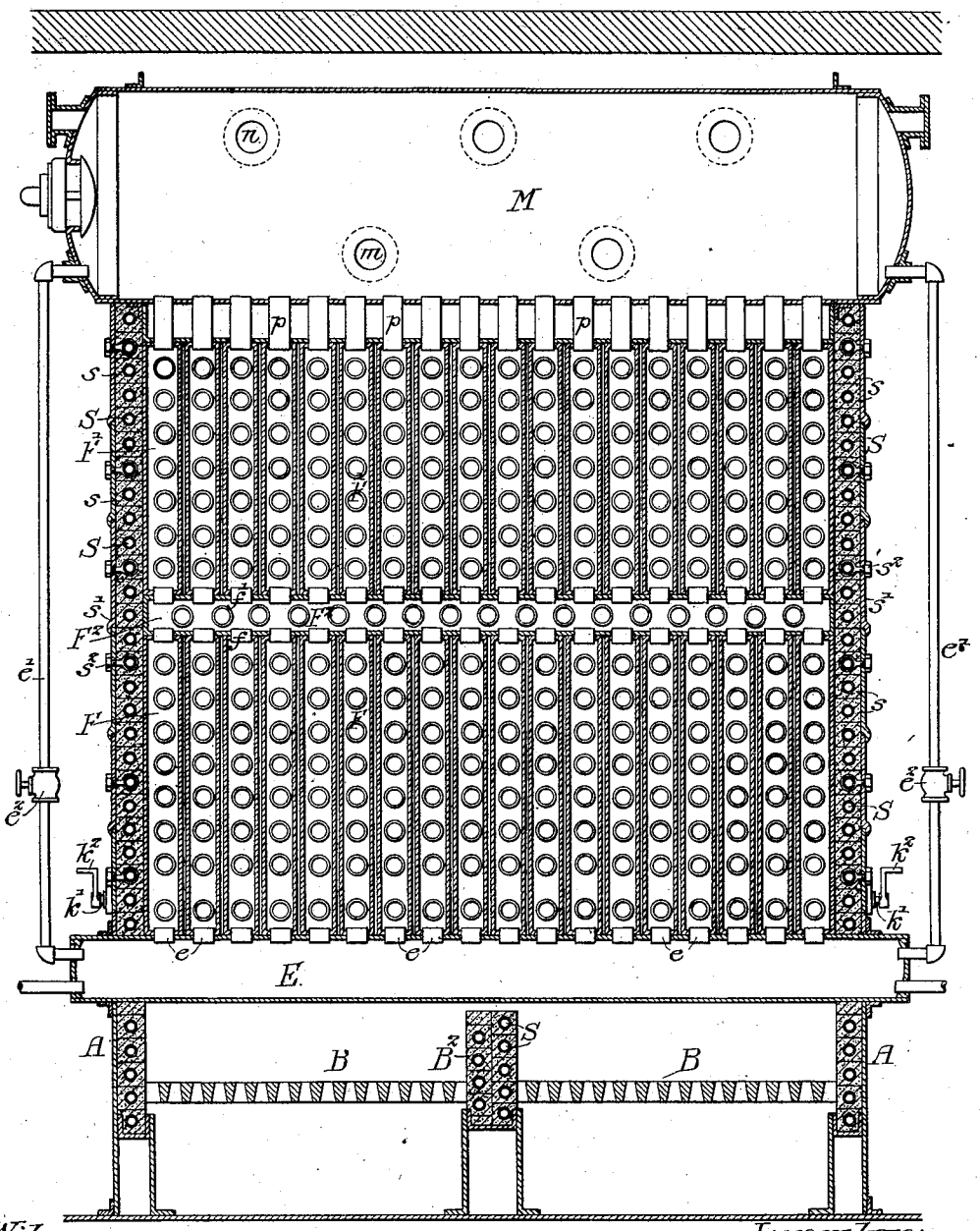
(No Model.) 5 Sheets—Sheet 2.

Fig. 2.



Witnesses:—
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(No Model.) 5 Sheets—Sheet 3.

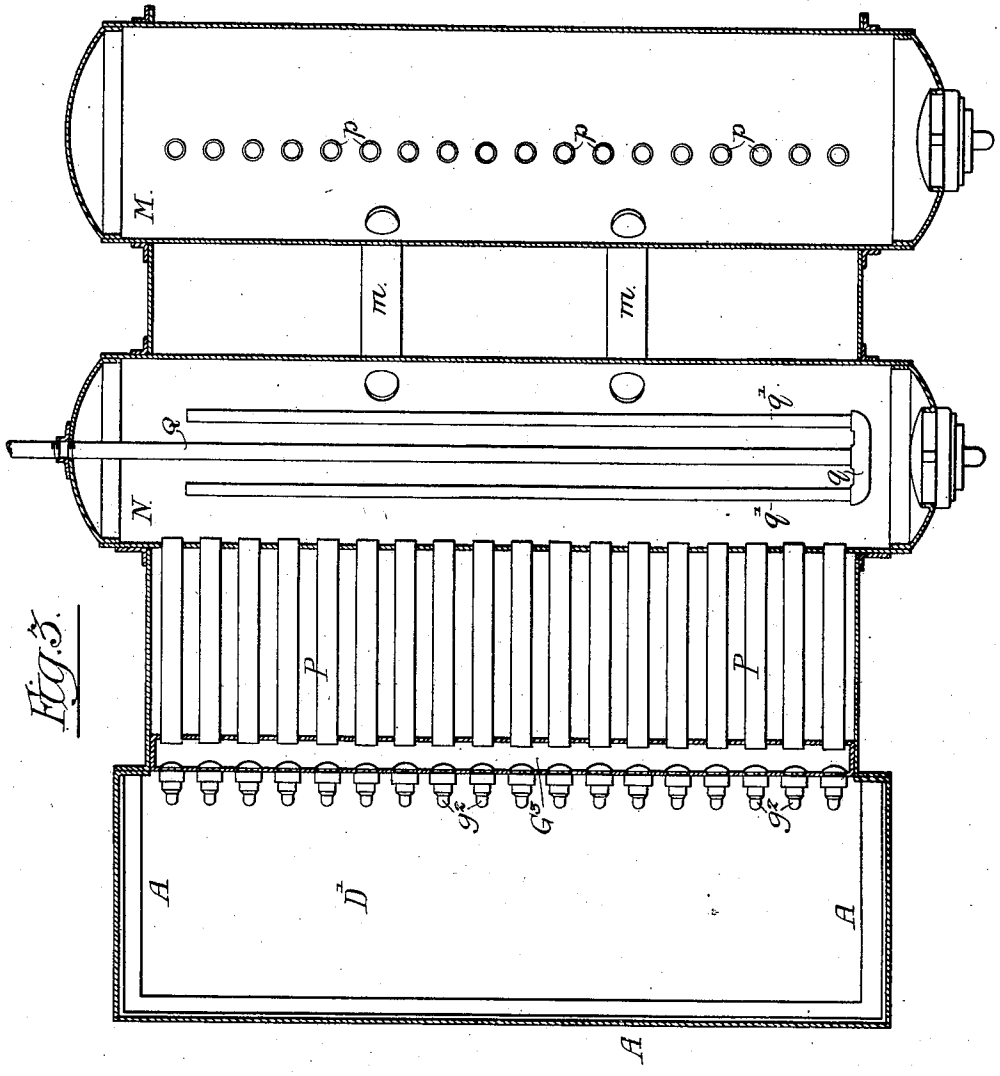

FIG. 3.

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No. 700,066. Patented May 13, 1902.

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STEAM BOILER.

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(No Model.) 5 Sheets—Sheet 4.

Fig. 10.

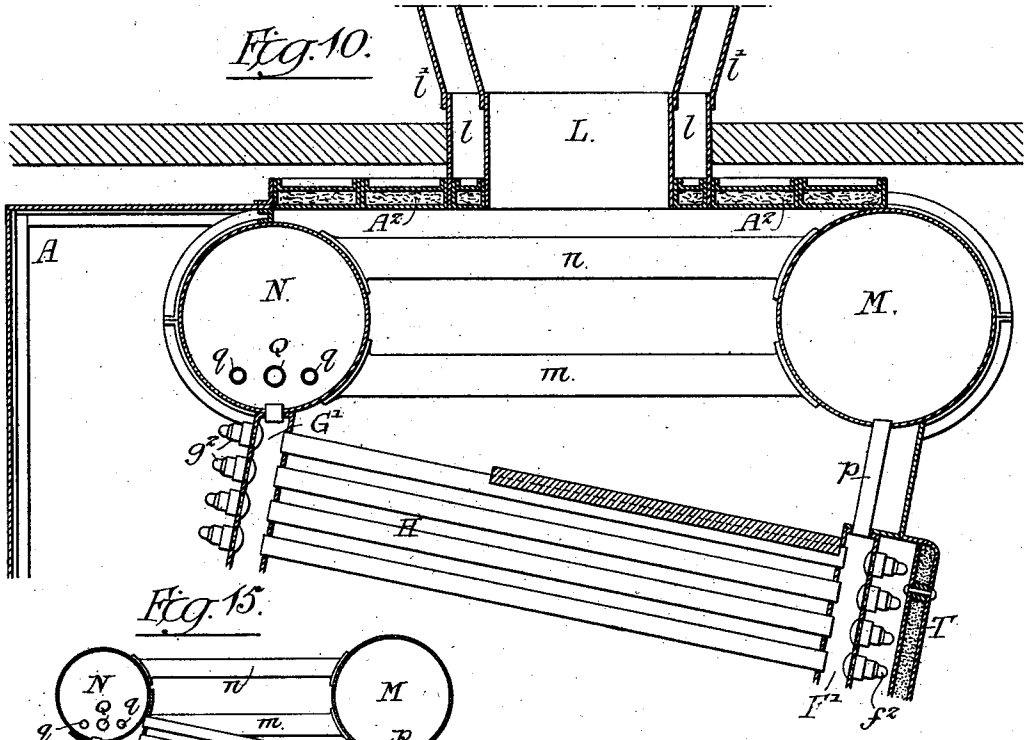


Fig. 15.

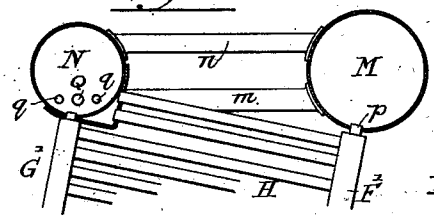
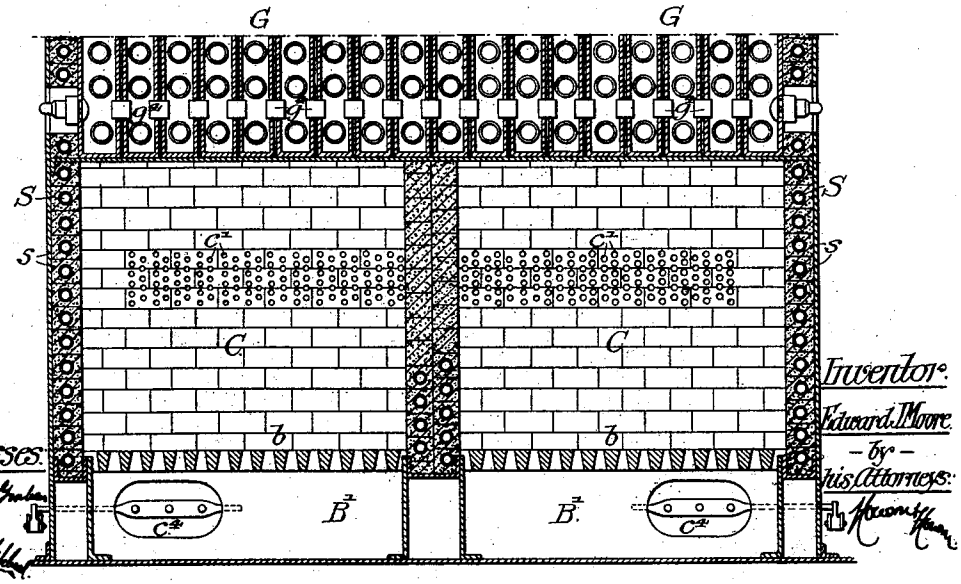


Fig. 4.



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No. 700,066. Patented May 13, 1902.

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STEAM BOILER.

(Application filed Feb. 19, 1900.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 5.

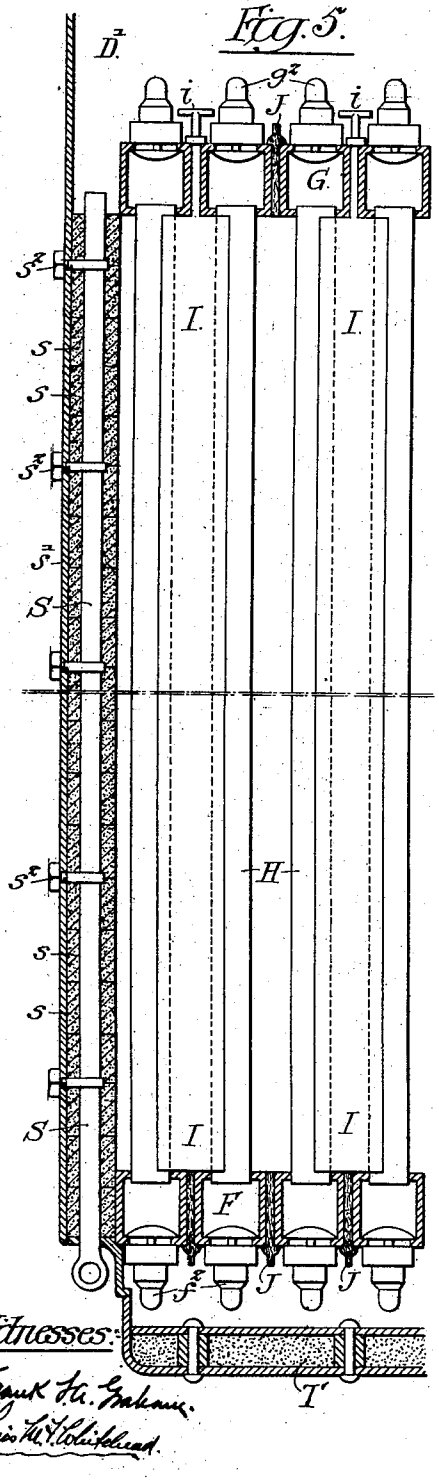


Fig. 9.

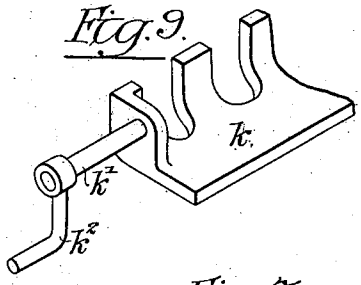


Fig. 6.

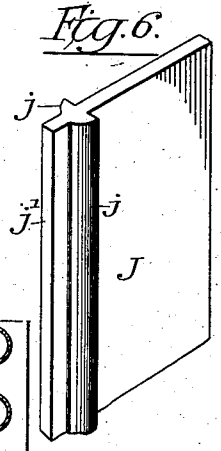


Fig. 7.

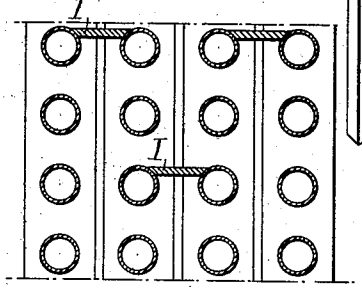


Fig. 8.

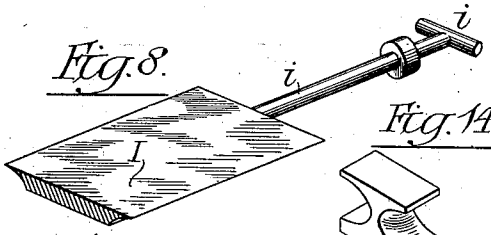


Fig. 14.

Fig. 11.

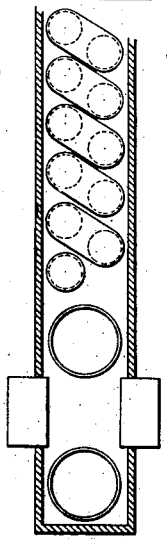


Fig. 12.

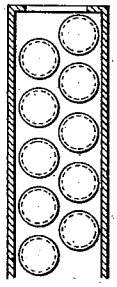
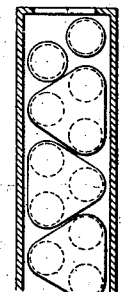


Fig. 13.



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UNITED STATES PATENT OFFICE.

EDWARD J. MOORE, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 700,066, dated May 13, 1902.

Application filed February 19, 1900. Serial No. 5,762. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. MOORE, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Steam-Boilers, of which the following is a specification.

The main object of my invention is to construct a high-pressure steam-boiler especially adapted for marine purposes.

A further object of my invention is to so construct the boiler that it will be compact and yet will have sufficient area to economically generate steam; and a still further object is to so construct the boiler that the rear portion is readily accessible, so that in the event of a group of these boilers being used separated by a bulkhead the bulkhead can be readily examined and painted when desired. The boiler is also constructed so that it can be readily cleaned, as fully described hereinafter.

In the accompanying drawings, Figure 1 is a vertical sectional view of my improved steam-boiler. Fig. 2 is a transverse section through the front header and steam-drum on the line 2 2, Fig. 1. Fig. 3 is a sectional plan view on the line 3 3, Fig. 1. Fig. 4 is a sectional view on the line 4 4, Fig. 1. Fig. 5 is an enlarged sectional plan view through a portion of the front and rear headers and a side wall. Fig. 6 is a perspective view of a part of one of the filling-pieces placed between the sections of the front and back header. Fig. 7 is a view showing the deflecting-plates between the heating-tubes. Fig. 8 is a perspective view of a portion of a deflecting-plate. Fig. 9 is a perspective view of a portion of the soot-catcher. Fig. 10 is a view of a modification of the arrangement of the drums. Figs. 11, 12, and 13 are views of modifications of the arrangement of the heating-tubes and headers. Fig. 14 is a view of one of the bricks used in the lower deflector, and Fig. 15 is a view of a modification of the upper portion of the boiler.

It will be noticed by referring to the drawings that the heating-tubes are inclined toward the front rather than to the rear, as in ordinary boilers of this type. This not only gives me more space in the fire-room, but also allows sufficient space at the back of the boiler for access to the rear header and the back plates of the structure. The inclined rear wall of the fire-chamber also allows for access to the back of the fire-chamber for repairs and examination when necessary, as it is desirable in marine boilers that access should be had to all parts of the inclosed casing.

A is the casing of the boiler.

B is the fire-chamber.

b is the grate slightly inclined to the rear.

B′ is the ash-pit, having a detachable bottom plate *d*, so that when this bottom plate is worn away or corroded it can be readily removed, inspected, and repaired or a new one substituted for it. It also allows for the inspection of the ship under the bottom plate.

C is the inclined rear wall of the fire-chamber, having a facing of fire-brick backed by cement, and in the rear wall is an air-chamber *c*, having air-ducts *c′* communicating with the fire-chamber. I preferably extend the air-chamber the full width of the furnace and provide a damper c^2 in the form of a hinged door operated by a rod c^3, extending to the front of the furnace, so that the damper can be opened and closed as desired.

Under the rear wall is an air-passage C′, forming a communication between the chamber D at the back of the wall and the ash-pit B′. In this passage is a pivoted damper c^4, operated by a rod c^5, extending to the front of the furnace, so that both the fire-chamber and the ash-pit can receive air from the chamber D when desired. This air-chamber also protects the framework of the ship from the intense heat of the fire-chamber.

The front plate A′ of the furnace has the usual fire-door *a* and ash-pit door *a′*. The lower portion of the front plate is made detachable, so that it can be removed when it is desired to withdraw the bottom plate *d* of the ash-pit.

Directly above the fire-door, on the inside of the furnace, is an angled bracket a^2, and carried by this bracket is the mud-drum or sediment-chamber E. This sediment-chamber extends throughout the entire width of the furnace, as shown in Fig. 2, and rests upon the side walls A, as clearly illustrated in said figure. This mud-drum is provided with blow-off and feed pipes at each end.

It will be noticed in referring to Fig. 2 that the boiler has two fire-chambers, separated by a division-wall B^2, and a single sediment-chamber extends across both fire-chambers.

Directly above the sediment-chamber are a series of polygonal headers F, arranged ver-

tically and of sufficient width to receive a single row of tubes in the present instance. These headers are spaced apart sufficiently to allow for the insertion of cleaning-tools for the purpose of removing soot from the outer surface of the tubes and are each coupled at the bottom by nipples *e* to the sediment-chamber E.

In boilers of large size I preferably make the headers in two sections, as illustrated in Fig. 2, the section F′ being mounted directly above the section F, and instead of coupling the two sections directly together, which may be done in some instances, I prefer to couple them to a horizontal polygonal header F^2, made in one or more sections extending across the boiler, and this header is coupled to the lower sections F by nipples *f* and to the sections F′ by nipples *f*′. This makes a rigid construction, and yet access may be had to all the tubes.

G G′ are the sections of the rear headers, made similar to the forward headers, and the upper and lower sections are connected to a horizontal header G^2 by nipples *g g*′. The lower portions of the headers G are connected together by nipples g^4, which act to brace the rear headers at that point, and cap-plates g^5 are secured to each side section, so that access may be had to the nipples and the several sections at this point. The rear headers I prefer to space apart similar to the front headers, so that access may be had to the tubes at the rear end; but they may be arranged close together and access only had to the tubes from the front of the furnace.

The heating-tubes H extend from the front headers to the rear headers and are coupled to the headers in the ordinary manner.

The usual cap-plates f^2 and g^2 are provided to close the openings directly opposite each tube in the headers, so that when it is desired to gain access to each particular tube its particular cap-plate can be removed and access may be had to it.

It will be noticed in referring to Fig. 2 that the tubes coupling the vertical headers together are preferably arranged in line one directly above the other, while the tubes of the central horizontal headers are staggered in respect to the other tubes, so that they act as deflectors to deflect the products of combustion, making them take a circuitous course through the furnace rather than a direct course. In order to still further deflect the products of combustion in their passage through the furnace, I provide deflecting-plates I, Figs. 6 and 7, which are of such a width as to rest on two adjoining tubes, as shown in Fig. 6, and these deflecting-plates are made thin and have handles *i* on one side, so that they can be inserted at intervals between the headers and turned so as to rest upon the adjoining tubes.

I provide closing-strips J to close the space between the vertical headers, as shown in Fig. 5. These strips are preferably made of asbestos material or metal covered with asbestos or other non-conducting material and have flanges *j j*, which rest against the outer surface of the headers, and a projection *j*′ allows for the ready removal of these strips when it is desired to cleanse the outer surface of the tubes. These detachable strips can be used at the back header as well as at the front, if desired. The back header may be permanently closed, if desired, although I prefer to use the detachable strips for the back headers as well as for the front headers. The application of these strips, as well as the deflecting-strips, is clearly shown in the plan view Fig. 5.

In order that the products of combustion can take a circuitous route through the furnace, I place a series of fire-bricks K, extending from the forward end of the furnace toward the rear directly above the fire-chamber, above the first series of tubes. These bricks are supported by the tubes, and between the front header and the fire-bricks is a pivoted soot or dust collector *k*, Fig. 9. The pivots *k*′ of this dust-collector extend through the side walls of the furnace and are provided with handles k^2, so that when the soot and dust accumulate in this collector from the surface of the fire-bricks K it can be tilted and the dirt dumped into the fire-chamber. I also provide a baffle-plate K′, extending from the rear header toward the front. This baffle-plate K′ is preferably made of metal and may be protected on its under side by fire-brick or other non-conducting material, if desired. The baffle-plate is supported on the tubes extending from the horizontal headers in the present instance.

L is the stack, and this stack is surrounded by an air-chamber *l*, formed by an outer shell *l*′.

I provide two steam-drums M and N. The steam-drum M is somewhat larger than the steam-drum N, and to this drum is connected the steam-pipe, as clearly shown in Fig. 2.

Directly above the upper row of rear headers is a horizontal header G^3, coupled to the vertical headers by nipples g^3. Extending from this horizontal header to the steam-drum N are the series of circulating-tubes P. These tubes extend across the opening into the stack from the combustion-chamber of the boiler and enter the drum, as indicated in Fig. 1.

The drums M and N are connected by two series of large tubes *m* and *n*. The lower tubes *m* are for the circulation of water, while the tubes *n*, which are connected to the drums at the top, are for the passage of steam generated in the tube N.

The water-supply pipe Q enters the drum N near the bottom and is connected to a cross-head *q*, which in turn is connected to two distributing-pipes *q*′. Both the drums are provided with manhole-openings, as shown in Fig. 3, so that access may be had to the interior of the drums.

In order to afford additional circulation between the drum M and the sediment-cham-

ber E, I couple the two chambers directly by means of outside circulating-tubes e'. These tubes enter the lower portion of the drum and the upper portion of the sediment-chamber and are provided with valves e^2, so that the circulation can be cut off, if desired.

The drum M is connected to the front headers by a series of short tubes p, so that the circulation of water can be maintained.

Directly above the tubes m, connecting the two drums M and N, is a non-conducting partition a^3, and inclosing the drum is an outer casing A^2, made up of sections formed by two flanged plates secured together, with non-conducting material packed between them. The sections are bolted together. This construction is fully set forth in the application for patent filed by me on the 21st day of September, 1898, Serial No. 691,491.

I preferably make the side walls of the structure A of tubular bricks s, and extending through the openings in the bricks are tubes S. (Clearly shown in Fig. 5.) These tubes extend through the entire length of the furnace and at the forward end are preferably provided with rings by which they can be withdrawn when it is desired to remove any one of the bricks or a series. If it is desired, I may use, in addition to the bricks, surface-plates, such as at s', one plate overlapping another, and I may secure the plates by bolts s^2, which have rings at their inner ends encircling the tubes S. Thus the bolts are securely held to the brickwork. The division-wall B^2 between the two furnaces is also made of tubular bricks held in place by the tubes S.

I preferably inclose the front headers by a casing T, which may be in the form of doors.

The circulation of water through the boiler is indicated by the arrows, Fig. 1, the circulation being the reverse to that of ordinary boilers of this type—that is, from the front headers through the heating-tubes to the rear headers, up the rear headers through the circulating-tubes to the drum N, and from the drum N through the tubes to the drum M, and down through the short tubes to the front header, the steam collecting in the two drums M and N. The products of combustion pass from the back of the fire-chamber forward between the lower set of heating-tubes, then back between the upper set of heating-tubes, and then between the circulating-tubes to the stack.

Air can be admitted when desired either to the ash-pit or to the combustion-chamber directly above the fire by operating either of the dampers controlled by the rods extending from the front of the furnace.

I find that when fresh fuel is placed in the furnace it is desirable to open the air-ducts in the back wall of the furnace, thus adding sufficient air to the gas, so that proper combustion will take place.

The space D′ back of the rear header and the space D back of the rear wall of the fire-chamber are separated by a partition-plate d', having a manhole therein provided with a cover d^2. The lower space is a hot-air chamber receiving air from the tubes S in the side walls of the furnace. Air passing through these tubes is heated by the heated brickwork, so that there is sufficient warm air entering the chamber D to aid combustion when either of the chambers are opened, so that the air will pass into the ash-pit or oven and into the fire-chamber above the fire.

In some instances I may make the chamber D′ also a hot-air chamber and connect this chamber with the lower chamber D. Both chambers are provided with doors, as shown, so that access may be had to them from the side.

It will be seen by the above construction that I am enabled to make a boiler which will withstand high pressures and which will be compact, and yet will have sufficient tube-surface to quickly generate steam, and will take up very little room in comparison with the amount of tube-surface exposed, and access may be had to the rear of the boiler as well as to the front.

By providing the spaces at the back of the boiler access may be had to the bulkheads of the ship when the boilers are mounted back to back with the bulkheads between them, and by making the bottom plate of the ash-pit removable access may also be had to the plates of the vessel for examination.

The bricks of the lower deflectors are made, as shown in Fig. 14, so as to envelop the tubes, thus not only deflecting the products of combustion, but also protecting the lower tubes.

The bricks or tiles of the side walls being made hollow and having the detachable tubes which can be used as air-ducts are arranged so that the tubes can be readily withdrawn when it is wished to repair the side walls.

Instead of placing the small drum N directly above the heating-tubes, as shown in Fig. 1, this drum may be mounted directly above the rear header, as in Fig. 10, and connected to the drum M by large pipes, which may extend on each side of the combustion-chamber, or may be mounted outside of the combustion-chamber, as desired, the flue to the stack in this case being situated between the two drums, or the modification shown in Fig. 15 may be used where the head room is limited.

I claim as my invention—

1. A water-tube boiler having inclined water-tubes, front and rear headers to which said tubes are connected, and water and steam drums arranged transversely above said tubes, one of said drums being situated directly over a series of heating-tubes having communication between the front and rear headers, substantially as described.

2. The combination in a boiler, of a series of inclined heating-tubes, front and rear headers to which said tubes are connected, with transverse drums mounted above said tubes,

said drums being connected together and to the front and rear headers, the connection between said drums affording a means of circulation through the same, substantially as described.

3. The combination in a steam-boiler, of inclined heating-tubes, front and rear headers to which said tubes are connected, two transverse heating-drums mounted above said tubes, said drums being connected together by horizontal pipes providing a circulation between the same, one of said drums being connected to the front header, and a series of tubes coupling the other drum to the rear header, said tubes extending across the opening leading to the stack, substantially as described.

4. The combination of inclined heating-tubes, front and rear headers, two transverse drums, one mounted above the front header and connected thereto, the other mounted above the heating-tubes, a series of circulating-tubes connecting said drum with the rear header, the two drums being connected at top and bottom, substantially as described.

5. The combination of the vertically-arranged polygonal front and rear headers, inclined heating-tubes coupled to the two sets of headers, and drums mounted above said heating-pipes and connected together by pipes affording a circulation between the same, said drums being also connected to the front and rear headers, substantially as described.

6. The combination of the front and rear headers, inclined heating-tubes coupled thereto, drums connected to the upper portion of the headers, a sediment-chamber mounted in front of the fire-box directly below the front header and coupled thereto, with independent circulating-pipes extending from both ends of said sediment-chamber to one of the drums exterior of the boiler, substantially as described.

7. The combination of a casing, a sediment-chamber supported thereby and extending through the side walls thereof, a series of vertically-arranged headers, each header being coupled to the sediment-chamber, inclined heating-tubes coupled to the front headers, rear headers to which the heating-tubes are also connected, a drum mounted above the front header, and pipes coupling the front header to the drum, said drum being connected to the rear header, substantially as described.

8. The combination of a front header made up of two series of sections arranged vertically, a transverse section to which both series of vertically-arranged sections are coupled, a rear header, and heating-tubes connected to the front and rear headers, substantially as described.

9. The combination of front and rear headers and inclined heating-tubes, said front header being made up of two series of vertically-arranged sections and a mid cross-section nippled to the vertical sections, the heating-tubes coupled to the vertical sections arranged one above another, while the heating-tubes coupled to the cross-section are arranged in line with the spaces between the other heating-tubes, substantially as and for the purpose set forth.

10. The combination of the front and rear headers, inclined heating-tubes coupled thereto, said front headers made up of sections spaced apart so that access may be had to the combustion-chamber to clean the tubes, and removable non-combustible section of filling material for closing the spaces between said headers, substantially as described.

11. The combination of front and rear headers, inclined heating-tubes coupled thereto, the front headers made up of sections spaced so that access may be had to the combustion-chamber to clean the tubes, with asbestos plates adapted to said openings, substantially as described.

12. The combination with a front header made up of a series of vertically-arranged sections, of a rear header made up of vertically-arranged sections, heating-tubes situated one above another and coupled to the sections of the front and rear headers, a horizontal section connected to the upper end of the rear header-sections, circulating-tubes coupled to the said sections, two drums coupled together, one of said drums connected to the circulating-tubes and the other connected to the front header, substantially as described.

13. The combination of a fire-chamber, an inclined back wall, a rear header mounted above the back wall and inclined forward, inclined heating-tubes coupled to the back header, a front header coupled to the heating-tubes, a sediment-chamber under the front header at the front of the fire-chamber, two drums, one mounted above the front header and coupled thereto and the other mounted above the heating-tubes and connected at top and bottom with the other drum, the outlet-flue to the stack from the combustion-chamber being between the said last-mentioned drum and the rear header, and a series of circulating-tubes coupling the rear header to the drum and extending across the flue to the stack, substantially as described.

14. The combination in a steam-boiler furnace, of the front headers, heating-tubes, rear headers made up of a series of vertical sections closed at their bottom, said sections being coupled together at the side near the base by nipples, a drum, and circulating-pipes connecting the drum with the front and rear headers, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD J. MOORE.

Witnesses:
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JAMES C. KRAYER.