J. B. BERNHARD.

SECTIONAL BOILER.

APPLICATION FILED AUG. 14, 1911.

1,038,718.

Patented Sept. 17, 1912.

3 SHEETS—SHEET 1.

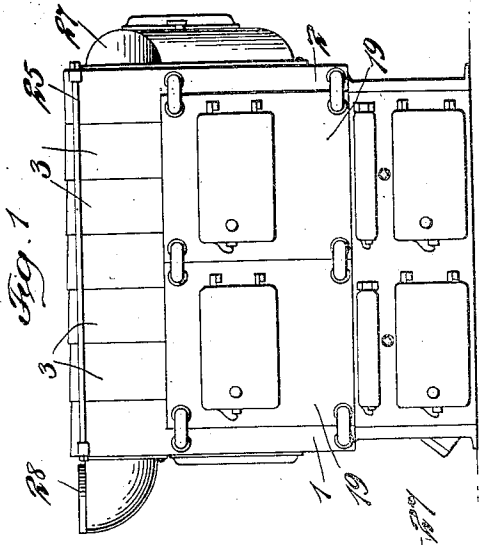

Fig. 1.

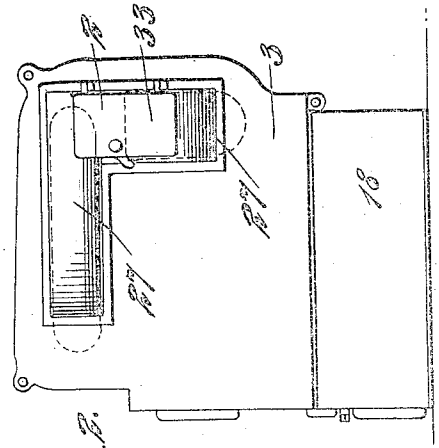

Fig. 2.

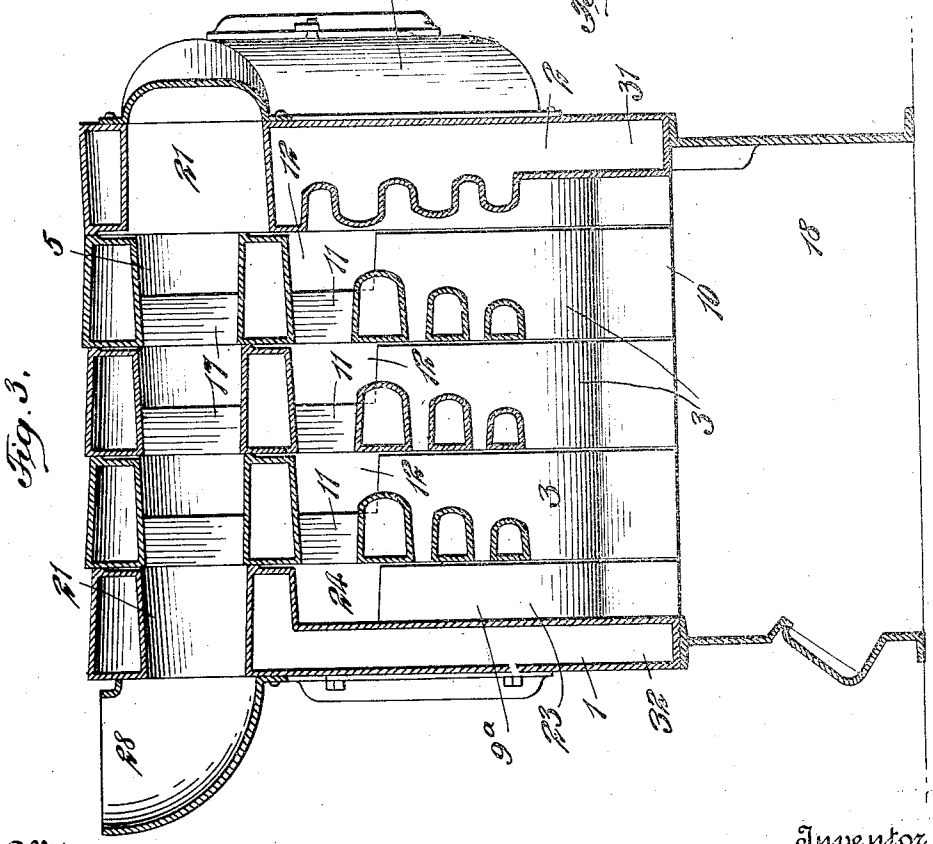

Fig. 3.

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3 SHEETS—SHEET 2.

Fig. 6.

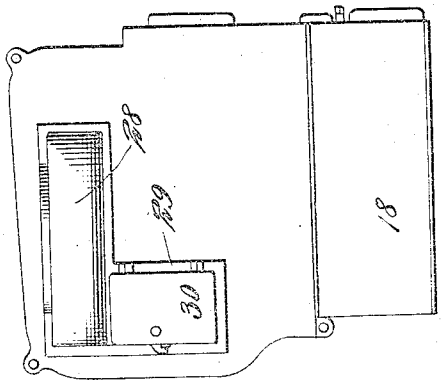


Fig. 5.

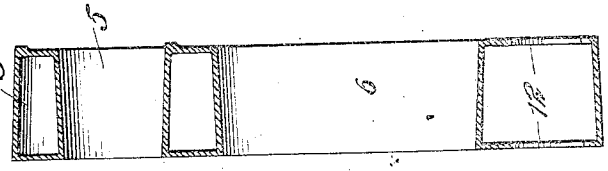
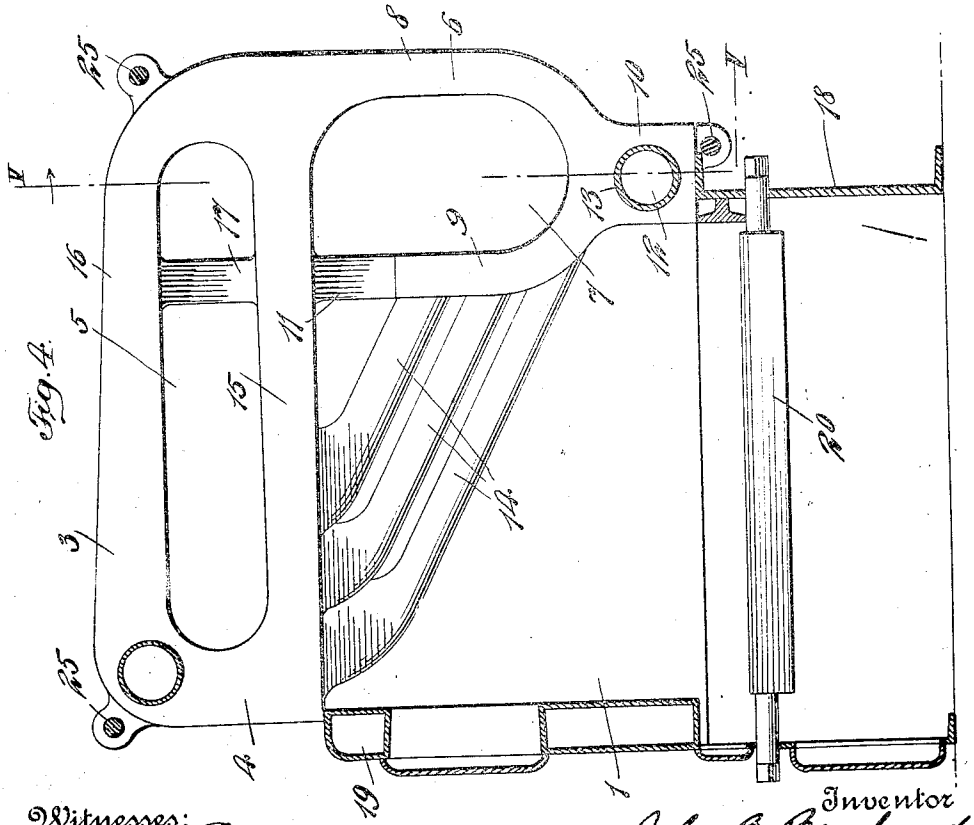


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 7.

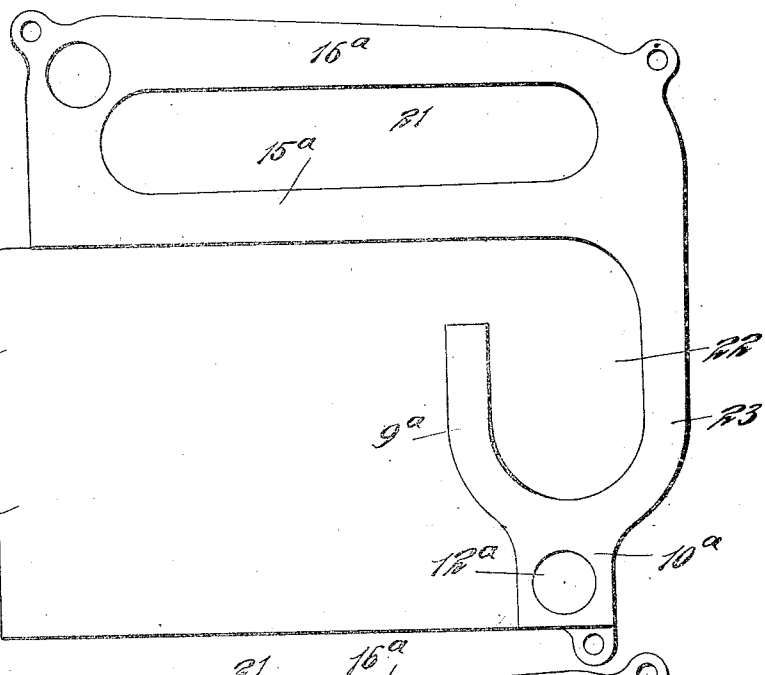
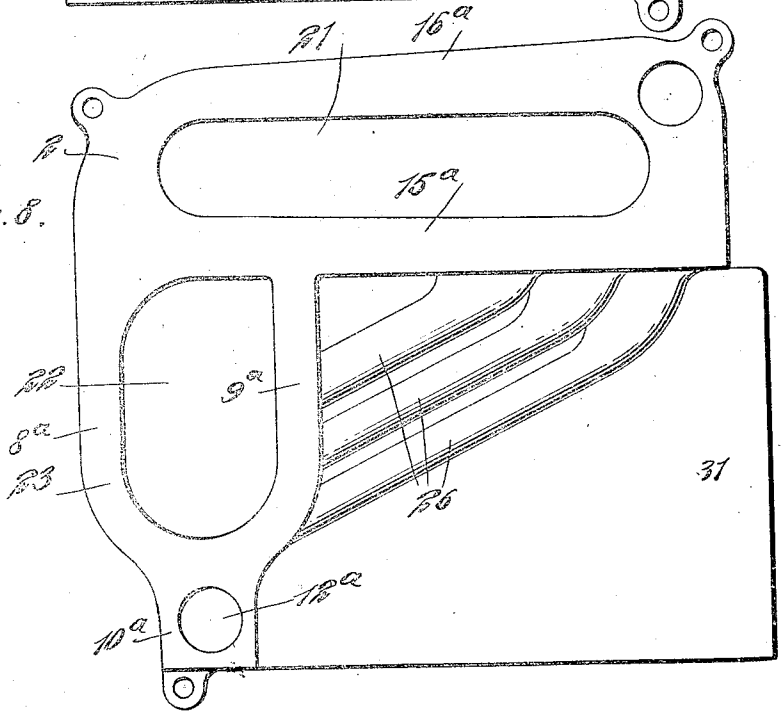


Fig. 8.



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UNITED STATES PATENT OFFICE.

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SECTIONAL BOILER.

1,038,718. Specification of Letters Patent. Patented Sept. 17, 1912.

Application filed August 14, 1911. Serial No. 643,850.

To all whom it may concern:

Be it known that I, JOHN B. BERNHARD, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Sectional Boilers, of which the following is a specification.

One of the many objects of this invention is to produce a boiler of simple construction equally well adapted for steam or hot water heating plants, and made up of sections or legs which extend from the front to the rear of the boiler, said sections being arranged side by side and so constructed that the fire will travel rearwardly and laterally.

Another object of the invention is to so construct the boiler sections as to secure a rapid heating of the water therein and an efficient fire travel.

Another important object of the invention is to so construct the water sections that they may be readily cast in a simple mold, thereby reducing the cost of construction.

Other objects and advantages of the invention will appear hereinafter.

In the drawings, Figure 1 is a front elevation of the boiler; Fig. 2 an end elevation of the right-handed end of the boiler; Fig. 3 a longitudinal vertical sectional view thereof on line III—III of Fig. 2. Fig. 4 a transverse vertical sectional view thereof on the line IV—IV of Fig. 1. Fig. 5 a sectional view through one water section or leg on the line V—V of Fig. 4; Fig. 6 an end elevation of the left-hand end of the boiler; Fig. 7 an elevation showing the inner side of the left-hand end section of the boiler; and Fig. 8 a similar view of the right-hand end section of the boiler.

Referring to the various parts by numerals, 1 designates the left-hand end section of the boiler, 2 the right-hand end section and 3 the intermediate or water leg sections. The water leg sections consist of a main portion 4 which is formed with the fire opening or flue 5; and 6 designates the pedestal portion of the water leg section which is formed with the fire flue 7 extending transversely or laterally through the same. This water leg section depends from the rear end of the main portion 4 of the water section. The pedestal portion of each water section is formed by the water chambers 8 and 9 which curve inwardly toward each other at their lower ends and connect with the base portion 10 of the said water section. The upper part of the water chamber 9 is reduced in thickness or cross sectional area, as at 11, to form the passageways 12 which lead from the firebox of the furnace, or the combustion chamber into the fire flue 7. This reduction in the thickness of the chamber 9 may be placed at any desired point along said chamber, but is preferably arranged at the upper end thereof and close to the bottom of the main portion 4 of the water section. The base 10 of the water section is formed with holes 12^b through which water may circulate from one section to the adjoining sections, and said holes are usually provided with short sleeves 13 which serve as a connecting means between the two contacting water sections.

Connecting the forward side of the water chamber 9 of the pedestal portion of the water section with the under side of the main portion 4 of said water section are a series of upwardly and forwardly inclined water tubes 14. These tubes are spaced apart a suitable distance so as to permit the hot gases to pass between and around them; and said tubes place the interior of the chamber 9 in communication with the interior of the main portion 4 of the water section. These tubes preferably enlarge toward their upper ends to facilitate the rising of the water therein as it is heated.

The fire flue 5 of the main portion 4 of the boiler section is of considerable area and its lower wall is formed by the upper surface of the water chamber 15. The upper ends of the water tubes 14 open into this chamber through the lower wall thereof. Extending upwardly between the water chamber 15 and in communication with the dome portion 16 is a water chamber 17, said chamber being considerably less in diameter than the thickness of the boiler section so that the hot gases may travel into all parts of the fire flue 5, said fire gases traveling laterally through the boiler as well as from front to rear thereof. The water tubes 14 extend from a point near the lower end of the pedestal portion of the water section upwardly and forwardly and are joined to the main portion of the water section, which main portion constitutes the crown sheet portion of the furnace, at a point near the forward edge thereof so that the said water tubes incline upwardly and forwardly over

the fire box, and are in such a position that they are subjected to the direct heat from the fire. The base portion 10 of the water section rests on the fire box frame 18 while the forward lower edge of the main portion of the water section rests on the front 19 of the furnace. The lower edge of the front 19 rests on the forward portion of the fire box frame and said frame carries a grate 20. It is manifest that this grate may be of any suitable form. It will also be understood that any form of boiler front may be used and that the sections may be supported on any form of fire box. As many of these intermediate water sections 3 may be employed as desired, depending upon the desired capacity of the boiler, only three of said sections being shown in the drawings. These sections are arranged side by side as shown, the flues 7 and 5 registering to form passages transversely through the boiler through which the products of combustion will pass.

The intermediate water sections are arranged between the end sections 1 and 2, as clearly shown in Figs. 1 and 3 of the drawings, these end sections being formed with the transverse flues 21 and 22 which register with the flues 5 and 7 respectively, of the intermediate sections, thus forming lateral passages extending entirely through the furnace from end to end. Each of these end sections is formed with the pedestal portion 23 to correspond to the pedestal portions of the adjoining water sections. The pedestal portion of each end section is formed with the water chambers 8^a and 9^a to correspond with the water chambers 8 and 9 of the intermediate sections; and these end sections are also each formed with the base portion 10^a to correspond to the base 10 of the adjoining water sections. Each of these base portions 10^a is formed with openings 12^a for the reception of the connecting thimbles or sleeves, similar to the sleeves 13 which are used to connect the intermediate water sections. The end sections are also formed with the crown sheet portions 15^a and the dome portions 16^a to correspond with the similar portions of the intermediate sections so that when the end sections and the intermediate sections are clamped together by means of the clamp bolts 25 the furnace gases may pass entirely through the furnace from end to end. The upper portion of the water chamber 9^a of section 1 is cut away, as shown clearly in Fig. 7 to form a passageway 24 from the fire box into the flue 22.

The end section 2 is formed on its inner or fire box side with a series of upwardly and forwardly extending corrugations which form water channels within the section and channels for the flue gases on the fire box side of said section. The interior water channels formed by these corrugations are in communication at their lower ends with the water chamber 9^a and at their upper ends with the lower portion of the water chamber formed by the crown sheet portion 15^a. The water chamber 9^a of this section is continued upwardly at its full width or thickness and is conected to the under side of the crown sheet portion, as shown clearly in Fig. 8, so that there is no passageway from the fire box into the flue 22 of said end section except from the adjoining intermediate section, as shown clearly in Fig. 3. The object of this is to force the hot gases from the furnace fire to pass into the transverse flue 22 from the adjoining intermediate section, as will be more fully hereinafter pointed out. To the outer side of the end section 2 is secured a fire flue 27 which receives the hot gases from the flue 22 of said end section and delivers them into the upper flue 21 of said section. From this latter flue the said gases travel through the flues 5 of the intermediate sections and then into the flue 21 of the end section 1, as clearly shown in Fig. 3 of the drawings. From this flue 21 the hot gases pass into the smoke outlet 28. The flue 22 of the end section 1 is closed by a suitable plate 29 provided with a clean-out door 30. As shown in Fig. 6 the smoke outlet pipe 28 extends over and receives the products of combustion from the entire flue or passage 21.

The interior water channels formed by the corrugations 26 are in open communication with the water chamber 31 forming a part of the end section 2, said water chamber forming one end of the fire box, as shown clearly in Fig. 3. The end section 1 is formed with a vertical water chamber 32 which forms the other end of the fire box, as shown clearly in Fig. 3. The lower edges of these chambers rest on the fire box frame, as clearly shown in Fig. 3 of the drawings. The fire flue 27 is formed with a clean-out door 33.

The products of combustion will circulate around the water tubes 14 and will pass upwardly to the opening 12 formed by the reduced portion 11 of the chamber 9 and into the fire flue 7. Said products of combustion will be projected against the rear wall of said fire flue and will also pass laterally therethrough to the flue 27 of the end section 2. Said products of combustion will then pass into the fire flue 27 and be by said flue directed into the upper flue 21 and thence into the flue 5 of the intermediate sections. After passing through said flues they will enter the smoke outlet 28. If it be desired to reverse the travel of the fire the fire flue 27 may be secured to the section 1 and the smoke outlet and clean-out doors connected to section 2. In view of the fact that the fire flue 27 is connected to

the outer side of the end section 2 said end section is not provided with any passage leading from the fire box into the flue 22, so that the products of combustion are all forced to pass through the intermediate sections and thence into the end section 2. By omitting communication between the fire box and the fire flue 22 of this end section and forming thereon the hollow ribs 26 the passage of the products of combustion is interfered with sufficiently to secure a proper circulation of the gases throughout all of the intermediate sections and the end section 1. It is manifest that if direct communication were formed through the end section 2 and flue 22 to the fire flue 27 a strong draft would result which would interfere with the proper circulation of the products of combustion through the other intermediate sections of the boiler.

In order to facilitate the manufacturing of the intermediate water sections and the end sections all of said sections are tapered from one side to the other side so that they may be readily drawn from a mold. The dome portions, the crown sheet portions, the pedestal portions and the water tube portions are all tapered in the same direction in transverse sectional view, and from one side of the section, as shown clearly in Fig. 3. The water tubes 14 extend inwardly from one side of each of the intermediate sections, the said tubes being tapered in cross section to correspond to the taper of the crown sheet and dome portions, so that the entire water section when cast may be readily drawn from a mold.

As shown in Fig. 3 the water tubes 14 are gradually increased in lateral dimensions from the bottom to the top one, so that each upper tube extends laterally beyond the tube directly below it, thereby interfering with the direct upward travel of the products of combustion. By this means an efficient circulation of the hot furnace gases between said flues is secured.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A boiler composed of two end sections and intermediate water sections arranged side by side and extending from front to rear of the boiler, each of said intermediate sections being formed with an upper main portion and a rear pedestal portion, the upper main portion being formed with a transverse flue and all of said main portions fitting closely together and forming a closed top to the fire box, the pedestal portion of each section being formed with a transverse flue and with a part reduced in cross section close to the top wall of the fire box to form a passage from the fire box into the fire flue of said pedestal, all of said pedestal portions fitting closely together and forming the rear wall of the fire box, means at one end of the boiler for directing the products of combustion from the pedestal fire flue into the fire flue of the main portion, and means at the other end of the boiler for directing the products of combustion from the upper fire flue to the smoke outlet.

2. A boiler composed of two sections and intermediate water sections arranged side by side and extending from front to rear of the boiler, each of said intermediate sections being formed with an upper main portion and a rear pedestal portion, the upper main portion being formed with a transverse flue and all of said main portions fitting closely together and forming a closed top to the fire box, the pedestal portion of each section being formed with a transverse flue and with a part reduced in cross section close to the top wall of the fire box to form a passage from the fire box into the fire flue of said pedestal, all of said pedestal portions fitting closely together and forming the rear wall of the fire box, and a series of forwardly and upwardly extending water tubes connecting the pedestal portion of each section with the main portion thereof, said water tubes being within the fire box.

3. A boiler composed of two sections and intermediate water sections arranged side by side and extending from front to rear of the boiler, each of said intermediate sections being formed with an upper main portion and a rear pedestal portion, the upper main portion being formed with a transverse flue and all of said main portions fitting closely together and forming a closed top to the fire box, the pedestal portion of each section being formed with a transverse flue and with a part reduced in cross section close to the top wall of the fire box to form a passage from the fire box into the fire flue of said pedestal, all of said pedestal portions fitting closely together and forming the rear wall of the fire box, and a series of forwardly and upwardly extending water tubes connecting the pedestal portion of each section with the main portion thereof, said water tubes being within the fire box and arranged one above the other and gradually increasing in diameter from the lower one to the upper one, one vertical side of each of said tubes being flush with one side of the boiler section, and said tubes serving to direct the fire gases to the passages leading into the pedestal fire flues.

4. A water section for a sectional boiler formed with an upper main horizontal portion substantially uniform in width and extending from the front to the rear of the boiler, a rear pedestal portion connected to the rear end of the main portion, each of said portions being formed with a transverse fire flue, the lower part of the main portion being adapted to form a part of the

upper wall of a fire box, the forward part of the pedestal portion being adapted to form a part of the rear wall of a fire box, a part of the pedestal portion on the fire box side thereof and close to the bottom of the main portion being reduced in cross sectional area, whereby a passage will be formed from the fire box into the pedestal fire flue when a plurality of sections are arranged side by side to form a boiler.

3. A water section for a sectional boiler formed with an upper main horizontal portion substantially uniform in width and extending from the front to the rear of the boiler, a rear pedestal portion connected to the rear end of the main portion, each of said portions being formed with a transverse fire flue, the lower part of the main portion being adapted to form a part of the upper wall of a fire box, the forward part of the pedestal portion being adapted to form a part of the rear wall of a fire box, a part of the pedestal portion on the fire box side thereof and close to the bottom of the main portion being reduced in cross sectional area, whereby a passage will be formed from the fire box into the pedestal fire flue when a plurality of sections are arranged side by side to form a boiler, and a series of forwardly and upwardly extending water tubes connecting the pedestal portion with the main portion, said water tubes being adapted to be within the fire box of the boiler.

6. A water section for a sectional boiler formed with an upper main horizontal portion substantially uniform in width and extending from the front to the rear of the boiler, a rear pedestal portion connected to the rear end of the main portion, each of said portions being formed with a transverse fire flue, the lower part of the main portion being adapted to form a part of the upper wall of a fire box, the forward part of the pedestal portion being adapted to form a part of the rear wall of a fire box, a part of the pedestal portion on the fire box side thereof and close to the bottom of the main portion being reduced in cross sectional area, whereby a passage will be formed from the fire box into the pedestal fire flue when a plurality of sections are arranged side by side to form a boiler, and a series of forwardly and upwardly extending water tubes connecting the pedestal portion with the main portion, said water tubes being adapted to be within the fire box of the boiler and arranged one above the other and gradually increasing in diameter from the lower one to the upper one, one vertical side of each of said tubes being flush with one side of the boiler section, and said tubes serving to direct the fire gases to the passages leading into the pedestal fire flues.

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

JOHN BLOOMFIELD BERNHARD.

Witnesses:
WM. R. DAVIS,
F. E. MILLER.