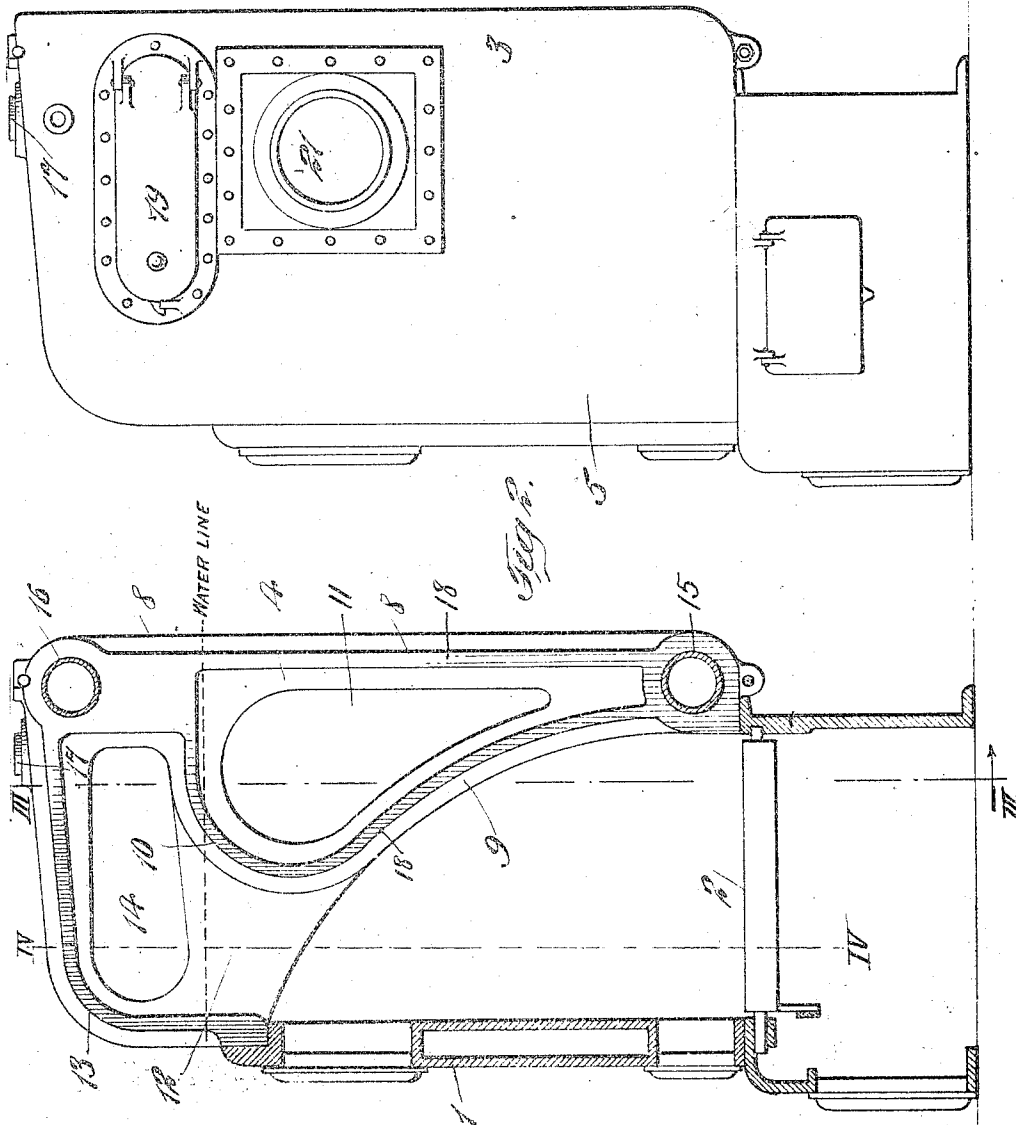


J. B. BERNHARD.
SECTIONAL BOILER.
APPLICATION FILED OCT. 20, 1909.

979,736.

Patented Dec. 27, 1910.

3 SHEETS—SHEET 1.



WITNESSES:

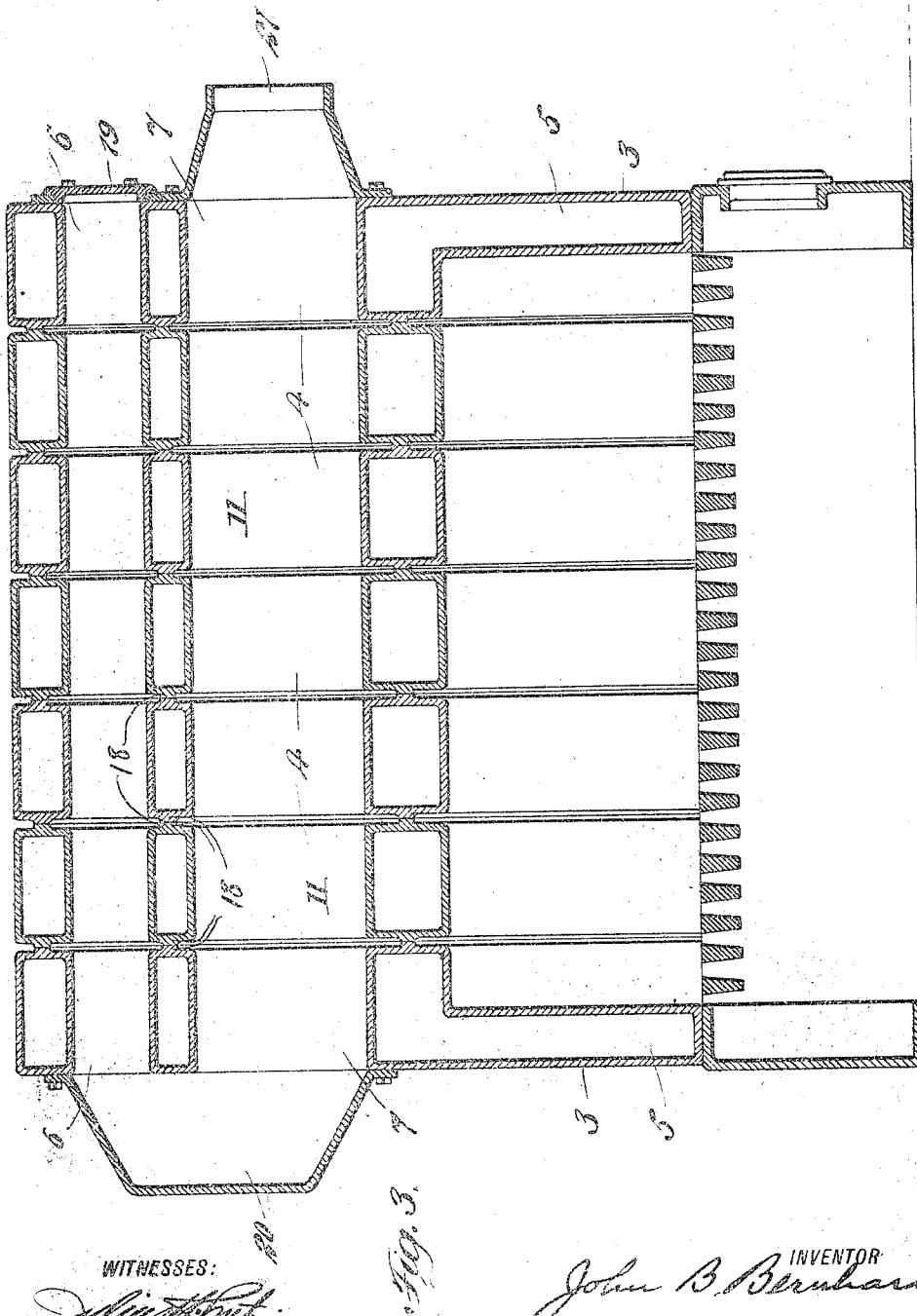
Julius Kutz
E. H. Kaufmann

John B. Bernhard INVENTOR
BY *David Davis* ATTORNEYS

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WITNESSES:
[Signature]
C. H. Kaufmann

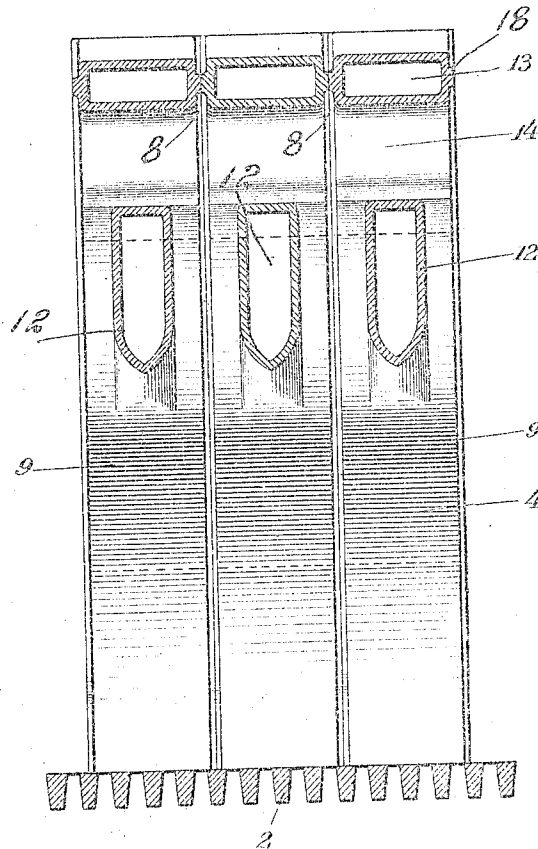
INVENTOR
John B. Bernhard
BY
Davis & Davis
ATTORNEYS

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Fig. 4



Witnesses:
F. R. Miller.
L. E. Peterson.

Inventor
John B. Bernhard.
By his Attorney
Davis Davis

UNITED STATES PATENT OFFICE.

JOHN BLOOMFIELD BERNHARD, OF NEWARK, NEW JERSEY, ASSIGNOR TO UNION BOILER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

SECTIONAL BOILER.

979,736.

Specification of Letters Patent. Patented Dec. 27, 1910.

Application filed October 20, 1909. Serial No. 523,681

To all whom it may concern:

Be it known that I, JOHN B. BERNHARD, a citizen of the United States, residing in the city of Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Sectional Boilers, of which the following is a specification, reference being had therein to the accompanying drawings in which—

Figure 1 is a vertical longitudinal sectional view; Fig. 2 a side elevation showing the smoke outlet; Fig. 3 a transverse vertical sectional view on a line III—III of Fig. 1; and Fig. 4 a vertical sectional view of three of the boiler sections on a line IV of Fig. 1.

A boiler made in accordance with my invention is of simple construction, equally well adapted for steam or hot water plants and is made up of sections or legs which extend from front to rear, said sections being arranged side by side and so constructed that the fire travel will be lateral through the furnace.

The main object of the invention is to so construct the boiler sections or legs as to secure a perfect water circulation, and to this end a portion of each of said sections is isolated from the hot gases of the combustion chamber and is subject only to the comparatively cooler gases passing to the smoke outlet, whereby the water will flow upwardly through those portions of the boiler sections which are exposed to the direct heat of the combustion chamber, and will flow downwardly through those portions which are isolated from the direct heat in the combustion chamber.

I have found it very essential in boiler construction to arrange the flues in such a manner that the hot furnace gases of the combustion chamber will only contact with those portions of the boiler sections in which it is designed that the water shall move upwardly and to direct the cooler gases which are about to enter the smoke passage, against the portions of the boiler sections in which it is designed that the water shall move downwardly. By this means I avoid setting up contrary currents in the water, and produce a very steady and continuous water circulation.

Referring to the various parts by numerals, 1 designates the boiler front; 2 the grate thereof; 3 the end sections and 4 the inter-

mediate sections or legs. These sections are alike in construction except that the end sections are formed with the water spaces 5 which close the ends of the fire box or combustion chamber, but the two end sections are substantially alike in construction, each having the upper transverse opening 6 for the passage of the hot furnace gases and the lower passage 7 for the passage of the cooler gases on their way to the smoke outlet.

Each intermediate section is formed with the rear, vertical portion 8 forming a water passage, and with a forwardly and upwardly curved portion 9 forming a water passage in direct communication at its lower end with the water passage 8. The portion 9 extends directly over the fire box and forms the rear wall thereof so that it is subject to the direct heat from the fire. The portion 9 at its upper end curves upwardly and rearwardly as at 10 and again connects with the portion 8 a suitable distance below the upper end thereof. The portions 8, 9 and 10 form a fire flue 11 through which the products of combustion may pass, as will be more fully hereinafter described. Each water section is formed with a portion 12 which is reduced in thickness, the interior of the said reduced portion being in direct open communication with the interior of portions 9 and 10. To the front end of the reduced portion 12 is connected the upwardly and rearwardly extending steam chamber 13, said steam chamber at its rear upper end being in direct open communication with the upper end of the water chamber 8. The steam chamber 13 together with the reduced portion 12 and the water chamber 10 form a broad, narrow, horizontal flue 14 at the top of the boiler through which the hot furnace gases will travel rapidly from one end of the furnace to the other. The front end of the boiler sections rests on the boiler front as shown clearly in Fig. 1, and adjoining sections of the boiler are connected together by means of bolts or other suitable means. The sections are in communication with each other at their lower ends through the openings 15 to permit water to freely circulate between said sections, and at their upper ends through the apertures 16 through which steam may circulate freely within the sections, steam, or hot water, may be taken from the boiler through the outlet 17.

Each boiler section is provided with the 11

ribs 18 which when the sections are assembled, contact with corresponding ribs on the adjoining boiler sections, and prevent the passage of the furnace gases between said sections. One end section is provided with a smoke box 20 which is arranged to direct the furnace gases from the upper flue 14 into the lower flue 11; and the other section is provided with a door 19 to close the end of the upper flue and with a smoke outlet 21 secured to said end sections over the opening 7 therein.

From the foregoing it will be seen that the products of combustion will first contact with the water chamber 9, and then pass upwardly around the reduced portion 12 and enter the horizontal flue 14 under the steam chamber. Said gases will then travel laterally and horizontally through said flue to the end section carrying the smoke box 20. The products of combustion pass through the box 20 and into the lower flue 11 and then horizontally and laterally through said flue to the smoke outlet 21. It is apparent, therefore, that the water in the water chambers 9 will be heated and will rise therein. It is also apparent that the water in the reduced portion 12 of the boiler sections will also be quickly heated. As the water is heated in these portions of the boiler sections it will rise thereby permitting the water in the water chambers 8 to fall. The preferred water level is indicated by the dotted line in Fig. 1, and is through and within the water chamber 10. It will therefore be seen that the water circulation will be around the flue 11, and that only the cooler gases, that is the gases which are passing to the smoke outlet, will contact with the water chamber 8 in which the water is moving downwardly. The hot gases direct from the fire contact with only those portions of the boiler sections in which it is designed that the water shall move upwardly. This arrangement of the fire travel avoids all contrary currents of water in the boiler sections, and produces a steady and constant circulation of water around the flue 11.

The end sections are so constructed that the smoke box 20, the smoke outlet 21, and the plate 19 may be reversed to permit the smoke pipe to be attached to either end section as desired, and as may be convenient in the installation of the boiler.

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

1. A steam boiler comprising end sections and intermediate sections extending from the front to the rear of the boiler, each of the intermediate sections being formed with an upwardly and forwardly extending water chamber, and with a rear upright water chamber connected at its lower end to the lower end of the upwardly and forwardly

extending chamber, the upper ends of these chambers being also connected together, the said chambers surrounding and forming a lower flue for the passage of the furnace gases, a reduced portion extending forwardly from and in communication with the said water passages, and an upwardly and rearwardly extending steam chamber connected to the forward end of the reduced portion and to the upper end of the rear vertical water chamber, said steam chambers forming an upper horizontal flue for the furnace gases, and means connected to the end sections for directing the furnace gases from the upper flue downwardly into the lower flue and from the lower flue to the smoke outlet.

2. A steam boiler comprising end sections and intermediate sections extending from the front to the rear of the boiler, each of the intermediate sections being provided with an upper flue and with a lower flue, and with a reduced portion forward of the lower flue, and forming channels leading into the upper flue, the forward wall of the lower flue being formed by an upwardly and forwardly inclined water chamber extending over the fire box, and the rear wall of said flue being formed by an upright water chamber connected at its lower end with the chamber forming the front wall of said flue, and means carried by the end sections for directing the furnace gases from the upper flue downwardly into the lower flue, and from the lower flue to the smoke outlet.

3. A steam boiler comprising end sections and intermediate sections extending from the front to the rear of the boiler, each of the intermediate sections being formed with an upwardly and forwardly extending water chamber, and with an upright water chamber in the rear of the inclined chamber, said chambers being connected together at their upper and lower ends and forming a flue for the passage of the furnace gases, a steam chamber above said water chamber and forming in connection therewith an upper flue for the furnace gases and a reduced portion forward of the lower flue, and forming channels through which the furnace gases may pass to the upper flue, and means carried by the end sections for directing the furnace gases from the upper flue into the lower flue and from the lower flue into the smoke outlet.

4. A section for a steam boiler formed with a lower flue and an upper flue, the lower flue being formed by an upwardly and forwardly inclined water chamber and a rear upright water chamber, said chambers being connected together at their upper and lower ends, and the upwardly inclined water chamber forming the rear wall of the fire box, the upper flue being formed by a steam chamber above the water chamber and con-

nected thereto, and a reduced portion forward of the water chamber and connected to the forward end of the steam chamber, said reduced portion permitting the furnace
5 gases to pass into the upper flue in front of the water chamber forming the lower flue.

In testimony whereof I hereunto affix my

signature in the presence of two witnesses this 28 day of September 1909.

JOHN BLOOMFIELD BERNHARD.

Witnesses:

C. HARR,

CHAS. R. FLOYD.