

No. 746,186.

PATENTED DEC. 8, 1903.

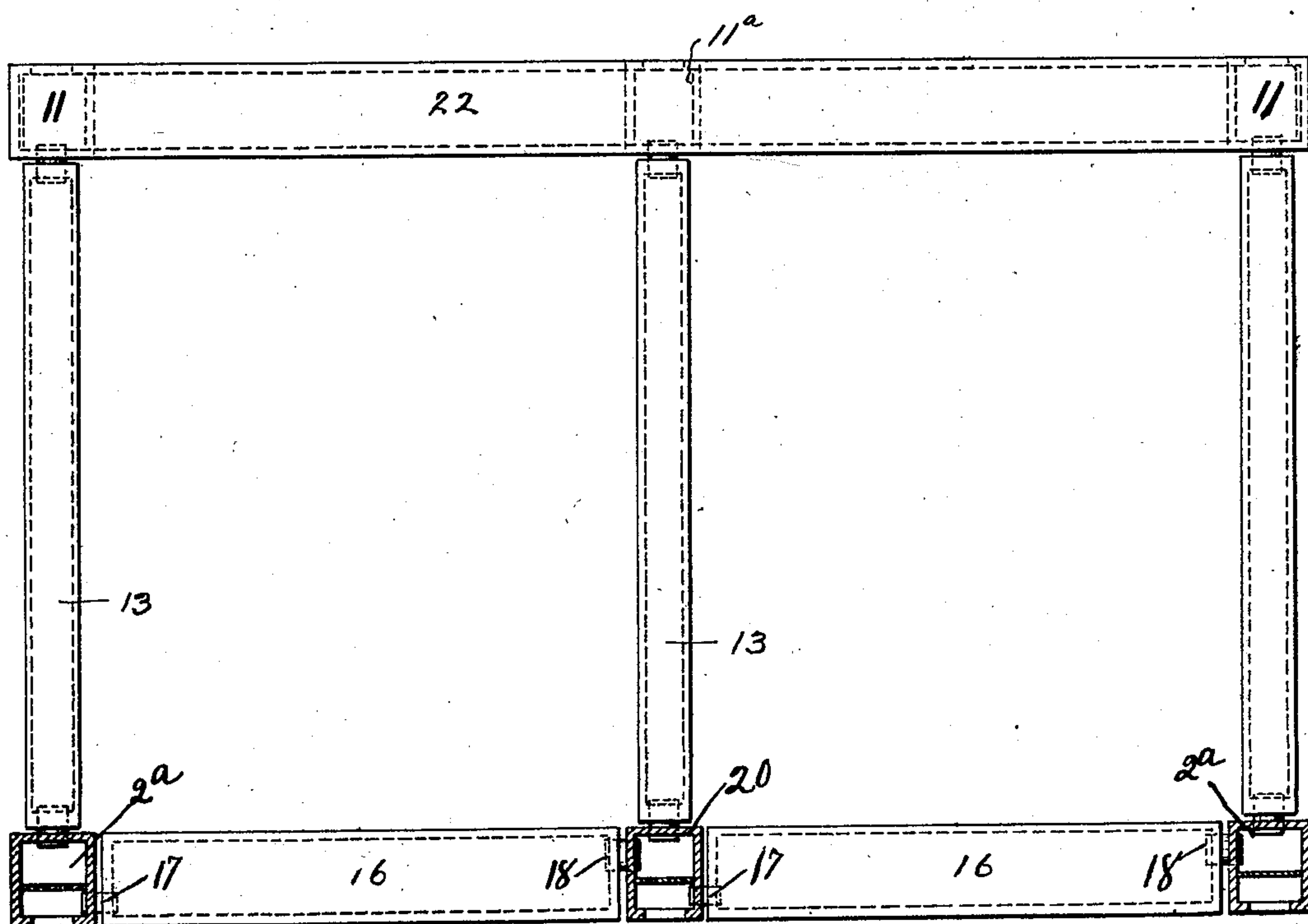
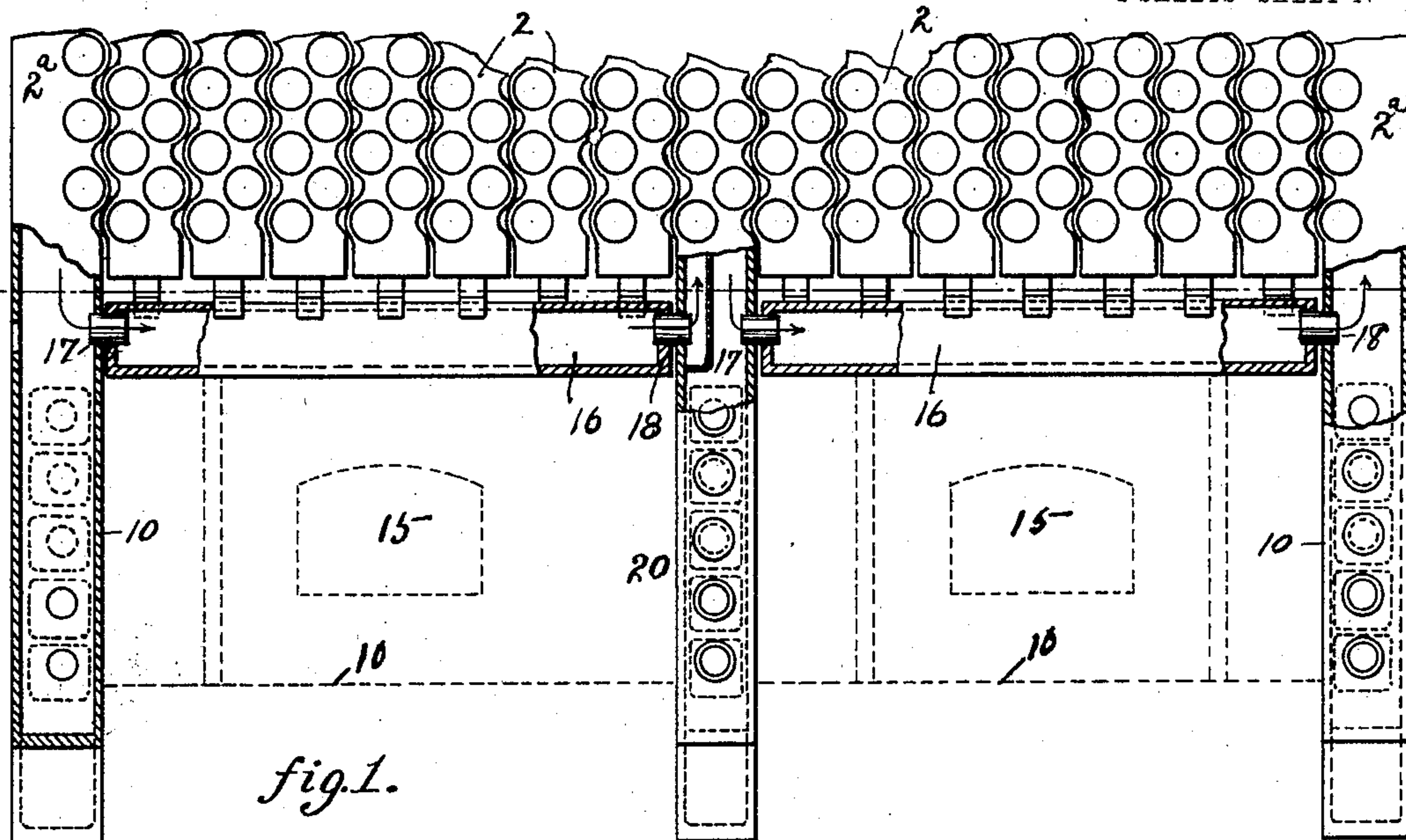
J. P. SNEDDON.

STEAM BOILER.

APPLICATION FILED FEB. 25, 1903

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses:

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fig. 2.

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2 SHEETS—SHEET 2.

fig. 3.

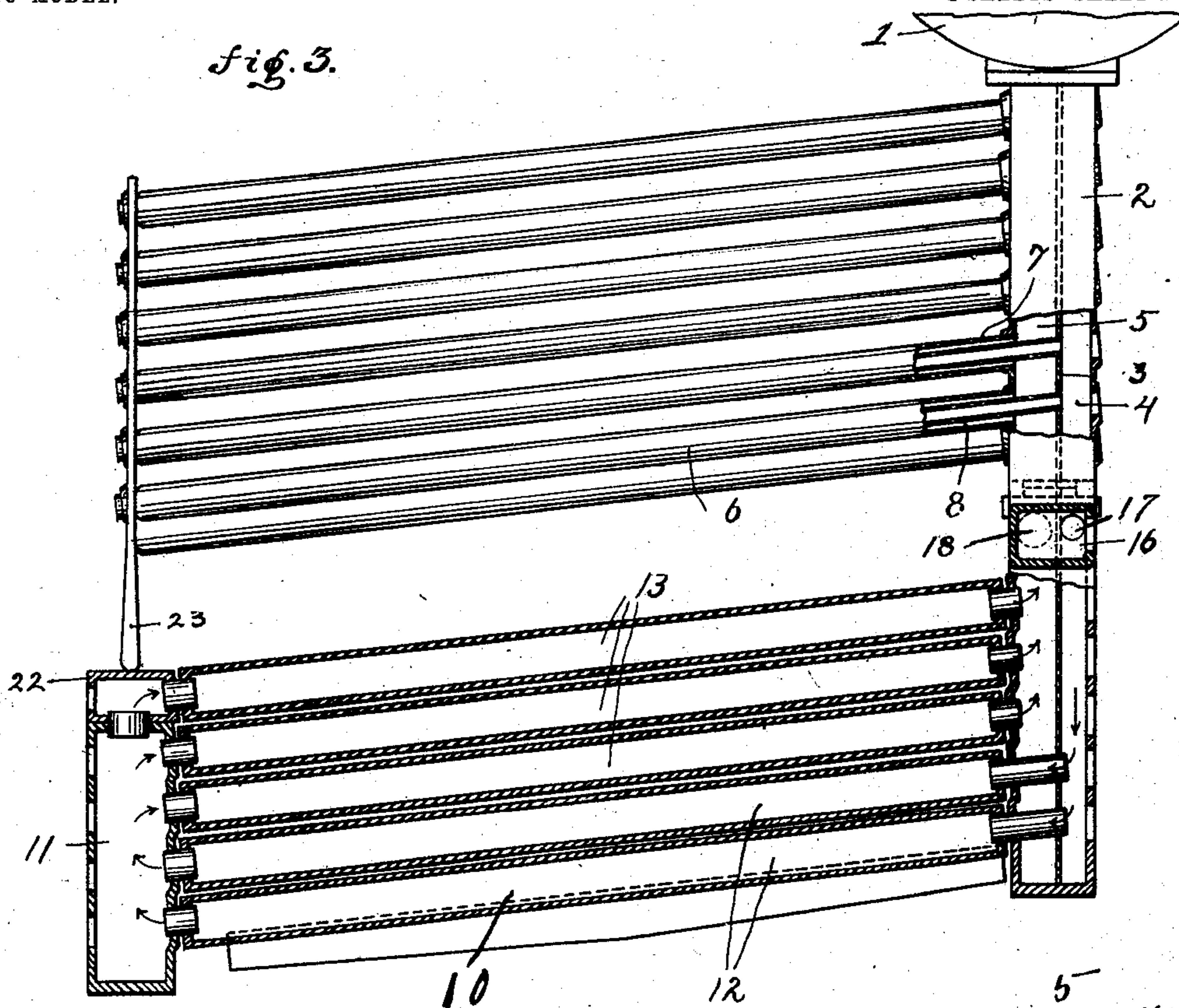
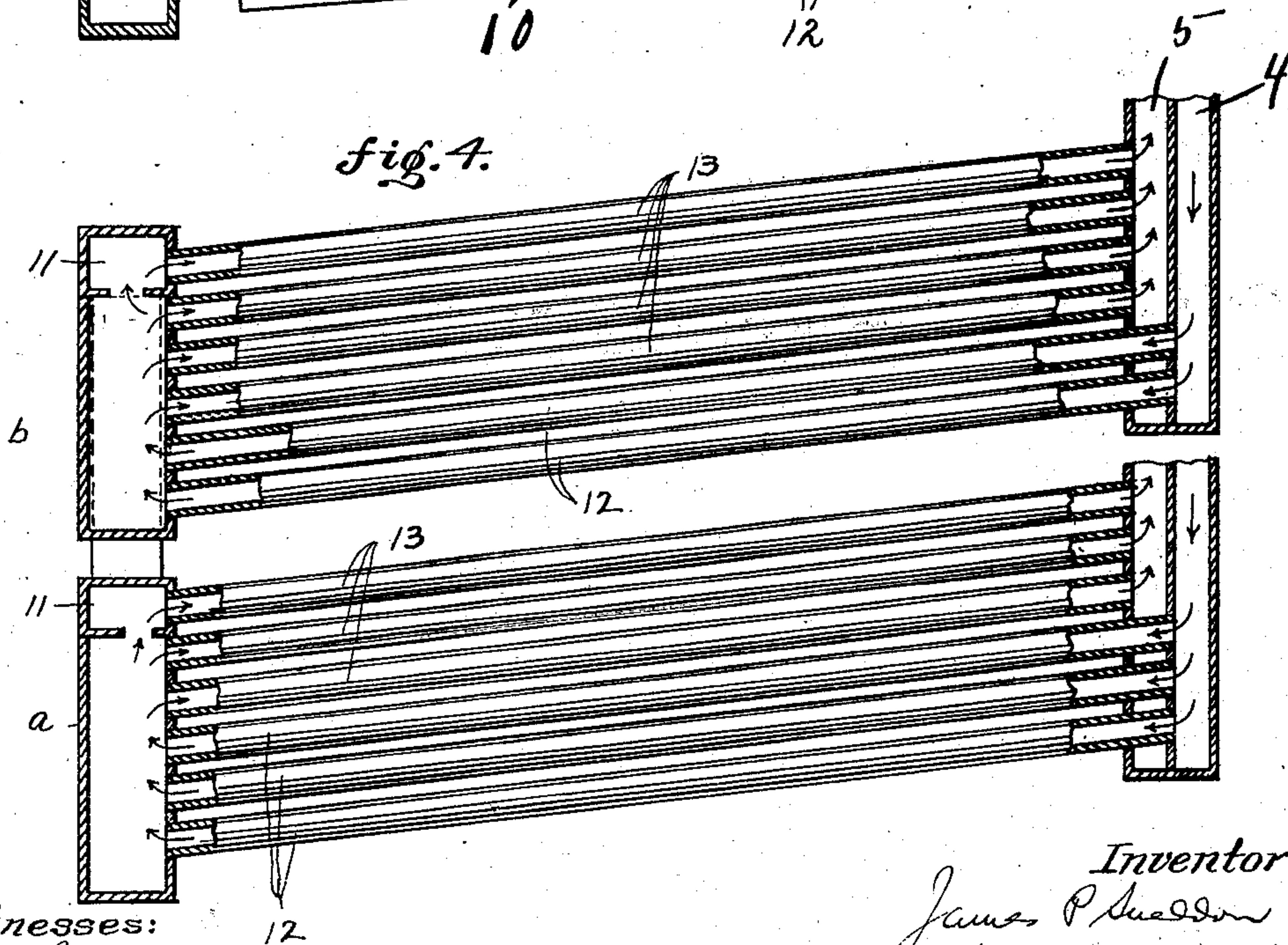


fig. 4.



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UNITED STATES PATENT OFFICE.

JAMES P. SNEDDON, OF BARBERTON, OHIO, ASSIGNOR TO THE STIRLING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 746,186, dated December 8, 1903.

Application filed February 25, 1903. Serial No. 145,048. (No model.)

To all whom it may concern:

Be it known that I, JAMES P. SNEDDON, a resident of Barberton, in the county of Summit and State of Ohio, have invented a new and useful Improvement in Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to steam-generators, and more especially to Nielausse or similar water-tube boilers.

The object of my invention is to dispense with the refractory lining at the sides and rear of the furnaces for Nielausse and similar boilers having water-tubes comprising inner and outer tubes communicating, respectively, with an uptake and a downtake chamber in the header. This object is accomplished by forming or lining the furnace-walls with water-tubes, preferably oblong, rectangular, or square in cross-section, and so connecting them to the other elements of the boiler that a circulation of water will be maintained therethrough.

The invention also consists in providing water-cooled cross tubes, boxes, or lintels both at the front and rear of the boiler.

One type of water-tube boilers, of which the Nielausse boiler is an example, is composed of a series of vertically-arranged headers, each divided by a longitudinal diaphragm extending for the full length of the header and dividing the same into two chambers, one of which forms the downtake of the circulation and the other the uptake, these headers being connected at their upper ends to elevated steam and water drums. To each header is connected a series of water-tubes, each comprising an outer tube communicating with one of the header-chambers—namely, the uptake—and having its rear end closed and an inner tube communicating with the other chamber of the header—namely, the downtake—and projecting into the outer tube and having an open rear end extending nearly to the closed rear end of the outer tube. The circulation in boilers of this type is from the steam and water drum downwardly through one chamber in the header, then through the inner tubes to the rear end thereof and back again through the annular space between the inner and outer tubes to the other header-

chamber, and thence up to the steam and water drum. In this type of boiler there is no header, water-box, water-column, or similar connection at the rear end of the water-tubes. By reason of this peculiarity it has heretofore been thought impossible to form or line the furnace-wall with water-tubes connected to the circulation of the boiler, so as to dispense with the refractory lining of the boiler-furnace. This latter has been accomplished with water-tube boilers of other types having headers both at their front and rear ends, so that by merely extending the side headers down to or below the level of the furnace-grate and connecting these extended portions by means of suitable tubes a circulation could be maintained therein. Nielausse and similar boilers, however, not having any rear headers or other vertical connections have heretofore not had applied thereto tubes which form side walls for the furnace, for the reason that no convenient means are presented for returning the circulation to the front headers. My invention overcomes this difficulty in boilers of the Nielausse type; and it consists in a construction of such boilers wherein the side walls of the furnace are formed of tubes through which water is circulated. This result is accomplished by extending the side headers downwardly and connecting to the downwardly-extending portions a series of water-tubes, preferably square or rectangular, which form the side walls of the furnace and extend to the rear end of the boiler, when they are connected by short vertical boxes or headers. In order to maintain a circulation through these tubes, some of them are connected to one of the front-header chambers—namely, the downtake—while others are connected to the uptake in said header, so that a circulation takes place through the tubes from the downtake of the front header through some of these tubes into the rear header or box and thence back through the remainder of said tubes to the uptake of the header.

The invention also comprises a water tube or box connecting the side headers and forming the lintel over the door, this lintel being connected to the downtake of one header and to the uptake of the other header, so that

a strong circulation is maintained there-through.

The invention also comprises a certain cross tube or box connecting the side rear headers in order to form a more firm support for the rear ends of the main tubes of the boiler and also comprises an arrangement of side tubes so as to maintain a circulation through this rear cross-box.

10 In the accompanying drawings, Figure 1 is a front view of the lower portion of a Ni-clausse boiler constructed according to my in-
 15 vention. Fig. 2 is a plan view of the lower portion thereof, the front headers being shown in section. Fig. 3 is a side view of the boiler, partly in section; and Fig. 4 is a dia-grammatic side view of a modification.

The boiler illustrated is of the usual Ni-clausse type, having an elevated steam and
 20 water drum 1, to which are connected a number of vertical headers 2, these headers preferably being corrugated or serpentine, as shown, so as to get the water-tubes close to-
 25 gether and in proper staggered relation. Each header is divided by means of a longitudi-nal diaphragm 3, which extends for the entire
 30 length thereof, into two chambers—namely a front or downtake chamber 4 and a rear or uptake chamber 5—both of which chambers
 35 are in free communication at their upper ends with the steam and water drum. To each header is connected a series of water-tubes 6, these also being of the usual Ni-clausse or Field
 40 tube construction and comprising outer tubes 7, communicating with the uptake 5 of the header and having their rear ends closed, and
 45 inner tubes 8, communicating with the down-take 4 of the header and projecting into the outer tubes, with their rear ends open and
 50 extending nearly to the rear closed ends of the outer tubes.

The boiler construction so far described is of the well-known Ni-clausse type and will be understood without further detailed descrip-
 45 tion. In this boiler the circulation is from the steam and water drum 1 down through the chamber 4, thence through the inner wa-
 50 ter-tubes 8 to the rear end thereof and back through the annular space between the tubes 8 and 7 to the uptake 5, and thence back to the steam and water drum.

In carrying out my invention the two side headers 2^a are made different from the inter-mediate headers not only in the fact that they
 55 contain but a single vertical row of tubes, whereas the intermediate headers contain two or more vertical rows of tubes, but also
 60 in the fact that the side headers extend down-wardly below the intermediate headers to or below the level of the grate, which is indi-
 65 cated at 10, Fig. 1. The diaphragm 3 of these side headers extends entirely to the lower end thereof. At the rear of the boiler, in line with the side headers, I provide short
 70 vertical boxes or headers 11, preferably of rectangular shape, as shown, and connecting

these rear headers with the downwardly-pro-
 75 jecting portion of the front headers are a se-ries of water-tubes 12 and 13, five such tubes being shown in Figs. 1 and 3, although the
 80 number thereof may vary as convenient or desired. These "side tubes," as I will desig-nate them, serve to form or line the walls
 85 of the furnace, so as to dispense with the usual refractory lining therefor. To best
 90 serve this purpose, the tubes will be of a shape in cross-section so that they will prac-tically form an unbroken wall, preferably be-
 95 ing rectangular or square, as shown, although they may be of other oblong or even round
 100 form. In order to take the place of the re-fractory furnace-lining, it is necessary that said tubes be cooled, and to do this a circula-
 105 tion of water must be maintained there-through. Inasmuch as the rear headers or
 110 boxes 11 have no communication with the other parts of the boiler than through the side tubes 12 and 13, other arrangements had
 115 to be devised for getting a circulation through these side tubes. I accomplish this result by
 120 connecting some of said tubes, such as the tubes 12, to the downtake-chamber 4 of the header and the remainder of said tubes, such
 125 as the tubes 13, to the uptake-chamber 5 thereof. As shown in Fig. 3, the two lower
 130 tubes are connected to the downtake and the three upper tubes to the uptake, so that the circulation is toward the rear in the two lower
 135 tubes, thence upwardly in the rear header, and then forwardly through the three upper
 140 tubes to the uptake of the front header. This particular arrangement of tubes, how-ever, need not be maintained, although it is
 145 always desirable to have more return than direct tubes, (by "return-tubes" I mean those
 150 leading from the rear header back to the front header and by "direct tubes" those leading from the front header to the rear
 155 header,) this being necessary, because com-paratively cold water will be flowing in the
 160 direct tubes and hot water in the return-tubes. The specific gravity of the latter be-ing much less than the former will necessa-
 165 rily take more tube-space. The side tubes 12 and 13 are preferably inclined from the
 170 front to the rear in accordance with the gen-eral inclination of the other portions of the boiler, so that the water flowing through the
 175 direct tubes 12 must flow downward, which is contrary to that which is usually thought
 180 to be possible in steam-boilers. I have dis-covered, however, that this flow will take place naturally and without obstruction, due
 185 entirely to the fact that the flow of water in boilers depends entirely upon the specific
 190 gravity of the water and not upon the inclina-tion at which it travels. It will be apparent that the water flowing through the upper
 195 tubes toward the front of the boiler is much hotter than that in the lower tubes, and con-
 200 sequently its specific gravity is less. This then causes it to flow upwardly through the

uptake 5 of the header. This upward flow of the water in the return-tubes 13 causes a preponderance of pressure or weight in the downtake-chambers 4 of the header, and this preponderance of pressure will supply the displacement that has taken place in the tubes 13, thus causing a natural flow rearwardly through the downwardly-inclined tubes 12.

10 In the usual Niclausse boilers the headers are supported on a plate-girder lintel above the furnace-doors, the latter being indicated at 15. I substitute therefor a water-box lintel 16, which is suitably connected to the side headers. This lintel is necessarily subjected to a very high heat, and as it must be protected a circulation of water must be maintained therethrough. This is provided for by connecting one end of the lintel, as at 17, 20 to the downtake of one of the outside headers and the other end of the lintel, as at 18, to the uptake of the other outside header. In this manner a strong circulation of water is maintained through the lintel to cool the same and maintain it rigid in order to properly support the intermediate headers. It will be observed that the connections 17 and 18 between the lintel and the headers are not concentric with the lintel, but are eccentric thereto, being near the upper walls thereof. This is to guard against the formation of steam-pockets in the lintel.

The usual boiler-furnaces are provided with two or more firing-doors 15, and in order that the inrush of cold air which takes place when the door is opened to renew the coal shall not distribute itself through and cool the entire boiler it is desirable to divide the furnace-chamber into two or more compartments. This is conveniently accomplished by extending the central header downwardly, as shown at 20, so as to terminate in the same plane as the outside headers 2^a. In line with this central header there is provided a short rear box or header 11^a, which is connected to the extension 20 of the central header by a series of water-tubes 12 and 13, exactly as heretofore described and connected in the same way, so that a circulation of water is maintained therethrough. These tubes serve to divide the furnace-chamber into two compartments, so that the inrush of cold air through any one door will be confined to one compartment alone. By this construction 55 better control can be maintained over the operation of the boiler and a higher efficiency gained. I have shown but a single central header projecting downwardly this way, and while I do not wish to be limited to the number of headers that should be brought down in this manner still it is desirable and preferable that adjoining firing-doors be separated by such a header. With very narrow boilers, however, having but a single firing-door none of the intermediate headers need to be projected downwardly, as shown. By

the term "side headers," however, as used in the claims I intend to include also any intermediate headers which are extended downwardly in the same manner as the side headers. 70

The rear boxes or headers 11 and 11^a are also connected by a cross lintel or water-box 22, which has for its object to form a more substantial support for the supporting means 23 for the rear ends of the generating-tubes 6 than is offered by the plate-girder construction ordinarily employed. This rear box or lintel is connected to the vertical rear headers 11 in the usual way, so that a circulation of water can be maintained therethrough. In 80asmuch, however, as the heat is not very great at this point, there is not the same necessity for a strong circulation therethrough as there is with the front lintel 16. Should it be desirable, however, to maintain a fairly strong circulation through this rear box, it can be conveniently accomplished by unbalancing the circulations of the two sets of side tubes 12 and 13. This can be accomplished in a great variety of ways—such, for instance, 90as giving the return-tubes of one set of side tubes a greater capacity than the return-tubes of the other set of side tubes and having the direct tubes of the two sets also unbalanced, being least in the first-named set and greatest in the second-named set. This unbalancing of the flow can be accomplished by merely changing the relative sizes of the direct and return tubes on the two sides of the boiler-furnace, or it may be accomplished 100by adding an extra direct tube to one side and an extra return-tube on the other side, this latter being diagrammatically shown in Fig. 4, wherein there are shown six tubes on each side of the boiler. On one side there 105are three direct tubes 12 and three return-tubes 13, while on the opposite side there are only two direct tubes 12 and four return-tubes 13. As a consequence more water will flow rearwardly in the side *a* than in the side *b*, while a less quantity of water can flow forwardly in the side *a* than in the side *b*. This will create an excess of pressure in the header 11 of side *a*, and under the general law of circulation of liquids this preponderance of 115pressure will cause a flow from the header 11 of side *a* to the header 11 of side *b* through the cross-box 22, thus keeping the latter cool. This cross box or connection 22 can be formed in any suitable way, such as a mere pipe connecting the two headers, but preferably will be a box, as shown, and connected to the upper ends of the headers 11 and having the topmost return-tube 13 connected thereto, as clearly indicated in Fig. 3. 125

The various tubes and headers of the boiler are shown as connected by expanded nipple-joints; but the invention of course is not limited thereto, as these connections can be made in any suitable way, preferably by expanded or screw nipples or cone-joints, as is well known in the construction of sectional 130

boilers, so that the several elements of the boiler can be readily taken apart without cutting or otherwise mutilating any part thereof.

The circulation of the boiler will be readily understood from the foregoing description. Suffice it to say that the circulation through the side tubes is rearwardly through the lowermost ones thereof and forwardly through the uppermost ones thereof, this being accomplished by connecting the lower tubes to the downtake-channel of the header and the upper tubes to the uptake-channel. A strong circulation is also maintained through the lintel 16 by connecting the same to the downtake-channel of one header and the uptake-channel of the other header, and a sufficient circulation through the rear water lintel or box 22 will be maintained by the natural operation of the boiler, but may be increased, if desired, by unbalancing the circulations in the two sets of side tubes, as above described.

It will thus be seen that I provide water-cooled side walls and cross-lintels for Niclausse and similar boilers in a manner that will not disturb the general circulation of the boiler and with the addition of only so many elements as are necessary to maintain the circulation through these lower water-tubes.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-generator, the combination of front vertical members divided longitudinally into two chambers, water-tubes connected to said members, one or more of said members extending below the others, one or more rear vertical members, and a series of water-tubes connecting said rear vertical members with the extended portions of the front members, some of said tubes communicating with one of the chambers in the front vertical members and the remainder of said tubes communicating with the other chamber in the front vertical members.

2. In a steam-generator, the combination of an elevated steam and water drum, a vertical member connected thereto and divided longitudinally into two chambers forming respectively an uptake and a downtake, a vertical member at the opposite end of the boiler, and a series of water-tubes connecting said vertical members, a majority of said tubes communicating with the uptake of the front vertical member and the remainder of said tubes communicating with the downtake thereof.

3. An element for a sectional steam-generator comprising a vertical header divided longitudinally into two chambers, a short vertical header opposite the lower end thereof, a series of water-tubes connecting said headers, some of said tubes communicating with one of the chambers in the divided header and the remainder of said tubes communicating with the other chamber in said divided header, and other water-tubes connected to said divided header and comprising outer tubes communicating with one of the cham-

bers in said header and having their outer ends closed, and inner open-ended tubes communicating with the other chamber in said header and projecting into the outer tubes.

4. In steam-boilers, the combination of an elevated steam and water drum, vertical headers connected to said drum and divided into two chambers, water-tubes communicating with the downtake and uptake of the headers, two or more of said headers extending downwardly below the other headers, short vertical headers at the opposite end of the boiler in line with the extended portions of the front headers, and a series of water-tubes connecting each of said short vertical headers with the extended portions of a front header, some of said tubes communicating with the downtake of the front header and the remainder of said tubes communicating with the uptake of said header.

5. In steam-boilers, the combination of an elevated steam and water drum, vertical headers communicating with said drum and divided into two chambers, water-tubes comprising inner and outer tubes communicating respectively with the downtake and uptake of said headers, two or more of said headers extending downwardly below the others, short vertical headers or boxes at the rear end of the boiler in line with the extended portions of the front headers, and a series of water-tubes connecting each of said rear headers with an extended front header, a majority of said tubes communicating with the uptake of the front header and the remainder of said tubes communicating with the downtake of said front header.

6. In steam-generators, the combination of two vertical headers divided longitudinally into two chambers, and a cross box or lintel connecting said vertical headers and communicating with the uptake of one of said headers and the downtake of the other of said headers.

7. In a steam-generator, the combination of two vertical headers divided longitudinally into two chambers, two vertical rear boxes or headers, a series of water-tubes connecting each of said rear vertical boxes with each of the vertical front headers, some of said tubes communicating with one of the chambers of said front header and the remainder of said tubes communicating with the other chamber of said front header, and a cross box or lintel connecting said rear vertical boxes.

8. In steam-generators, the combination of two vertical front headers divided longitudinally into two chambers, two rear vertical boxes or headers, a series of water-tubes connecting said rear boxes or headers with said front headers, some of said tubes communicating with one chamber of said front headers and the other of said tubes communicating with the other chamber of said front headers, a cross box or lintel connecting said front headers and communicating with the uptake of one header and the downtake of the other

header, and a cross box or lintel connecting the two rear vertical boxes or headers.

9. In steam-boilers, the combination of an elevated steam and water drum, vertical headers divided into two chambers, water-tubes connected to said headers and comprising inner and outer tubes communicating respectively with the downtake and uptake of said headers, two or more of said headers extending downwardly below the others, a cross box or lintel connecting said extended headers and supporting the intermediate headers, said lintel communicating with the uptake of one header and the downtake of the other header, two or more vertical rear boxes or headers, and a series of water-tubes connecting each of said rear headers with the extended portion of a front header, some of said water-tubes communicating with the downtake of the front header and the others communicating with the uptake of said header.

10. In steam water-tube boilers, the combination of an elevated steam and water drum, a series of headers communicating therewith and divided into two chambers, water-tubes connected to said headers and comprising inner and outer tubes communicating respectively with the downtake and uptake of the headers, two or more of said headers extending downwardly below the others, a cross box or lintel supporting the intermediate headers and connected with the two side headers, said cross box or lintel communicating with the downtake of one of said headers and the uptake of the other of said headers, two or more vertical rear boxes or headers, and a series of water-tubes connecting each of said rear headers with the extended portion of a front header, a majority of said tubes communicating with the uptake of the front header and the remainder with the downtake of said front header.

11. In steam water-tube boilers, the combination of an elevated steam and water drum, of vertical headers communicating therewith and divided into two chambers, water-tubes connected to said headers and comprising inner and outer tubes communicating respectively with the downtake and the uptake of the headers, two or more of said headers extending downwardly below the others, a pair

of rear boxes or headers, and a series of tubes connecting each of said rear headers with the extended portion of a front header, some of said tubes communicating with the uptake of the front headers and the remainder with the downtake thereof, and a cross box or lintel connecting said rear headers.

12. In steam water-tube boilers, the combination of an elevated steam and water drum, vertical headers communicating therewith and divided into two chambers, water-tubes connected to said headers and comprising inner and outer tubes communicating respectively with the downtake and uptake of the headers, two or more of said headers extending downwardly below the others, a cross box or lintel connecting said extended headers and supporting the intermediate headers, said lintel being connected to the downtake of one of said headers and the uptake of the other of said headers, two or more vertical rear headers, a series of water-tubes connecting each of said headers with the extended portion of a front header, some of said tubes communicating with the downtake of the front header and the remainder with the uptake of the front header, and a cross box or lintel connecting said rear headers.

13. In a steam-generator, the combination with two vertical headers divided longitudinally into two chambers, two rear vertical headers, a series of water-tubes connecting each front vertical header with the rear vertical header, some of said tubes communicating with the uptake of said front headers and the remainder of said tubes communicating with the downtake thereof, the tubes connecting with the uptake of one header having a greater capacity than those connected to the uptake of the other header, and the tubes connected with the downtake of the first header having a smaller capacity than those connected to the downtake of the second header, and a cross box or lintel connecting the rear headers.

In testimony whereof I, the said JAMES P. SNEDDON, have hereunto set my hand.

JAMES P. SNEDDON.

Witnesses:

E. E. BAKER,
J. C. FRANK.