

(No Model.)

4 Sheets—Sheet 1.

W. M. MACKAY.
SECTIONAL STEAM BOILER.

No. 496,089.

Patented Apr. 25, 1893.

Fig. 2.

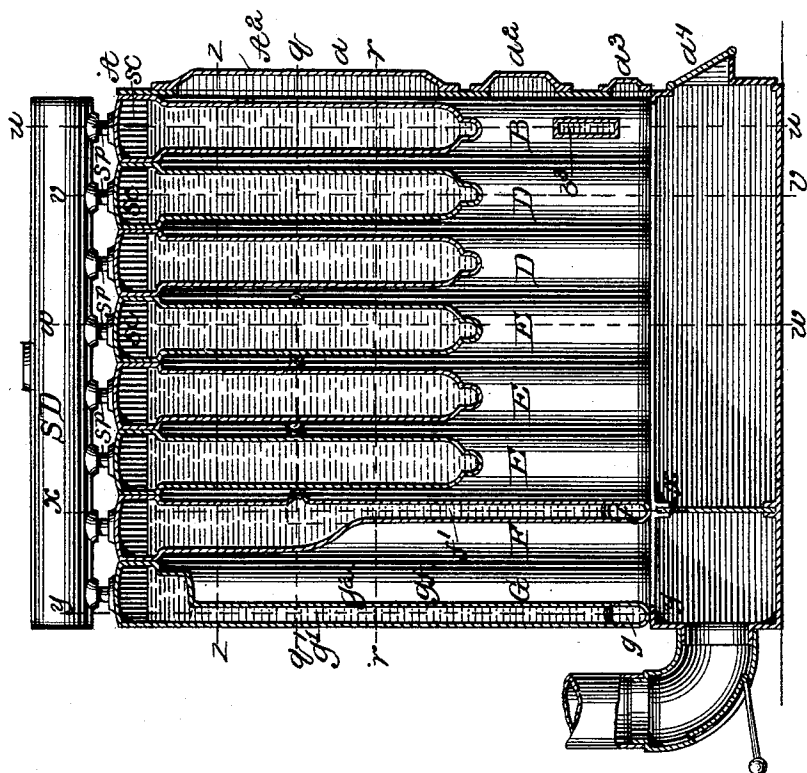
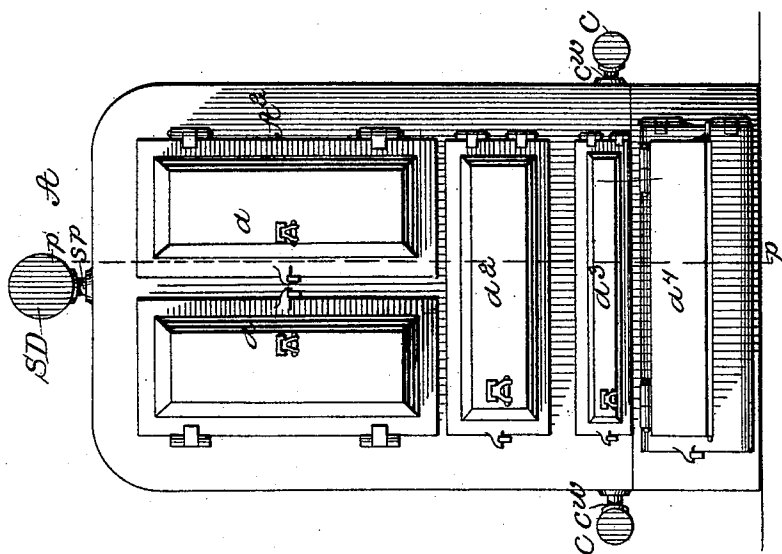


Fig. 1.



Witnesses:

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James F. Duhamel

Inventor:

Wm. M. Mackay
for *W. M. Mackay*

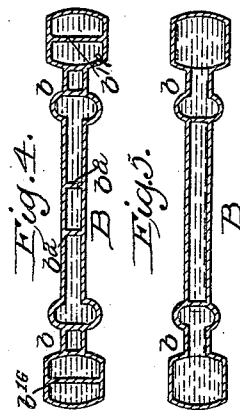
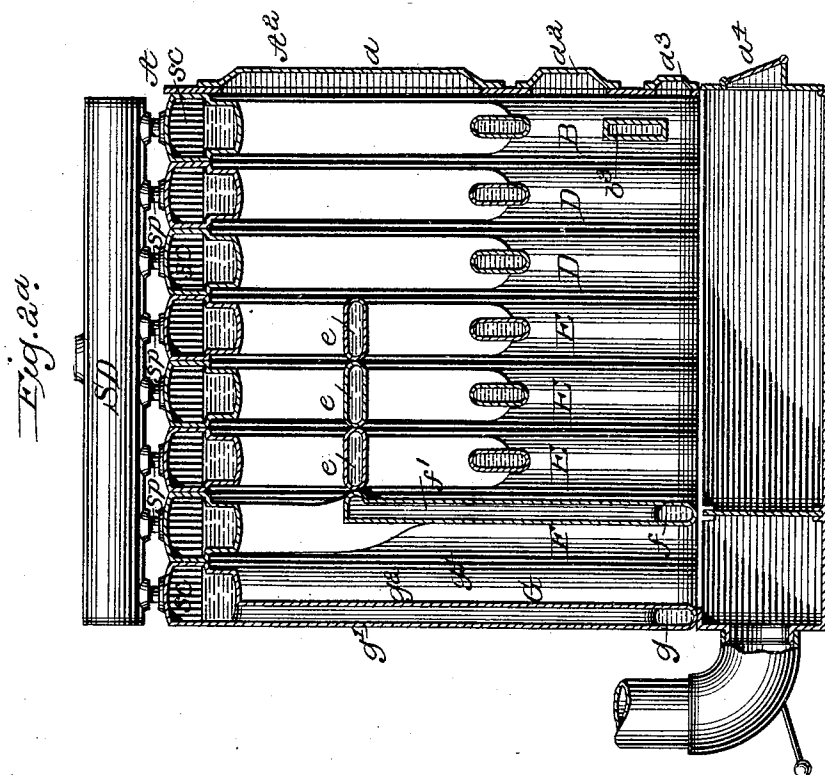
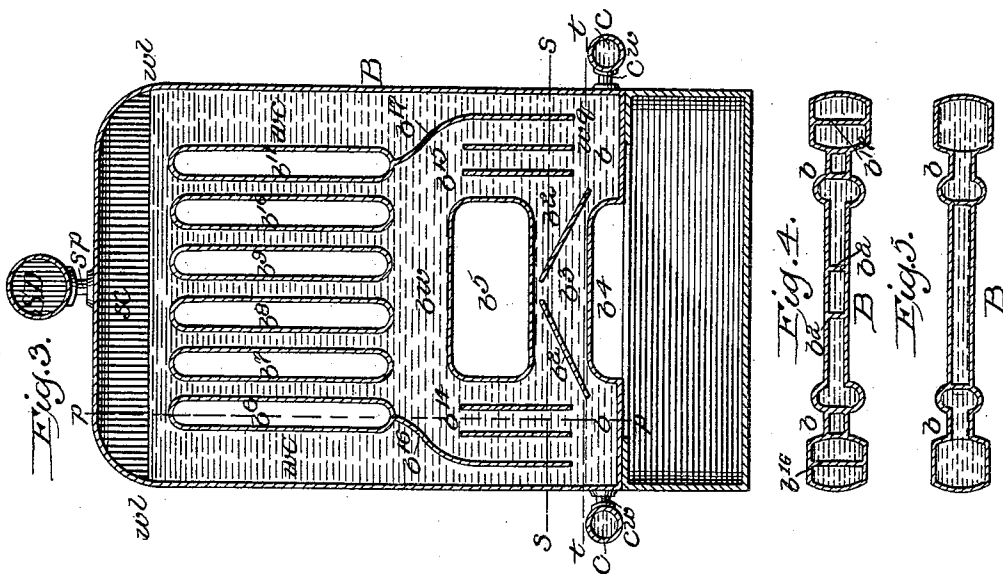
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Witnesses:

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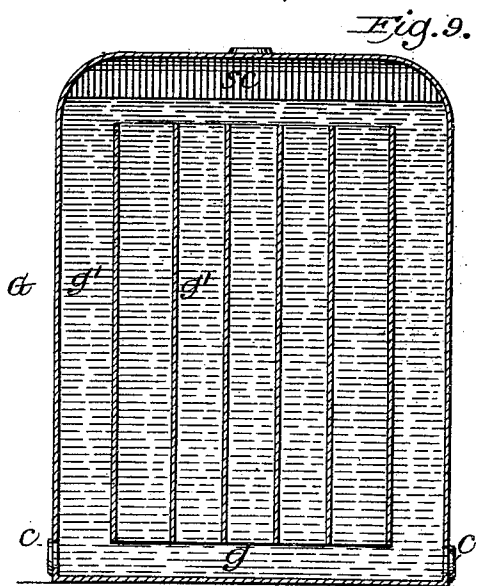
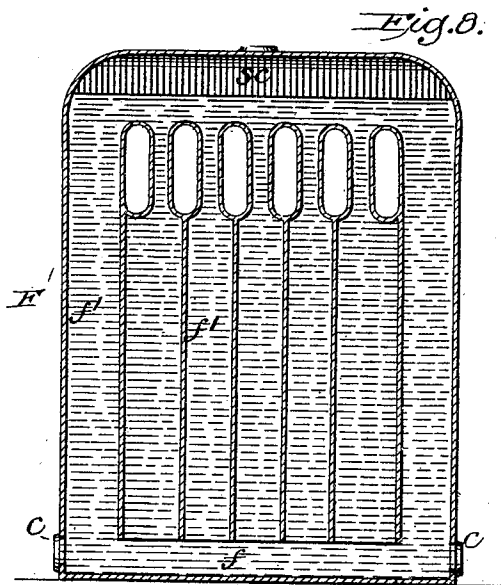
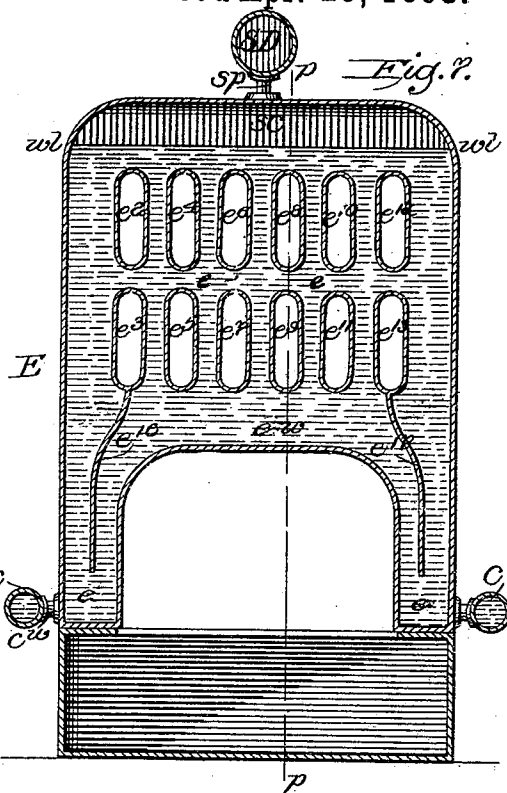
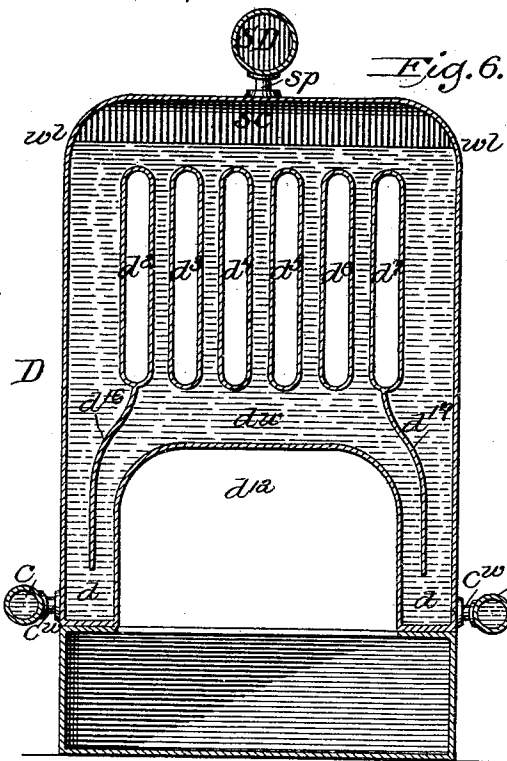
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W. M. MACKAY.
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No. 496,089.

Patented Apr. 25, 1893.



Witnesses

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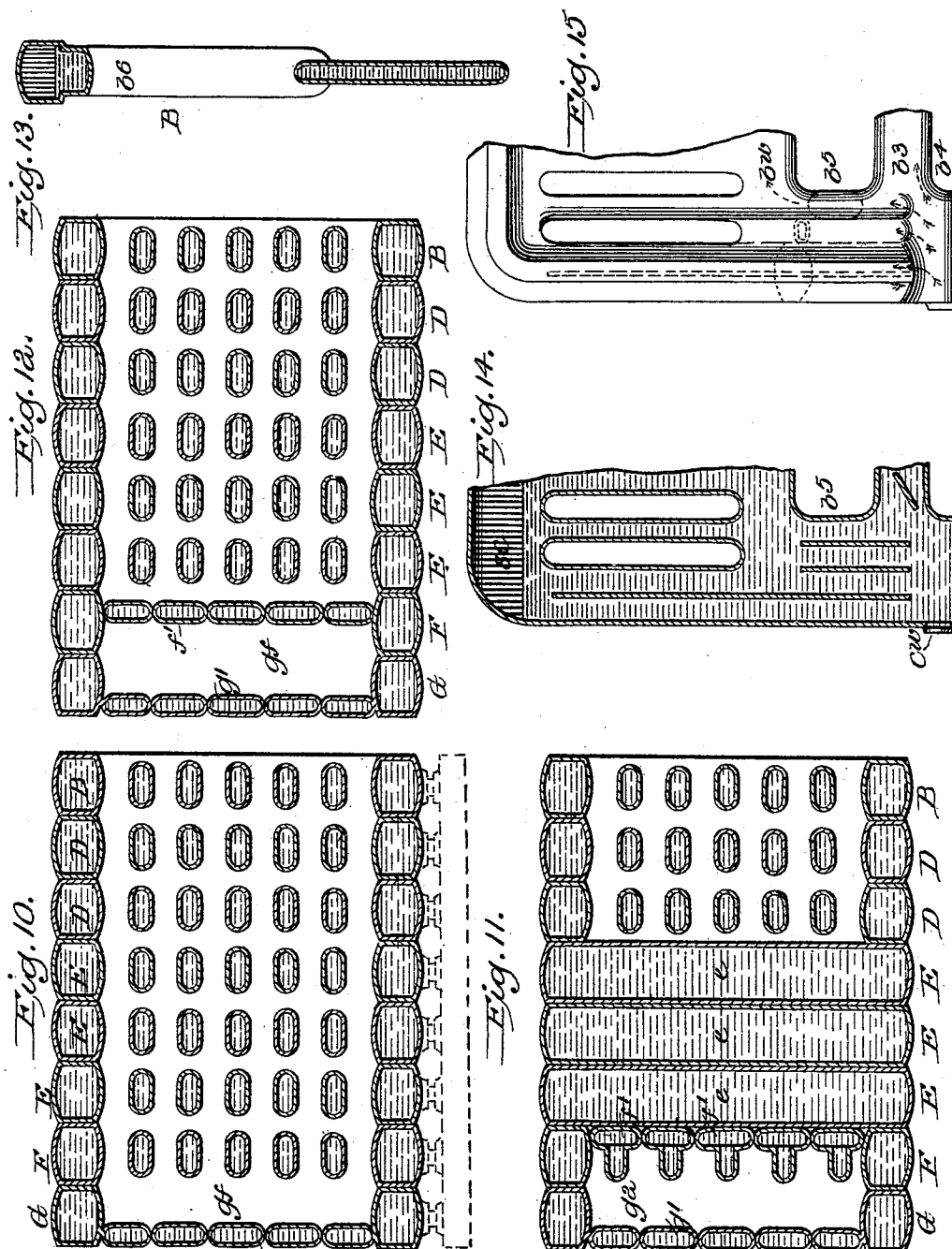
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W. M. MACKAY.
SECTIONAL STEAM BOILER.

No. 496,089.

Patented Apr. 25, 1893.



Witnesses:
Arthur Ashbery
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UNITED STATES PATENT OFFICE.

WILLIAM M. MACKAY, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE
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SECTIONAL STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 496,089, dated April 25, 1893.

Application filed January 9, 1893. Serial No. 457,804. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. MACKAY, a citizen of the United States, and a resident of the city of Newark, in the county of Essex, in the State of New Jersey, have invented a new and useful Sectional Steam-Boiler, of which the following is a correct description.

The invention relates generally to that class of sectional steam-boilers which are composed of vertical sections which, in assembling, are placed face to face, to constitute by their jointure, in their outer portion, the shell of the boiler, and in their interior portion, the combustion-chamber of the boiler, and the smoke-flues which lead therefrom; and it relates particularly to certain improvements upon the boiler which constitutes the subject of United States Patent, No. 476,804, which was issued to me on the 14th day of June, 1892.

The invention consists in part in certain improvements in the front steam and water section of the boiler, whereby the front and rear walls of the section are additionally connected together, and are thereby greatly strengthened against pressure from within or from without; whereby the water-containing capacity of the section is increased; and whereby the circulation of the currents of water within the section is facilitated and accelerated, and its steam-producing power is augmented.

The invention consists also in certain improvements in the transverse steam and water sections which are located immediately behind the front steam and water section;—whereby increased rapidity in the circulation of the water-currents, and increased strength in the construction of the sections, are insured.

The invention consists also in certain improvements in several of the transverse steam and water sections which are located immediately in front of the bridge-wall section;—whereby the circulation of the water-currents is accelerated; whereby the strength of the section is increased; and whereby portions of such sections are made to constitute, when assembled, a horizontal deflecting diaphragm which operates to change the direction of the

flow of the volatile products of combustion, and in effecting such change of direction, to most effectively utilize the heat contained in such products.

The invention consists also in certain improvements in the bridge-wall section of the apparatus, whereby the impact of the heated and volatile products of combustion is more effectually utilized in the acceleration of the movement of the water currents, and in the production of steam; and whereby a diving-flue space of large capacity is provided within the area of the section itself,—thereby obviating necessity for the employment of an additional open section between the bridge-wall section and the rear closing steam and water section.

The invention consists also in certain improvements in the rear or closing steam and water section, whereby a large diving-flue space is provided within the front and rear planes of the section, and whereby the extent of the water space, from front to rear, is so reduced, as to insure a high temperature in the contents thereof, under all conditions within the fuel-chamber, combustion-chamber, and flue-system of the apparatus.

The invention consists also in various novel combinations or operative assemblages of parts in a sectional steam-boiler, as will appear from the following detailed description of the construction and operation thereof, and from the paragraphs which follow such detailed description.

In the accompanying drawings which constitute a part of this specification—Figure 1 represents a front elevation of the sectional steam-boiler. Fig. 2 is a vertical longitudinal central section of the apparatus. Fig. 2^a is a vertical longitudinal section, as on the line *p—p* in Fig. 7. Fig. 3 is a transverse vertical central section of the front steam and water section of the apparatus, as in the line *u—u* of Fig. 2. Fig. 4 is a horizontal section, in the line *s—s*, of Fig. 3. Fig. 5 is a horizontal section, in the line *t—t*, of Fig. 3. Fig. 6 is a transverse vertical section, as in the line *v—v*, of Fig. 2. Fig. 7 is a transverse vertical section, as in the line *w—w*, of Fig. 2. Fig. 8 is a transverse vertical section, as in the line

$x-x$, of Fig. 2. Fig. 9 is a transverse vertical section, as in the line $y-y$, of Fig. 2. Fig. 10 is a transverse horizontal section, as in the line $z-z$, of Fig. 2,—the front closing-plate or door-section having been removed. Fig. 11 is a transverse horizontal section, as in the line $q-q$, in Fig. 2. Fig. 12 is a transverse horizontal section, as in the line $r-r$, of Fig. 2,—the front closing-plate, or door-section, having been removed. Fig. 13 is a vertical longitudinal section of the front steam and water section,—as in the line $p-p$, of Fig. 3. Fig. 14 is a detail vertical transverse section of the front steam and water section. Fig. 15 is a diagram representing the manner in which currents of water, received within the inlet water-ways or chambers, are conducted to the transverse water-ways or chambers.

In further reference to the several figures of the drawings, it will be seen that the front closing-plate or door-section A^2 , of the boiler A , is provided in its upper portion, with a pair of flue-doors a ; that immediately below the middle portion, is the fuel-door a^2 ; below which is the slicing-door a^3 , which is immediately above the ash-pit door a^4 , which in practice will be provided with registered air-inlet openings. Like the other transversely-extending steam and water sections, the front steam and water section B has, at each side, at its foot, a tapped opening, for connection of the nipple from a longitudinally-extending cold water supply pipe C . Coincident with each of the cold water openings cw , is a horizontal chamber or inlet water-way b , which is merged, in its upper portion, first, in an outer vertical water column wc ; next, in a secondary water-passage wp ; and thirdly, in part in a vertical water-passage wq , at one side, while at its inner extremity it opens into the transversely-extending water-chamber b^3 , between the slicing-door passage b^4 , and the fuel-door opening b^5 .

Within the transverse horizontal water-chamber b^3 , longitudinally-arranged deflecting diaphragms b^2 , extend from front to rear of the section and, from their coincident upper extremities, in a plane a short distance below the top of the chamber, they incline downwardly and outwardly, as shown, to a point near the outer vertical plane of the chamber, and to a point in a plane a short distance above the bottom of such chamber.

Above the feed or fuel-supply opening b^5 , vertically-extending clearing-openings b^6 , b^7 , b^8 , b^9 , b^{10} , b^{11} , corresponding in number and location to the smoke-flues in the several steam and water sections which are in rear of the front steam and water section, are provided, the intervening and surrounding contiguous spaces being, ordinarily, filled with water to about the plane indicated by the dotted line $w-l$.

From the lowermost extremity of the two outermost flue-clearing openings, b^{16} and b^{11} , diaphragms, b^{16} and b^{17} respectively, extend, first preferably in a curved line, downwardly

and outwardly, to a point at about the center of the water-column wc , and then directly downward to a point near the lower extremity of such water-column.

It should be understood that the diaphragms or deflecting-plates b^{16} and b^{17} extend longitudinally of the apparatus, from front to rear of the section, and that the entire section is formed as an integer,—that is, as a single casting.

It will be understood that at a point coincident with the water-way or water-chamber b^3 , in the front steam and water section, the water-passage wq is cut away or left open, to permit supply of water to such water-way or chamber; and that at a point opposite to the water-way or chamber bw , the wall of the water-way wp is in like manner cut away or discontinued, to permit the currents of water to pass from such water-way or passage wp , to the horizontal chamber water-way or passage bw .

Directly in rear of the front steam and water section B , are the front fuel and combustion-chamber steam and water sections D , in any desired or suitable number,—each corresponding in its exterior outline, in the number and in the relative location of its smoke-passages,— d^2 , d^3 , d^4 , d^5 , d^6 , and d^7 ;—and also in the location, arrangement, and extent of its curved outwardly and downwardly extending diaphragms d^{16} and d^{17} , with the similar elements in the front steam and water section B . It will be observed however, that the fuel-space or fuel-chamber portion d^{12} , and the water-way or water-chamber dw , are of much broader dimensions than the fuel-door or fuel-supply passage b^5 , and its corresponding water-chamber bw , in such front steam and water section; and that at the right and at the left of the fuel-chamber the water-space is of smaller horizontal extent, from left to right, and is divided into but two vertical passages.

In rear of the front fuel and combustion-chamber steam and water sections D , are the rear fuel and combustion-chamber steam and water sections, or diaphragm-sections E . These are provided, in any suitable number, in the interval between the open or undiaphragmed sections D , above described, and the bridge-wall section F . These sections differ from the sections D , in that, in the plane of the bridge-wall, they are enlarged, or spread out, as it were, front and rear, their outer portions meeting, and forming by the contact of these enlargements e , a continuous smoke-deflecting diaphragm. This provision has the important effect of bisecting the longitudinal smoke-passages,—as represented in the sections D ,—and thus converting each of such passages into two distinct short flues, e^2 , e^4 , e^6 , e^8 , e^{10} , and e^{12} , above the diaphragm,—and e^3 , e^5 , e^7 , e^9 , e^{11} , and e^{13} , below such diaphragm, and of changing the point at which the products of combustion escape from the combustion-chamber,—in their passage to the diving-flue,—from the crown of the bridge-wall, to the

front extremity of the first of the diaphragm-sections E.

Immediately in rear of the rear fuel and combustion chamber steam and water sections or diaphragm-sections E, is the bridge-wall steam and water section F. This section like all the other steam and water sections is, in all its outer portions, of uniform longitudinal extent, so as to form with each contiguous section a close joint; but from a point a short distance below the upper extremity of the combustion and smoke space, it is downwardly reduced or indrawn from the rear toward the front, to a point a short distance below the plane of the bridge-wall, from which point the water compartments or tubes *f*, of which the section is mainly composed, are spread out or flattened, transversely of the apparatus, so as to provide below the bridge-wall a thin water space *f'*. On reference to Figs. 2 and 11 of the drawings, it will be seen that under this construction the water spaces of the section are not reduced in capacity but are simply changed in direction and in their relation to the opposing smoke-currents. It will however be observed that two important results arise from the peculiar formation of this section. The provision of a water-space of inconsiderable longitudinal extent, insures the maintenance of a high degree of heat in the contents thereof, without necessity for a large consumption of fuel,—the water-space being continually in contact, on its front face, with the incandescent fuel, and upon its rear face with the descending highly heated volatile products of combustion; and the reduction, below the plane of the bridge-wall, of the longitudinal area of the water-space, serving to produce a corresponding increase in the capacity of the diving-flue *gf*, and thereby obviating necessity for the provision of an independent open section between the bridge-wall steam and water section, and the rear or closing steam and water section.

The rearmost or closing steam and water section G, is, in its outer portion, of like longitudinal and transverse extent with the other steam and water sections, but, as will be seen in Fig. 2, instead of slight recesses only, in both front and rear faces of the upper portions of the sections,—as in the combustion-chamber steam and water sections D and E,—it is recessed wholly in its front. In other words,—its vertical steam and water tubes *g'*, which extend from the transverse water-way *g*, at its base, to the steam-chamber *sc*, at its upper extremity, are arranged edge to edge, transversely of the section, and at the rear extremity thereof, thereby producing a recess or cavity *g''*, of large capacity, in its front,—in substantial reversal of the construction shown in the lower portion of the bridge-wall section,—in connection with which the closing-section forms a diving-flue *gf* of ample capacity. It will be apparent that under this construction, the heat contained in the descending volatile products of combustion will

in large degree be absorbed and advantageously utilized in elevating the temperature of the contents of the section.

As will be seen in the drawings, each of the transversely-extending steam and water sections is provided, at its upper extremity, with a connecting-pipe *s, p*, through which steam is discharged into the surmounting longitudinal steam-drum SD.

To persons skilled in the art to which the invention relates, it will be obvious that the vertical diaphragm in the steam and water columns, might, as represented in Fig. 14, extend directly upward, from its lower extremity to a point in the upper portion of the section, a short distance below the water-line,—instead of being curved inwardly to the lower extremity of the outermost flue-clearing opening,—with substantially the same resultant advantages. It will be apparent that by reason of the peculiar location and arrangement of the several guide-plates or diaphragms in the front steam and water section, and of the inner and outer diaphragms in the fire-box or fuel-chamber sections, the flow of the cooler currents downward, and of the warmer currents upward, will be greatly facilitated and accelerated, such plates or diaphragms serving not only to deflect, but to separate such currents from each other, and to impart to them an added impulse in the direction in which they are impelled by their own temperature.

Through the provision of the projecting chambers or lateral enlargements upon the sections in front of the bridge-wall, by which a flue-plate or diaphragm is in effect produced, the escaping volatile products of combustion are prevented from passing directly to the crown of the bridge-wall, and are directed toward the front of the apparatus, and are brought more closely in contact with the upper portions of the inclosing steam and water sections.

The relatively thin or outspread formation of the lower front portion of the bridge-wall section,—wholly exposed upon both faces to the direct action of the heat particles, insures quick steam production, and thorough utilization of the heat evolved through combustion. The same is true, only in a diminished degree, of the analogous construction shown in the rear covering or closing section.

The nature, the objects, and the peculiarities of the invention having been thus set forth and the distinguishing features of the apparatus in which it is embodied having been thus fully described, what is claimed is—

1. A sectional steam-boiler the front steam and water section of which embraces, in its outer portion inclosing left and right steam and water columns; a horizontal longitudinal recessed or bifurcated opening or passage, in the central lowermost portion of the section; a fuel opening or supply passage, below the midheight of the section; and a transverse water-way or chamber, below the fuel-door

passage, which is in open communication with the left and right steam and water columns.

2. A sectional steam-boiler the front steam and water section of which embraces inclosing left and right steam and water columns; a central slicing-door passage, at the lower extremity of the section and embraced by its bifurcation; a horizontally-extending inlet water-way, coincident with each side of the slicing-door passage; and a transverse water-way or chamber which is directly above the central slicing-door passage, and which is in communication with the inclosing left and right steam and water columns, and with the coincident horizontally-extending inlet water-ways.

3. In a sectional steam-boiler, a front steam and water section which at its lower extremity is provided with a central slicing-door passage; a horizontal inlet water-way, at each side of the slicing-door passage; an intermediate water-way or water-chamber, directly above the central slicing-door passage; and oppositely-placed inclined guide-plates or deflecting diaphragms, in the water-way above the slicing-door passage, which extend from the central upper portion of such water-way, to a point near the lower and outer extremity thereof;—substantially as and for the purposes set forth.

4. A sectional steam-boiler the front steam and water section of which, at its lower extremity, is provided with a central slicing-door passage; a transversely-extending inlet water-way or chamber, in a plane with the slicing-door passage; a transversely-extending water-way or chamber, directly above the central slicing-door passage; and oppositely-placed inclined guide-plates or deflecting-diaphragms, in the water-way or chamber above the slicing-door passage, which extend from a point in the central upper portion of such upper water-way or chamber, to a point near the lower and near the outer extremity thereof; combined and arranged substantially as shown and described.

5. A sectional steam-boiler one of the steam and water sections of which is provided with a left steam and water column, and with a right steam and water column; with a series of elevated, longitudinally-extending, vertically-arranged flue-clearing openings; and with a guide-plate or deflecting-diaphragm which extends from the front to the rear wall of the section, and from the lower extremity of each of the two outermost flue-clearing openings, first downwardly and outwardly, and then directly downward, to a point near the lower extremity of such steam and water section; substantially as specified.

6. A boiler which is composed of an independent base or ash-chamber section, and a series of transversely-extending steam and water sections one of the water-sections of which embraces a fuel-door opening or passage, in the central and lower portion of the section; a left steam and water column and a right

steam and water column; a series of elevated longitudinally-extending, vertically-arranged flue-clearing openings; and guide-plates or deflecting-diaphragms one of which extends upwardly from a point within, and near the lower extremity of each of the two steam and water columns.

7. In a sectional steam-boiler, a transversely-extending steam and water section which is provided, below the central plane thereof, with a fuel-door opening or supply-passage; with a left steam and water column, and a right steam and water column; with opposite horizontal inlet water-ways or chambers, at the foot of and in open communication with the steam and water columns; with a series of elevated longitudinally-extending, vertically-arranged flue-clearing openings; and with a guide-plate or deflecting-diaphragm which extends from the lower extremity of each of the two outermost flue-clearing openings, first downwardly and outwardly, and then directly downward to the upper extremity of the opposite horizontal inlet water-ways or chambers.

8. In a sectional steam-boiler, a transversely-extending steam and water section which embraces a left steam and water column, and a right steam and water column; a horizontal inlet water-way or water-chamber, at the foot of and in open communication with the steam and water column; a series of vertically-arranged, longitudinally-extending flue-clearing openings or passages, in the upper portion of such steam and water section; and a guide-plate or deflecting-diaphragm which extends from the lower extremity of each of the two outermost flue-clearing openings, first downwardly and outwardly and then directly downward to a point near the lower extremity of such steam and water section; substantially as shown and described.

9. In a sectional steam-boiler, a transversely-extending steam and water section which embraces, in its upper portion a series of vertically-placed, longitudinally-extending, flue-clearing openings which at top, bottom, and sides, are inclosed by water-spaces; below its midheight portion a longitudinally-extending fuel-way or passage; at the left and at the right of the fuel-way or passage, a series of vertically-extending steam and water passages which are separated by vertical diaphragms; in its lowermost portion, horizontal inlet water-ways, and an intermediate slicing-opening; and between the slicing-opening and the fuel-way or passage, a transversely-extending water-way which at its left and right extremities communicates with the contiguous vertically-extending steam and water passages.

10. A sectional steam-boiler the fuel and combustion-space of which is inclosed, above and laterally, by a series of steam and water sections each of which is open or bifurcated in its lower portion, and each of which embraces exterior vertical left and right steam

and water columns which are divided in their main lower portion, by vertically-arranged longitudinally-extending guide-plates or diaphragms; an upper steam space or chamber; an intermediate or midheight transversely-extending chamber or passage which directly connects the vertical exterior or inclosing columns, and which, longitudinally of the boiler, is of an extent about equal to one-third the longitudinal extent of such inclosing columns; and a series of vertically-arranged passages which extend downwardly from the steam-space or chamber, and embrace or overlap and unite with the intermediate or mid-height chamber or passage.

11. A sectional steam-boiler the fuel and combustion-space of which is inclosed, above and laterally, by a series of steam and water sections each of which embraces exterior vertical left and right steam and water columns; an upper steam space or chamber; an intermediate or mid-height transversely-extending water-way which directly connects the left and right water and steam columns, and which longitudinally of the boiler, is of an extent about equal to one-third the longitudinal extent of such left and right columns; and a series of vertically-arranged passages which extend downwardly from the steam space or chamber, and embrace or overlap and unite with the intermediate or midheight chamber or passage, and which in a plane at about the vertical mid-distance between the steam space or chamber and the transverse water-way, are provided with enlargements which extend horizontally outward, and which meet the contiguous sections, edge to edge, and jointly constitute a smoke-deflecting diaphragm.

12. In a sectional steam-boiler, a series of steam and water sections which in their entire longitudinal extent embrace the fuel and combustion space, above and laterally; and which in a portion of their longitudinal extent are provided with integral chambered edge to edge enlargements which extend in a horizontal plane with the bridge-wall which divide such portion into lower and upper horizontally-extending passages, for the escape of the volatile products of combustion.

13. A sectional steam-boiler in which are combined a series of transversely-arranged steam-and-water sections, each of which, in horizontal plane with the bridge-wall, is provided with a deflecting enlargement,—the several enlargements being in contact, edge to edge, and serving by their contiguity to direct the escaping products of combustion into the unenlarged transverse sections which embrace the front portion of the combustion-chamber.

14. In a sectional steam-boiler, the combination of two series of steam and water sections,—the front series being open, between its members, for the upward movement of the escaping volatile products of combustion; and the rear series being provided, preferably

above the midheight of each section, with outwardly-extending, coincident, integral enlargements which are contiguous to each other, and which by their continuous contact, constitute an intercepting and deflecting diaphragm, whereby escaping volatile products of combustion are caused to pass from the rear portion of the combustion-chamber, along the under surface of the diaphragm, to the front extremity thereof.

15. In a steam-boiler which in its main portion is composed of vertical transversely-extending steam and water sections, a bridge-wall section which in its outer portion is of uniform longitudinal extent, but which in its inner or inclosed bridge-wall portion embraces, at its front, flattened or transversely spread-out, contiguous, vertical steam and water tubes which at their front are unrecessed, and at its rear is, in its main portion, continuously open or recessed from the plane of the bridge-wall downward, to the bottom transverse horizontal steam and water passage, to constitute a portion of the broad diving-flue of the boiler.

16. In a sectional steam-boiler, a bridge-wall steam and water section which in its outer portions is of uniform longitudinal extent, and which from a point a short distance below the upper extremity of the combustion and smoke space is downwardly reduced or indrawn, from the rear toward the front, to a point in or slightly below the plane of the bridge-wall, from which point the contiguous or edge to edge water compartments or tubes of which the section is composed, are unrecessed at their front, but at their rear are deeply recessed, spread out or flattened, transversely of the apparatus; whereby a thin water space is provided below the plane of the bridge-wall; substantially as and for the purposes set forth.

17. In a sectional steam-boiler, a bridge-wall steam and water section which in its outer portions is of uniform longitudinal extent, and which at its front, in and below the plane of the bridge-wall, is composed of a relatively thin, spread-out, or flattened, tubular, steam and water portion; in combination with a series of steam and water sections, which in plane with the bridge-wall, are provided or formed with outwardly-extending face to face enlargements which together constitute a continuous deflecting diaphragm which extends from the bridge-wall into and toward the front of the upper portion of the combustion-chamber.

18. A sectional steam-boiler which in its main portion is composed of transversely-extending steam and water sections, in which are combined a bridge-wall steam and water section which in its outer portion is of uniform longitudinal extent,—which in its upper interior portion is downwardly indrawn or diminished, on the rear face of the section, to a point substantially in plane with or somewhat below the plane of the crown of the

bridge-wall thereof; which below the bridge-wall is at its foot provided with a transversely-extending water-way, and is flattened or spread out at its front, and recessed at its rear; and a series of transversely-extending steam and water sections, each of which is provided with a chambered projection which extends outwardly to a similar projection upon the contiguous section,—these several projections constituting by their contact a continuous smoke-deflecting diaphragm; substantially as and for the purposes specified.

19. In a sectional steam-boiler, a bridge-wall steam and water section which in its outer or inclosing portions is of uniform longitudinal extent, and which at its front, in and below the plane of the bridge-wall, has at its foot, a transversely-extending water-way, and in its intermediate or inclosed portion, is composed of a relatively thin, spread-out, or flattened, tubular, steam and water portion; in combination with a series of steam and water sections which, in plane with the bridge-wall, are formed with outwardly-extending chambered enlargements which together constitute a continuous deflecting diaphragm which extends from the bridge-wall into and toward the front of the combustion-chamber.

20. In a sectional steam-boiler which in its main portion is composed of transversely-extending steam and water sections;—a rear or closing imperforate steam and water section which in its outer portions is of uniform longitudinal extent, which is provided with a transversely-extending water-way and with a vertical downwardly discharging smoke opening at the foot of the section, between the vertical inclosing steam and water columns; which in its intermediate or inclosed portion is composed of contiguous flattened or spread-out vertical steam and water tubes or passages; and which in its front portion,—at all points within its inclosing vertical steam and water columns, is open or recessed, from side to side and from top to bottom—whereby a relatively broad and deep diving-flue space is

provided within such closing steam and water section.

21. In a sectional steam-boiler which in its main portion is composed of vertical transversely-extending steam and water sections,—an imperforate rear or closing steam and water section which in its outer portion is of uniform longitudinal extent, and which in its inclosed or intermediate portion is composed, substantially, of rear flattened or spread-out integral vertical steam and water tubes or ways, and which at its front, in its main portion, is recessed from side to side and from its transverse upper portion to its open lower extremity; combined with a bridge-wall section which at its front has integral vertical water-tubes or ways, and which in its rear portion is deeply recessed or open at all points within its inclosing steam and water columns, and in coincidence with the recess in the body of the rear section; whereby the two opposite recesses constitute the open-bottomed diving-flue of such sectional steam-boiler; substantially as shown and described.

22. In a sectional steam-boiler, a transversely-extending section in which are combined a fuel-door opening or supply passage; a transversely-extending water way or chamber, below such fuel opening or passage; a transversely-extending water-way or chamber, above such fuel opening or passage; an inlet water-way or chamber, at each side and at the lower extremity of the section; and outer, inner, and intermediate vertical water tubes or passages which extend upwardly from the inlet water way or chamber;—the inner vertical tube or passage supplying water to the lower transverse water-way, and the intermediate vertical tube or passage supplying water to the transverse water-way or chamber above the fuel opening or passage.

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Witnesses:

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