

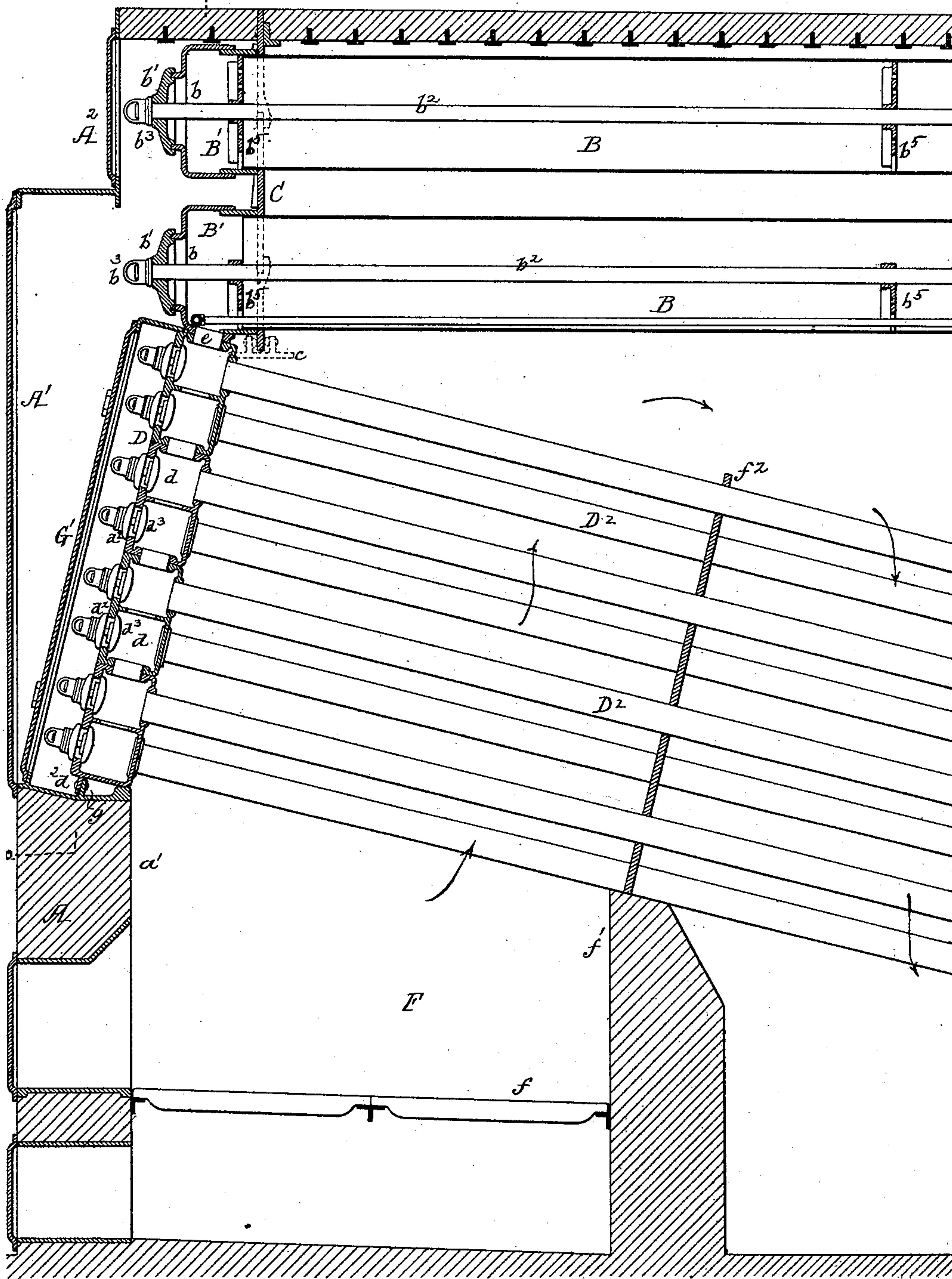
(No Model.)

5 Sheets—Sheet 1.

E. J. MOORE.
STEAM BOILER.

No. 582,939.

Patented May 18, 1897.



Witnesses:
Hamilton E. Turner
Murray E. Royer

FIG. 1A

Inventor:
Edward J. Moore
by his Attorneys,
Howson & Howson

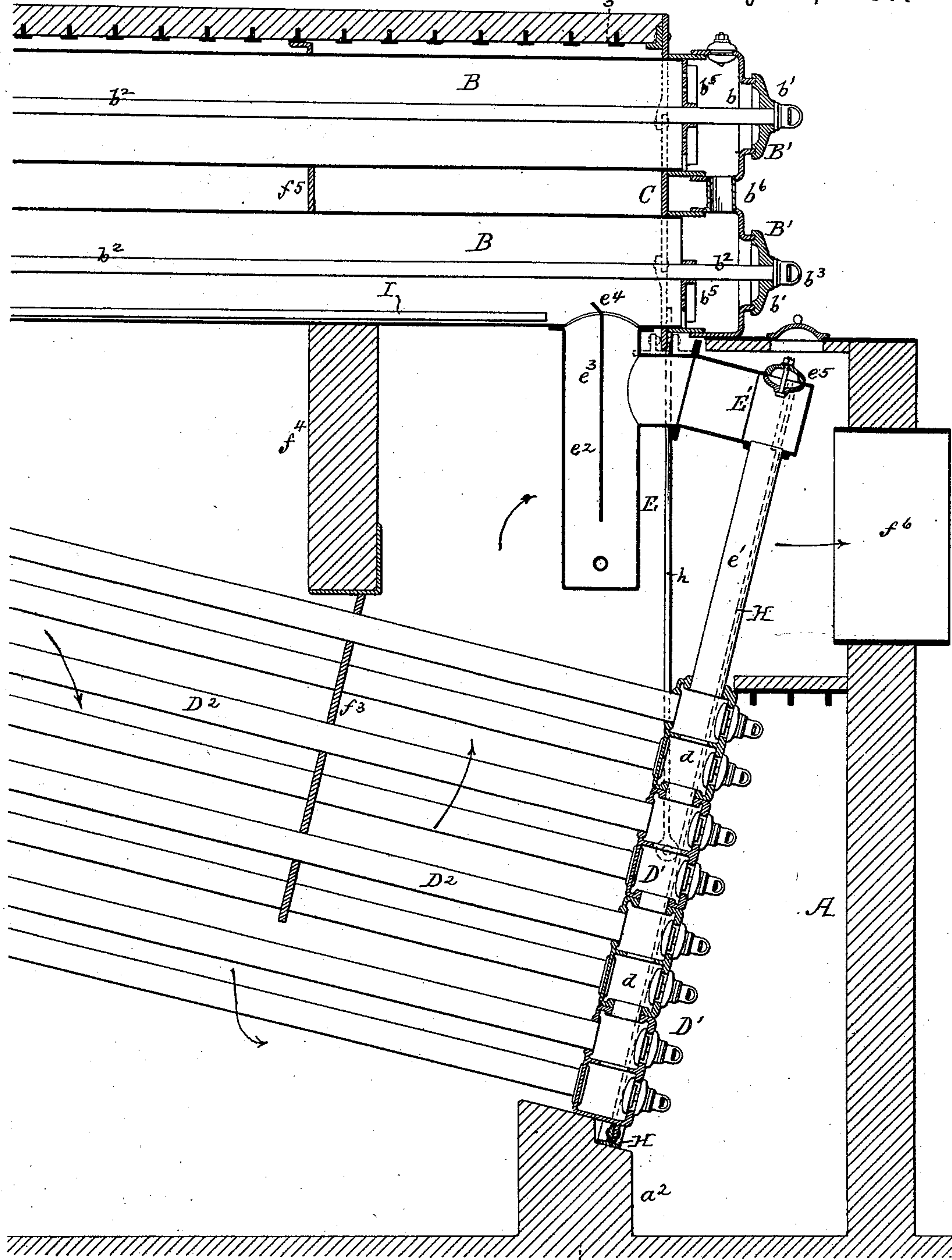
(No Model.)

5 Sheets—Sheet 2.

E. J. MOORE.
STEAM BOILER.

No. 582,939.

Patented May 18, 1897.



Witnesses:
Hamilton D. Turner
Murray C. Boyer

FIG. 1^B 3

Inventor:
Edward J. Moore
by his Attorneys,
Howson & Howson

(No Model.)

5 Sheets—Sheet 8.

E. J. MOORE.
STEAM BOILER.

No. 582,939.

Patented May 18, 1897.

FIG. 2.

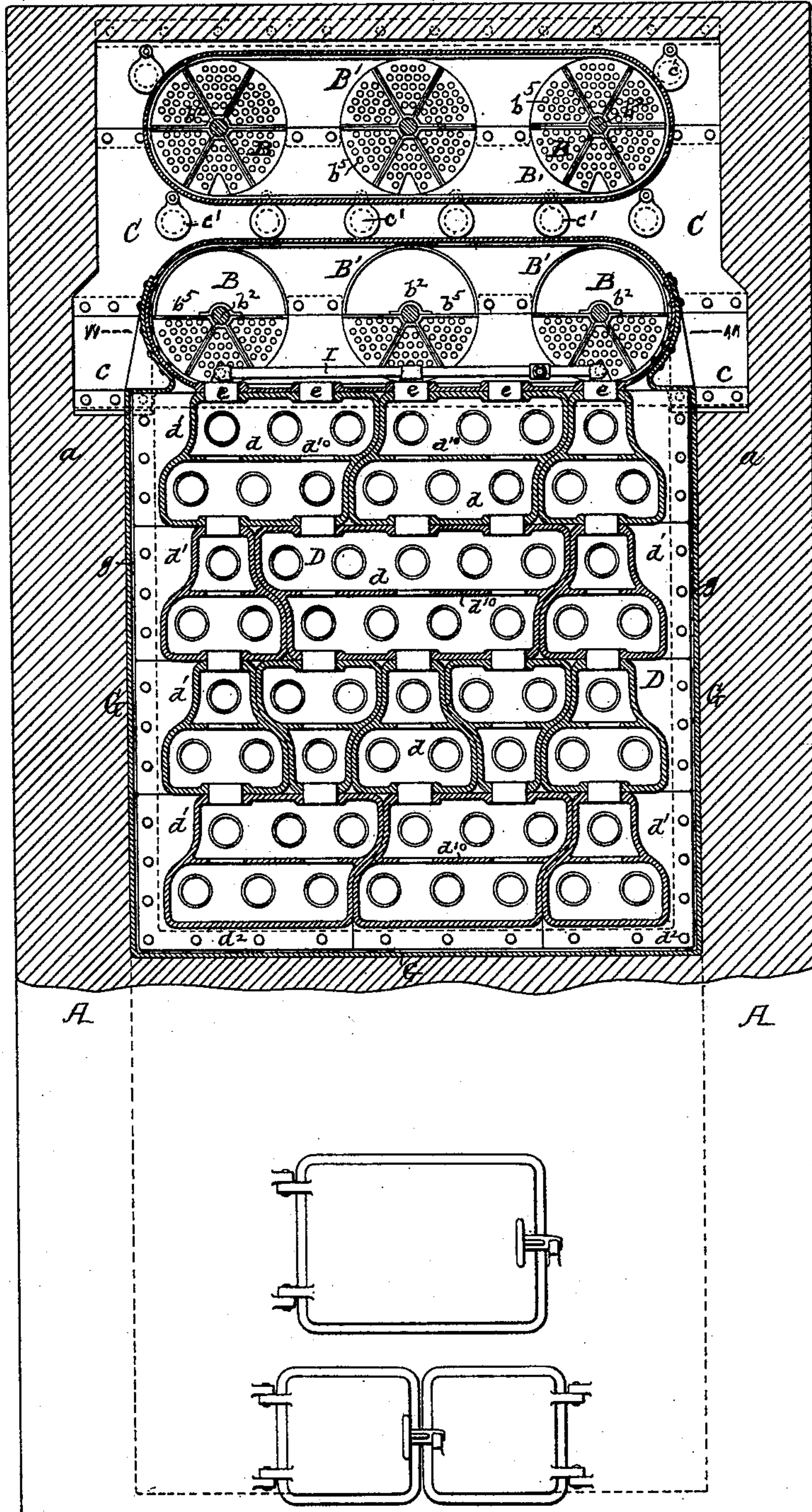
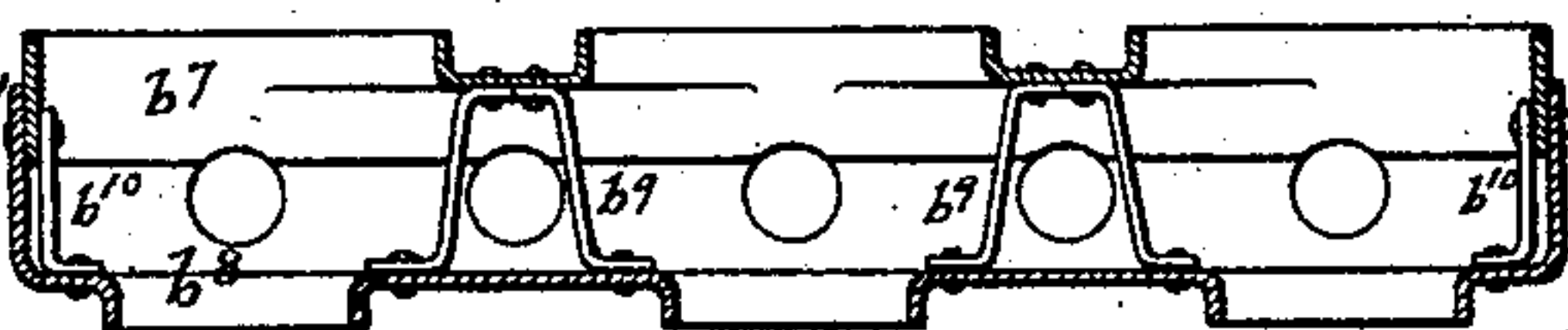


FIG. 11.



Witnesses:
Hamilton J. Turner
Murray C. Taylor

Inventor:
Edward J. Moore
by his Attorneys,
Howson & Howson

(No Model.)

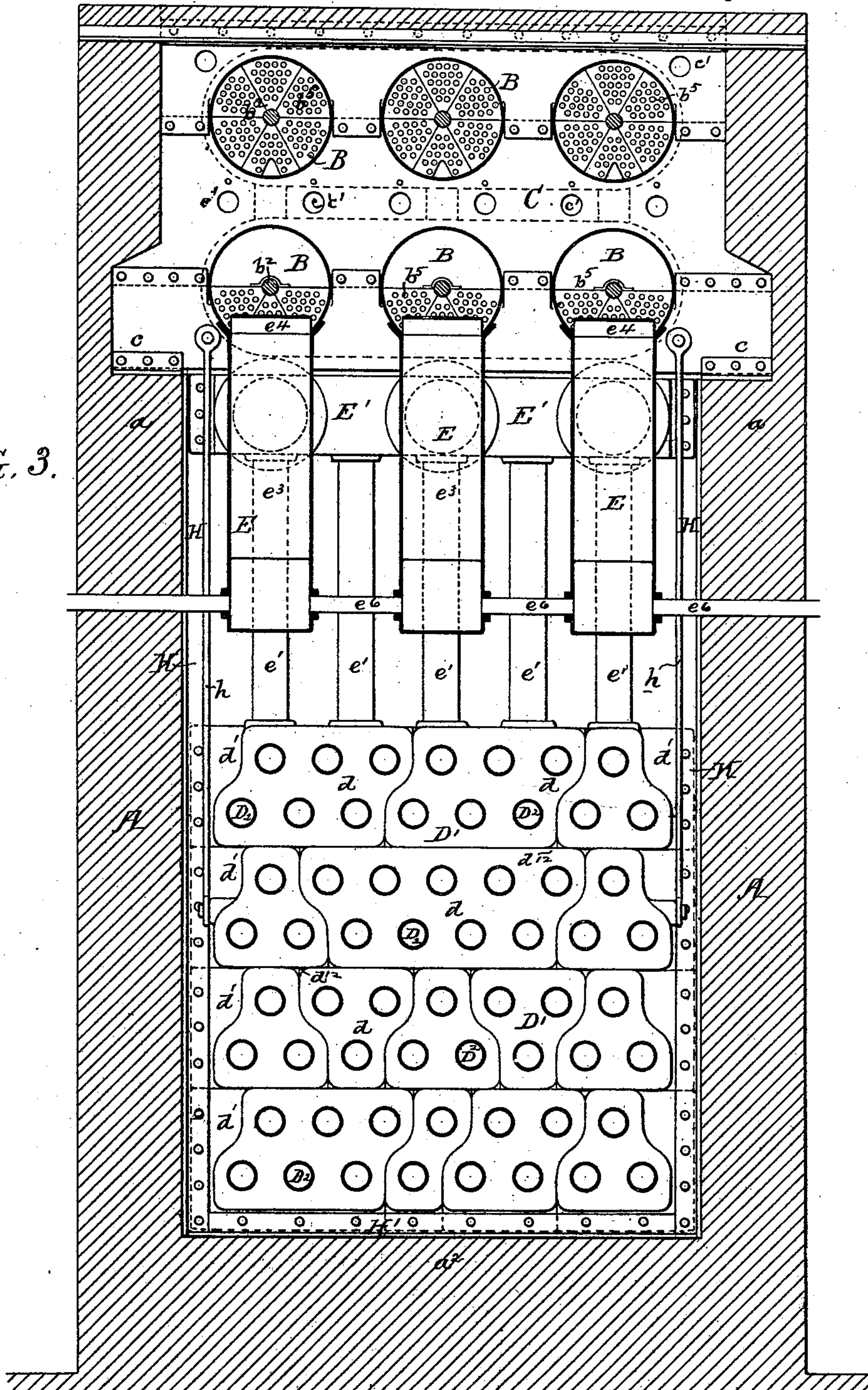
E. J. MOORE.
STEAM BOILER.

5 Sheets—Sheet 4.

No. 582,939.

Patented May 18, 1897.

FIG. 3.



Witnesses:
Baylton S. Turner
Murray Boyer

Inventor:
Edward J. Moore
by his Attorneys,
Horn & Horn

(No Model.)

5 Sheets—Sheet 5.

E. J. MOORE.
STEAM BOILER.

No. 582,939.

Patented May 18, 1897.

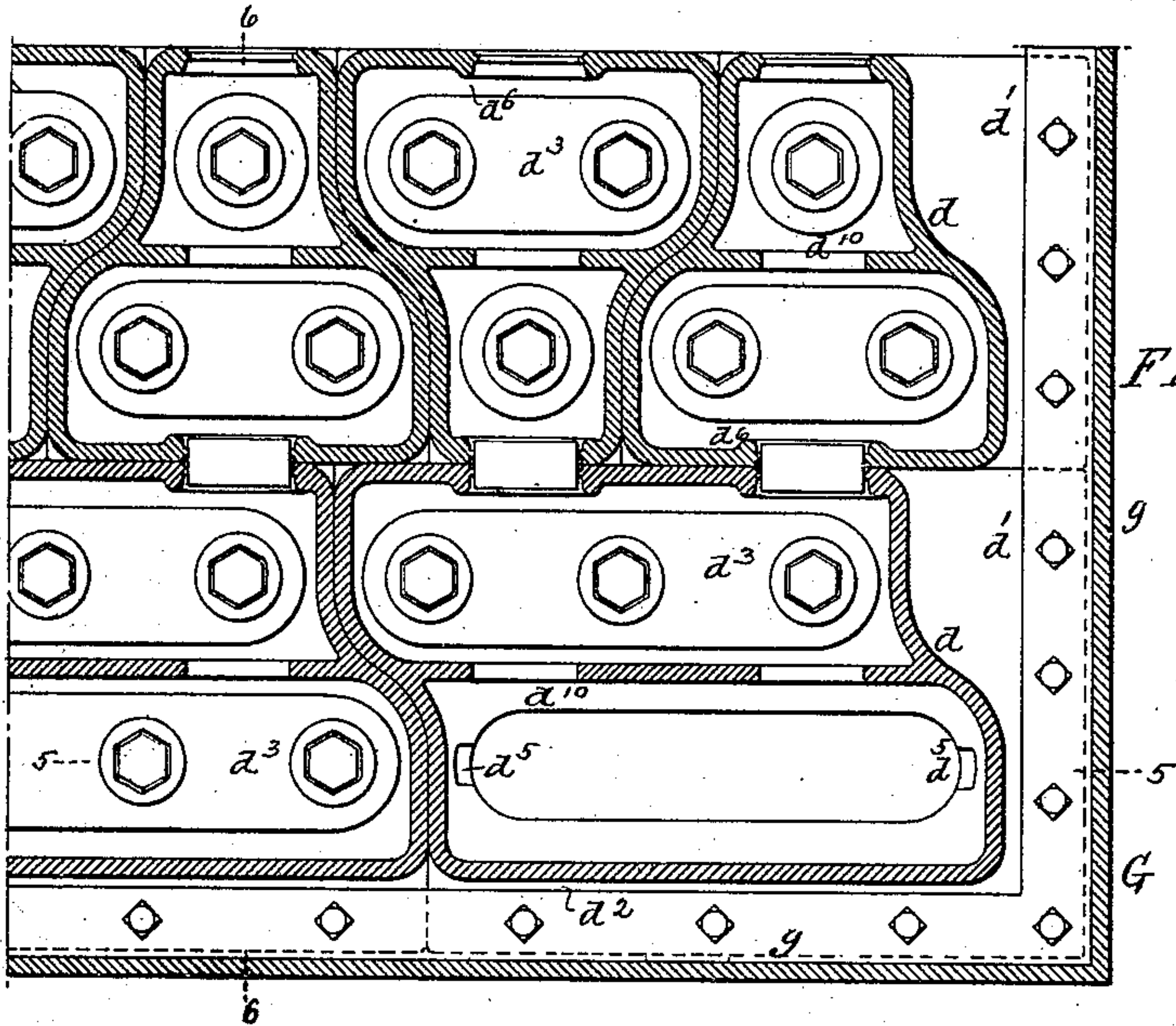


FIG. 5.

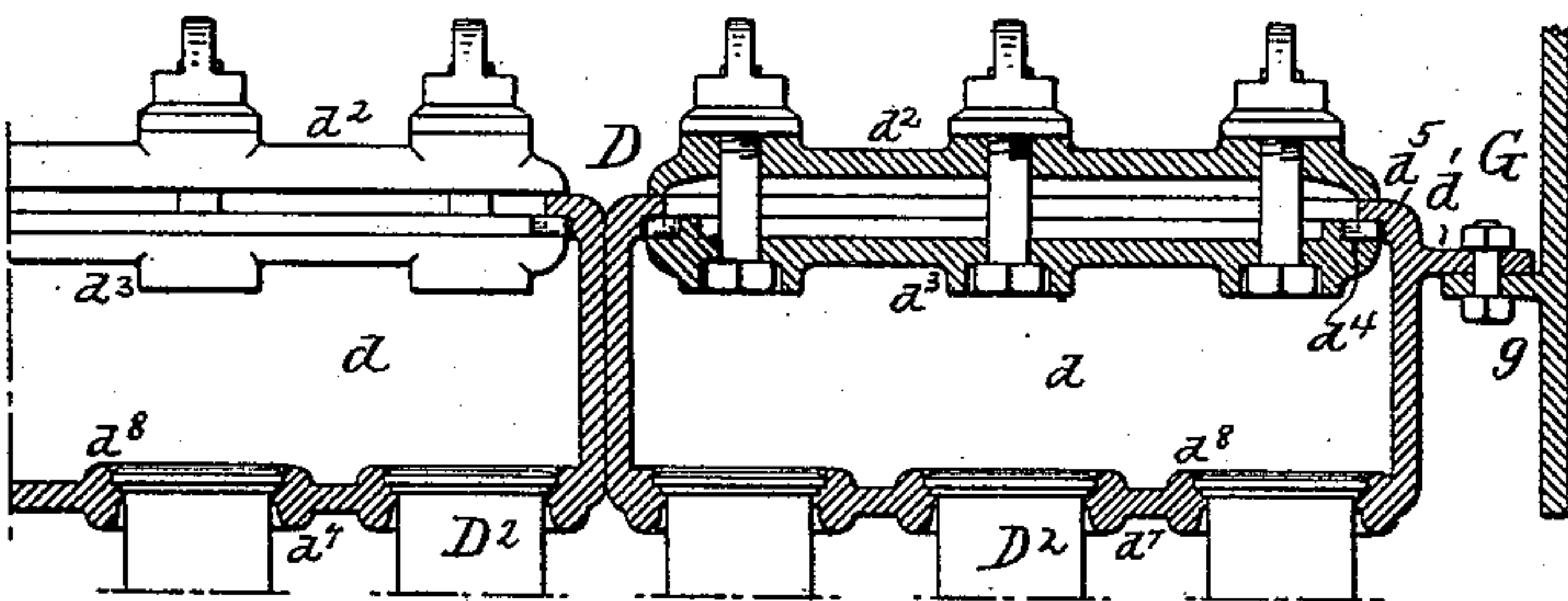


FIG. 6.

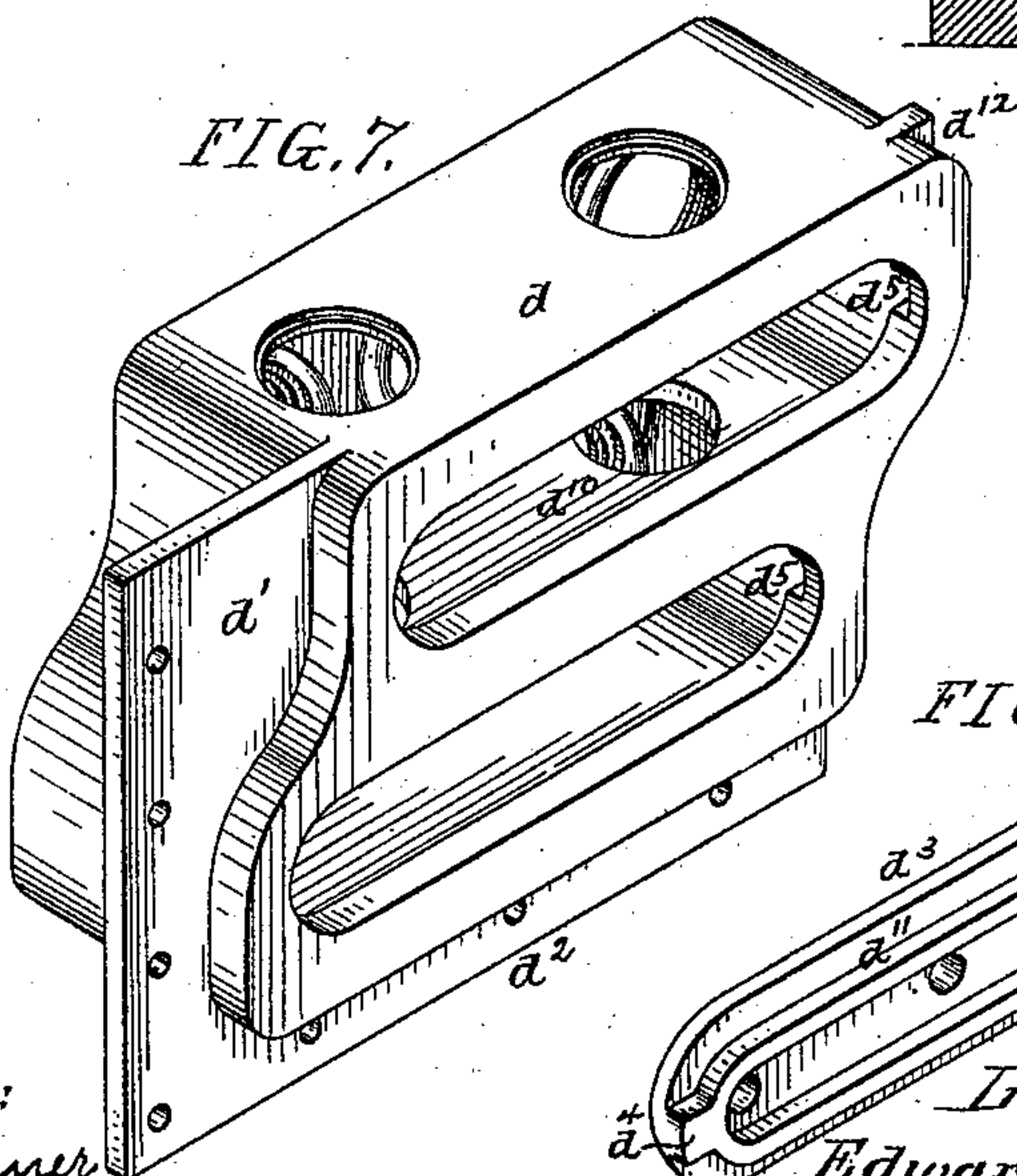


FIG. 7.

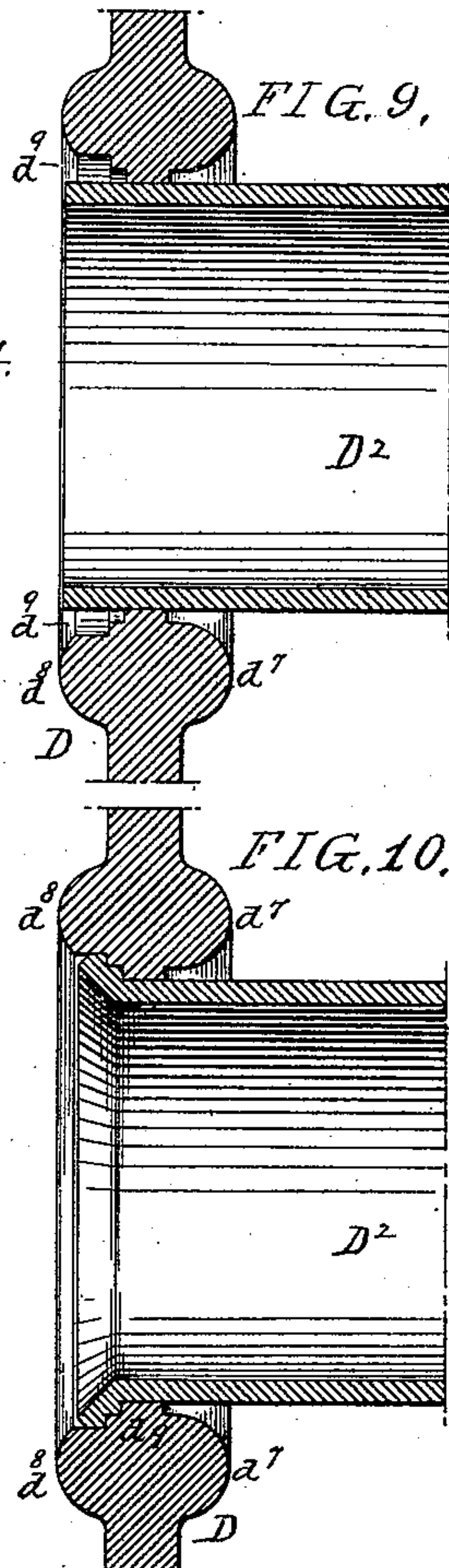


FIG. 9.

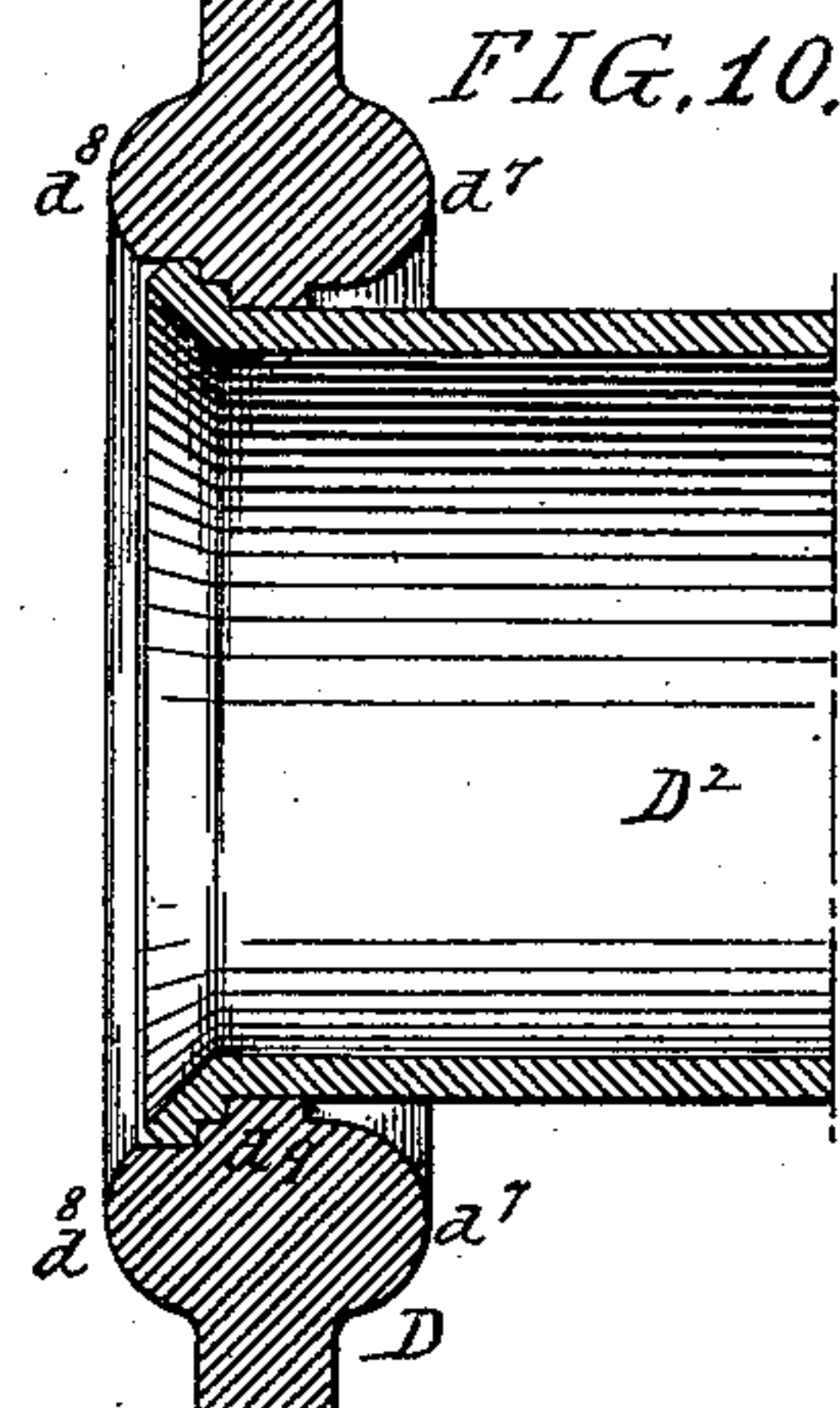


FIG. 10.

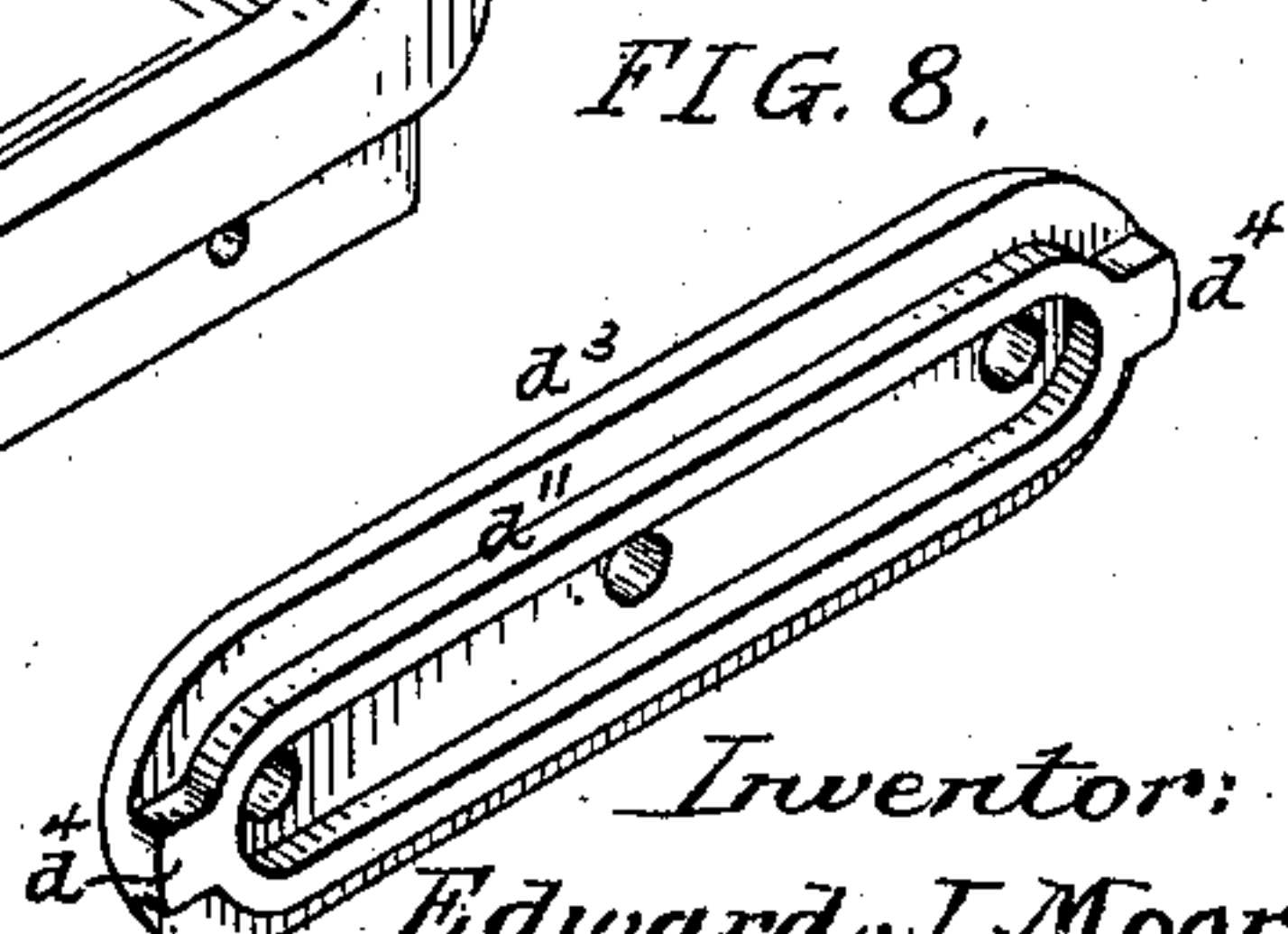


FIG. 8.

Witnesses:
Hamilton D. Turner
Murray C. Boyer

Inventor:
Edward J. Moore
by his Attorneys,
Howson & Howson

UNITED STATES PATENT OFFICE.

EDWARD J. MOORE, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 582,939, dated May 18, 1897.

Application filed November 18, 1896. Serial No. 612,635. (No model.)

To all whom it may concern:

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

The object of my invention is to improve the construction of sectional water-tube boilers so that they can be used at high pressures.

10 A further object of the invention is to so form the headers that they can be secured together independently of the nipples and tubes; and my invention further relates to details of construction, as fully described hereinafter.

15 In the accompanying drawings, Figure 1^A is a longitudinal sectional view of the front half of my improved steam-boiler. Fig. 1^B is a longitudinal sectional view of the rear half of the boiler. Fig. 2 is a transverse section on the line 2 2, Fig. 1^A. Fig. 3 is a transverse section on the line 3 3, Fig. 1^B. Fig. 4 is an enlarged sectional view through the front header. Fig. 5 is a sectional plan view
25 on the line 5 5, Fig. 4. Fig. 6 is a sectional view on the line 6 6, Fig. 4. Fig. 7 is a perspective view of one of the header-sections. Fig. 8 is a perspective view of one of the caps. Figs. 9 and 10 are views showing the method
30 of making the joints between the header and tubes, and Fig. 11 is a section on the line 11 11, Fig. 2, of one of the drum-headers.

A are the walls of the boiler, in the present instance of brick. On the side walls *a*
35 rest the shoes *c* of the plates *C*, which carry the drums *B*, six in the present instance, arranged in two rows, one above the other.

On the front wall *a*¹ rests the front header *D*, and on the wall *a*² rests the rear header *D*¹.
40 These heads are connected by inclined heating-tubes *D*². The front header *D* is connected to the lower row of drums by nipples *e*, and the rear header is connected to opposite ends of the drums by circulating-tubes *e*¹ and
45 mud-collectors *E*, through which the water circulates.

F is the fire-pot, having grates *f*, and at the rear is the bridge-wall *f*¹, having an extension *f*² in the form of a plate, so as to direct
50 the products of combustion in the direction of the arrows. At the rear is a deflecting-plate *f*³, depending from a wall *f*⁴, and above

this wall is another plate *f*⁵, to direct the products of combustion downward before entering the chimney-flue *f*⁶. 55

Each of the drums *B* is connected to drum-headers *B*¹ at each end, and the rear headers are connected together by short sections *b*⁶, and opposite each drum are openings *b* in the walls of the headers, provided with suitable
60 covers *b*¹. Extending entirely through the drums are bolts *b*², having covered nuts *b*³, which hold the covers *b*¹ in place, thus dispensing with inside anchors. The bolts being
65 long are supported at proper intervals by perforated plates *b*⁵, which are made in sections, so as to be easily applied. The upper drums are steam-drums, and the perforated plates extend the full diameter of each drum. In
70 the present instance they are made in six sections bolted together and may be secured to the drums in any manner. The plates of the lower drums only extend up to the bolts and are secured thereto by clamps, as shown.

The plates *C* for supporting the drums are
75 made in three sections in the present instance, the overlapping edges being bolted or riveted together, as shown in Figs. 2 and 3. Cleaning-openings *c*¹ are made in the plates, which are provided with pivoted covers. The plates
80 *C* also act as partition-walls to prevent the escape of the products of combustion.

The front header *D* is made of a series of sections *d*, as shown in Figs. 1^A and 2. Some
85 of these sections are coupled to six tubes, some to two, three, or nine tubes. These sections may be of any form and may be coupled to as many tubes as desired. The end sections are provided with flanges *d*¹, and the bottom sections are provided with flanges *d*², as shown
90 clearly in Figs. 2 and 7. These flanges are bolted or riveted to a flange *g* on a frame *G*, inclosing the front header. This frame is secured to the lower header *B*¹ of the drums *B*, so that the strain is removed from the nipples
95 coupling the several sections *d* together and the nipple *e* coupling the front header to the drum-header *B*¹. The frame extends beyond the caps of the hand-hole openings and is provided with doors *G*¹, which prevent the escape
100 of the products of combustion which would pass through the spaces between the header-sections. These doors *G*¹ are inside the main doors *A*¹, which, in the present instance, with

the doors A², inclose the entire front of the boiler-furnace. The header-sections when their corners are round may also have flanges d¹², Fig. 7, at the corners, so as to entirely close the space between the several header-sections, thus adding another barrier against the escape of the products of combustion.

Referring to Figs. 1^B and 3, the rear header D' is made up of sections in a manner similar to the front header, and the side and bottom sections are provided with flanges adapted to be secured to angle-bars II II'. In the present instance the side bars II II' extend up to and are secured to the manifold E, as clearly shown in Fig. 3, so that the strain is taken off of the nipples and circulating-tubes, while the header is hung from the rear plate C by suspension-rods h h, which are coupled at any convenient point to the header.

Both the front and rear header-sections have clean-out openings directly in front of the tubes, and these clean-out openings are provided with caps d², which are adapted to the outside of the section, while cover-plates d³ are adapted to the inside of the section, as clearly shown in Figs. 5 and 6. Some of the openings are elongated and the caps are correspondingly elongated to cover more than one tube, as shown in Fig. 4.

Each cover-plate has an internal rib d¹¹, which projects into the clean-out opening for the purpose of strengthening the plate. By this means I utilize a waste-space for the strengthening-rib, and it does not interfere with the free circulation of the boiler.

Bolts d⁴ pass through both the plate and cap, and adapted to the bolts are nuts b⁵. The heads of the bolts are set in recesses in the inside plate. I form on each end of the inside plates d³ lugs d⁴, which are adapted to recesses d⁵ in the header-sections. These recesses do not pass entirely through the shell of the section, but only so far as to allow the lug to hold onto the section and thus retain the inside cover-plate in position while the outside cap is being placed in position, as in Fig. 6. Otherwise it would be almost impossible to centrally locate the inside plate on the front header. The lugs need not be used on the rear header, as the rake of the header is sufficient to hold the inside cover-plate in position, but it is necessary on the front header, as the rake is in the wrong direction.

I preferably form a bead d⁶ around each nipple on the inside of the header-section, and I also form on both the outside and inside of the header-sections around the opening for the reception of the heating-tube ribs d⁷ d⁸. These ribs strengthen the header-sections to a considerable extent and allow for the formation of a tight joint, as clearly shown in Fig. 10. This joint is stepped at d⁹, and the tube or nipple is set into the opening, as shown in Fig. 9. A tube-expander is then inserted, forcing the tube out against the stepped portion d⁹, so as to form a double joint, as shown in Fig. 10, thus making a very

tight joint and one which cannot be readily pulled out by the expansion and contraction of the parts. I preferably form all tube-joints in the boiler in this manner.

When the sections are made as shown in Figs. 2 and 4, I preferably form a perforated strengthening-plate d¹⁰ across the header-section. The perforations therein are of sufficient size as not to interfere with the proper circulation.

The drum-headers B' are preferably made, as shown in Figs. 2 and 11, of two struck-up plates b⁷ and b⁸, one plate b⁷ having flanges to which are secured the drums B, while the other plate has the flanged opening b to accommodate the caps b'. The headers have braces b⁹ and b¹⁰ extending from one plate to the other, as shown in Fig. 11.

Depending from each of the lower drums B are mud-collectors E. These consist of depending drums e², closed at the bottom and having a vertically-arranged circulating-plate e³, which has an inclined upper end e¹, so as to deflect the water as it comes in from the supply-pipe I. Each mud-drum is connected to a manifold box E', as clearly shown in Figs. 1^B and 3, and this box is coupled to the upper portion of the rear header by circulating-tubes e'. These circulating-tubes are sufficient in number to allow for the proper circulation of the water through the boiler.

In the upper portion of the manifold box E' are clean-out openings e⁵, provided with suitable caps, so that the circulating-tubes can be readily cleansed or removed when necessary.

The mud-drums have blow-off tubes e⁶. In the present instance these tubes are in line and form a connection with the series of mud-drums. The blow-off tubes are provided with suitable valves.

It will be understood that when a single steam-drum is used in place of a series, or where only two drums are used one above the other, then there is only one mud-collector required.

It will be understood that the boiler is so formed that when an increased horse-power is required an additional header-section with two or more heating-tubes attached can be readily added to one side of the boiler and, if necessary, an additional set of drums can be attached; and it will also be understood that in a small boiler two drums may be used one above another and the number increased according to the horse-power required.

I claim as my invention—

1. The combination in a water-tube sectional boiler, of the coupled header-sections, flanges on the outer header-sections and a bar at each side to which the flanges of the headers are secured so that the sections are secured together independently of the coupling-nipples, substantially as described.

2. The combination in a water-tube sectional boiler, of the header-sections, a frame

within which the sections are mounted, flanges on the said frame and flanges on the outer header-sections, and means for securing the header-flanges to the frame-flanges, substantially as described.

3. The combination in a water-tube sectional boiler, of the header-sections, a frame within which the sections are mounted, flanges on the said frame and flanges on the outer header-sections coupled to the flanges on the frame, with a door hung to the frame so as to inclose the header, substantially as described.

4. The combination in a water-tube sectional boiler, of the header-sections, flanges on said sections, a frame within which the header-sections are mounted, said flanges being secured to the frame so that the headers are coupled together independently of the nipples, a door hung to the frame and an outer door, substantially as described.

5. The combination of the rear headers, circulating-tubes and steam-drum, with a mud-receiver directly above the rear header and depending from the steam-drum and connected above its bottom to the rear header, substantially as described.

6. The combination of the front and rear headers, circulating-tubes and steam-drum, a mud-collector depending from the rear of the steam-drum, a manifold box connected to the rear header and to the mud-collector, substantially as described.

7. The combination of the front and rear headers, circulating-tubes and steam-drum, a mud-collector depending from the rear of the steam-drum, a manifold box connected to the rear header and to the mud-collector and a division-plate in the mud-collector, substantially as described.

8. The combination of the front header, circulating-tubes, rear header, steam-drum, a mud-collector depending from the rear of the steam-drum, a manifold box at the back of the mud-collector and tubes extending from the box to the upper section of the rear header, substantially as described.

9. The combination of the front header, circulating-tubes, rear header, steam-drum, a mud-collector depending from the rear of the steam-drum, a manifold box at the back of the mud-collector and tubes extending from the box to the upper section of the rear header and bars secured to the sections of the rear header and manifold box whereby they are coupled independent of the nipples and circulating-tubes, substantially as described.

10. The combination of the front header, circulating-tubes, rear header, steam-drum, a mud-collector depending from the rear of the steam-drum, a manifold box at the back of the mud-collector, tubes extending from the box to the upper section of the rear header, bars secured to the sections of the rear header and manifold box whereby they are coupled independent of the nipples and circulating-

tubes, and suspension-rods by which the rear header is hung, substantially as described.

11. The combination of a water-tube sectional boiler, the front and rear headers, circulating-tubes and steam-drum, the sections of the rear headers having flanges and a plate to which the flanges are secured so that the rear headers are coupled together independent of the nipples, substantially as described.

12. The combination in a steam-boiler, of the sectional headers, each section having flanges, nipples securing the said sections together, the flanges of the sections when the said sections are assembled forming a solid wall between the fire-chamber and the exterior, substantially as described.

13. The combination in a steam-boiler, of the sectional headers, each section having flanges, nipples securing the said sections together, the flanges of the sections when the said sections are assembled forming a solid wall between the fire-chamber and the exterior, the outer flanges being secured to bars so that said sections are coupled together independently of the nipples, substantially as described.

14. The combination in a steam-boiler, of the inclined heating-tubes, headers at each end of the tubes, a series of drums mounted above the tubes, the headers to which the drums are coupled, nipples connecting the front drum-header with a front heating-tube header and circulating-tubes and mud-drums connecting the rear of the tubes with the rear heating-tube header, supporting-plates for said drums, a frame extending around the front heating-tube headers and adapted to the front drum-header, bars secured to the rear heating-tube headers and adapted to the rear supporting-plate, substantially as described.

15. The combination of the drum of a steam-boiler, a bolt extending from end to end of the drum, openings in each end of the drum, caps for said openings, said bolt passing through the caps, and nuts on each end of the bolt for holding the caps to the drums so that either cap can be removed without drawing the bolt, substantially as described.

16. The combination of the drum of a steam-boiler having openings at each end, caps for the openings, a bolt extending through the drum and the caps and having nuts confining the caps to the drums and perforated supporting-plates arranged at intervals within the drum so as to support the bolt, substantially as described.

17. The combination in a steam-boiler furnace, of the heating-tubes, the front and rear headers, two sets of drums mounted above the heating-tubes and connected thereto, a front and rear header for each set of drums, openings in each header opposite the drums, caps for said openings, bolts extending through the drum and caps, nuts on the bolts for securing the caps in place on the headers,

perforated supporting-plates in each drum for the bolt, the perforated plates of the lower drums extending up to the bolts leaving the upper part clear while the plates of the upper
 5 drums extend the full diameter of the drum, substantially as described.

18. The combination of a drum, a header at each end thereof, caps on each header, bolts extending through the drum and header and
 10 caps, nuts on the ends of the bolts for securing the caps in place and supporting-plates for the bolts made up of a series of sections bolted together, substantially as described.

19. The combination in a header-section of
 15 a steam-boiler, heating-tubes, openings in the header-section opposite the heating-tubes, outside caps adapted to close the openings, inside plates having lugs adapted to recesses

in the inside walls of the header-section, said recesses and lugs being so formed as to hold
 20 the inside plate in position while the cap is being attached, substantially as described.

20. A header for a steam-boiler having tube-openings, ribs extending around the openings on the inside, the edge of the open-
 25 ings being stepped, and a tube expanded against the stepped portion and the rib of the header-section so as to form a double joint, substantially as described.

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

EDWARD J. MOORE.

Witnesses:

WILL. A. BARR,
 JOS. H. KLEIN.