

No. 608,065.

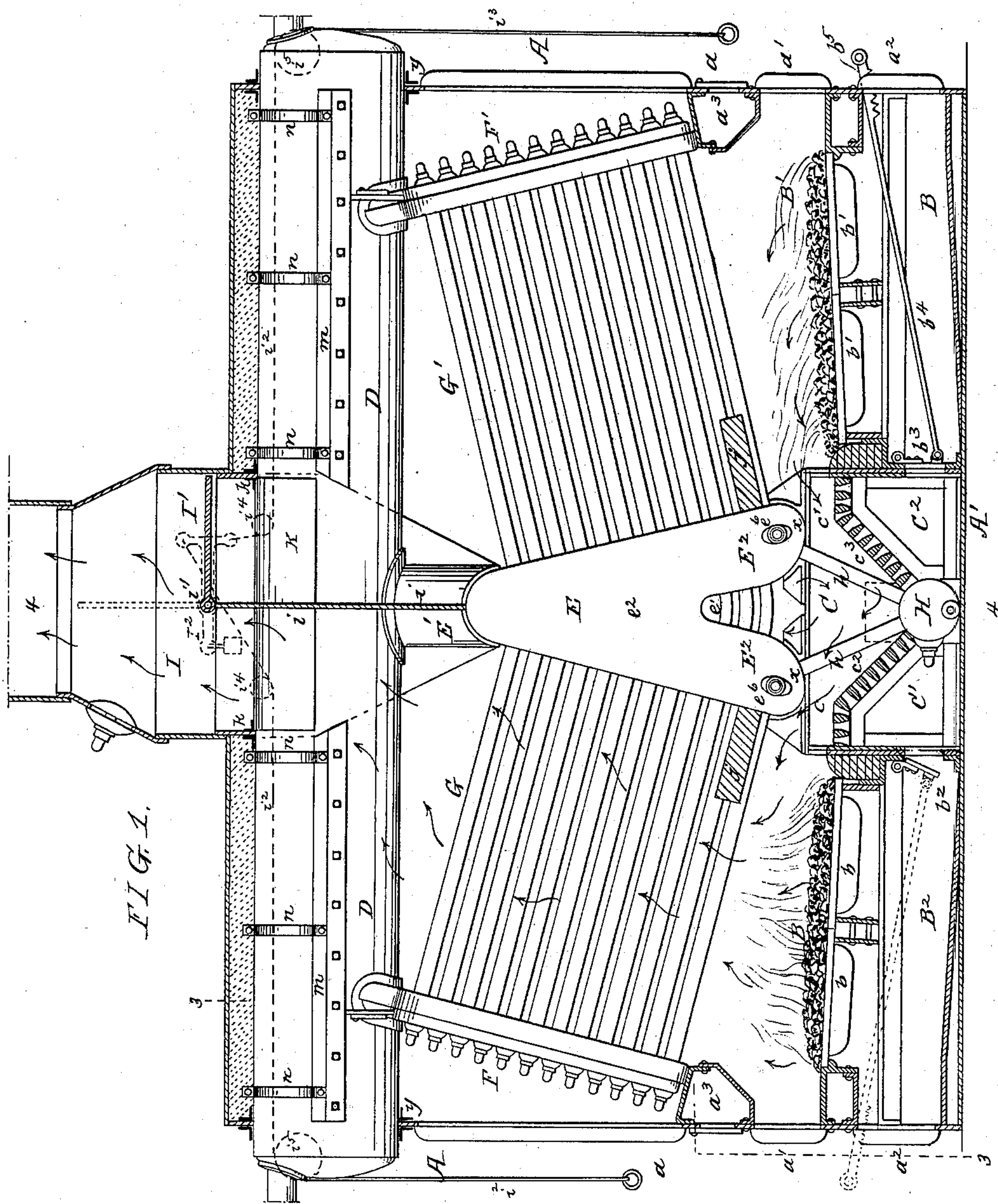
Patented July 26, 1898.

E. J. MOORE.
STEAM BOILER.

(Application filed Dec. 4, 1897.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:
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John A. Barr.

Inventor:
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by his attorneys
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4 Sheets—Sheet 2.

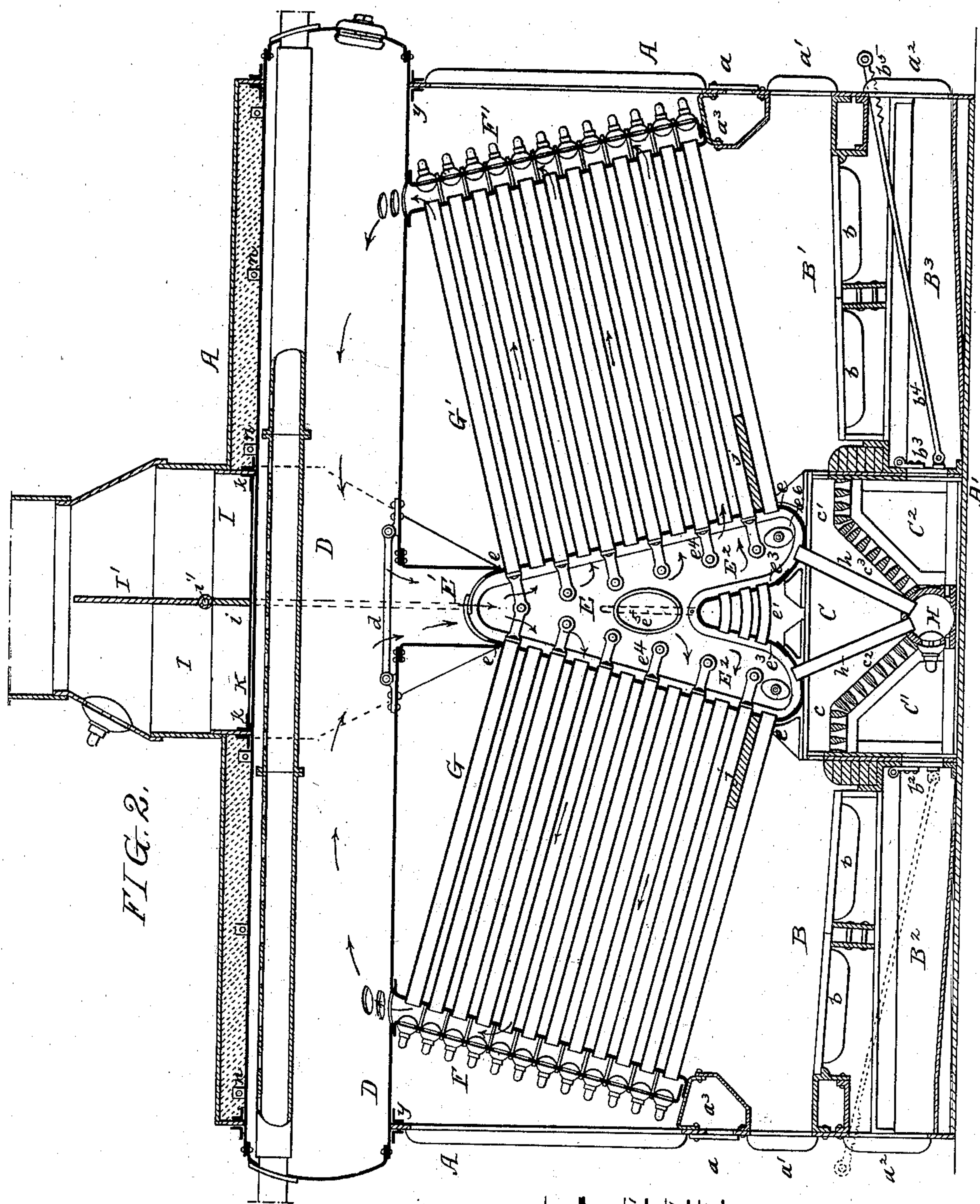


FIG. 2.

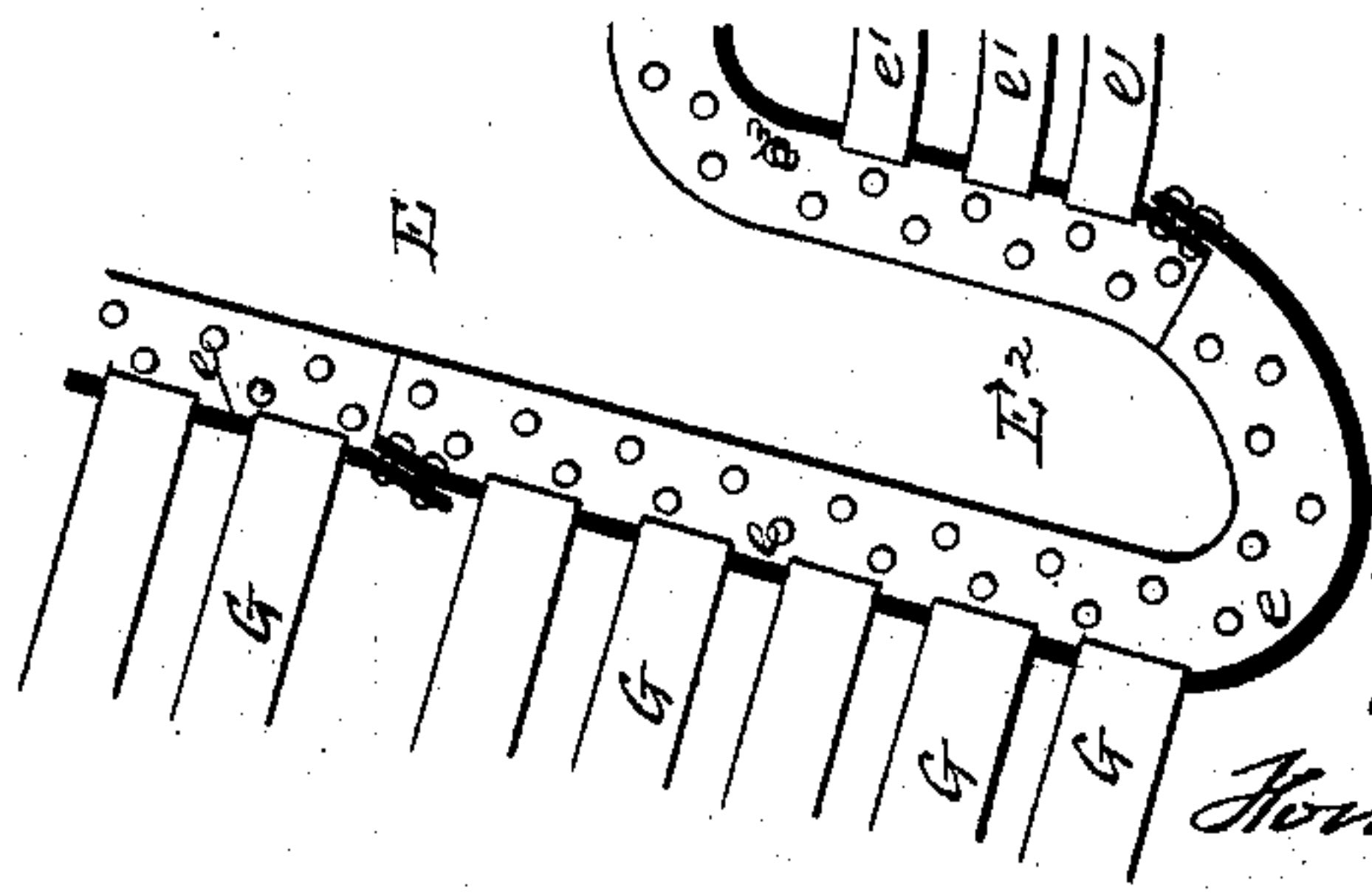


FIG. 11

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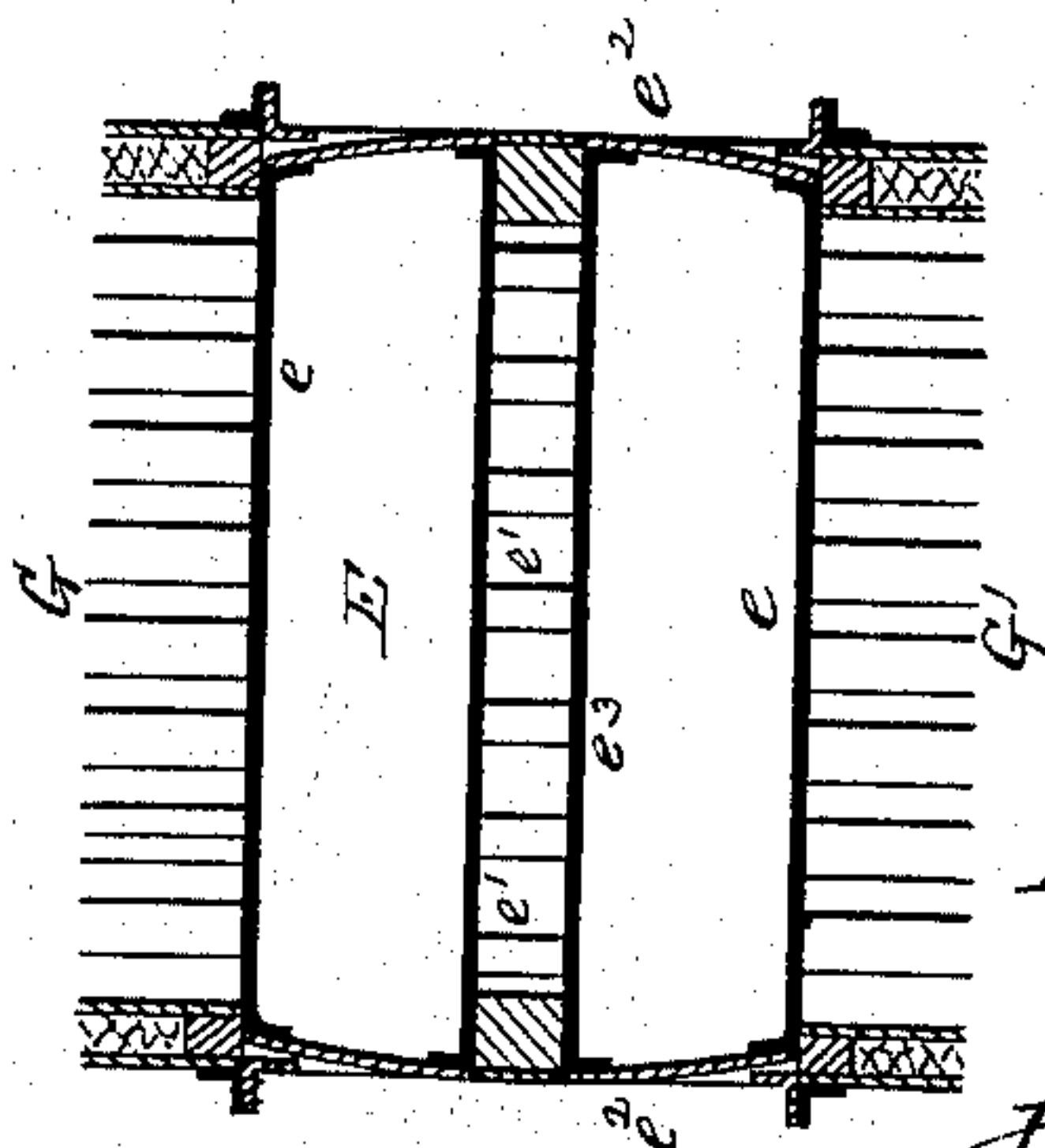
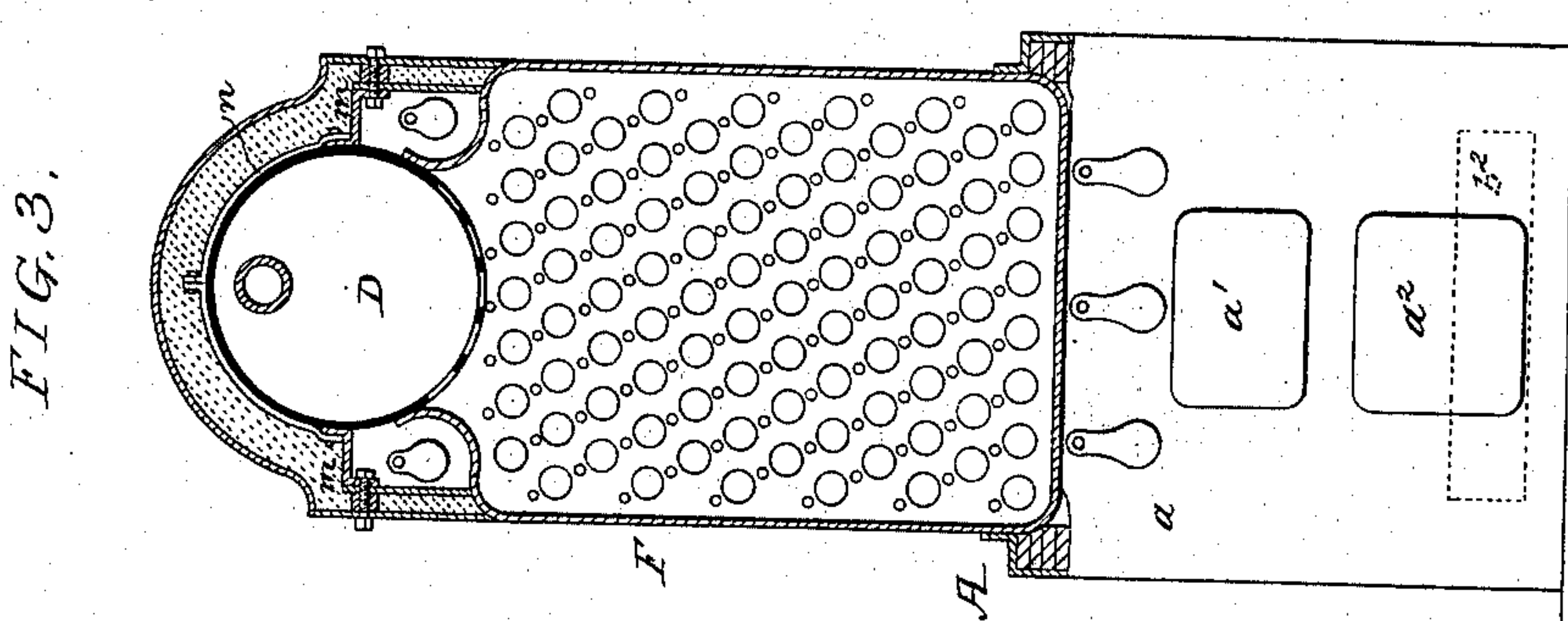
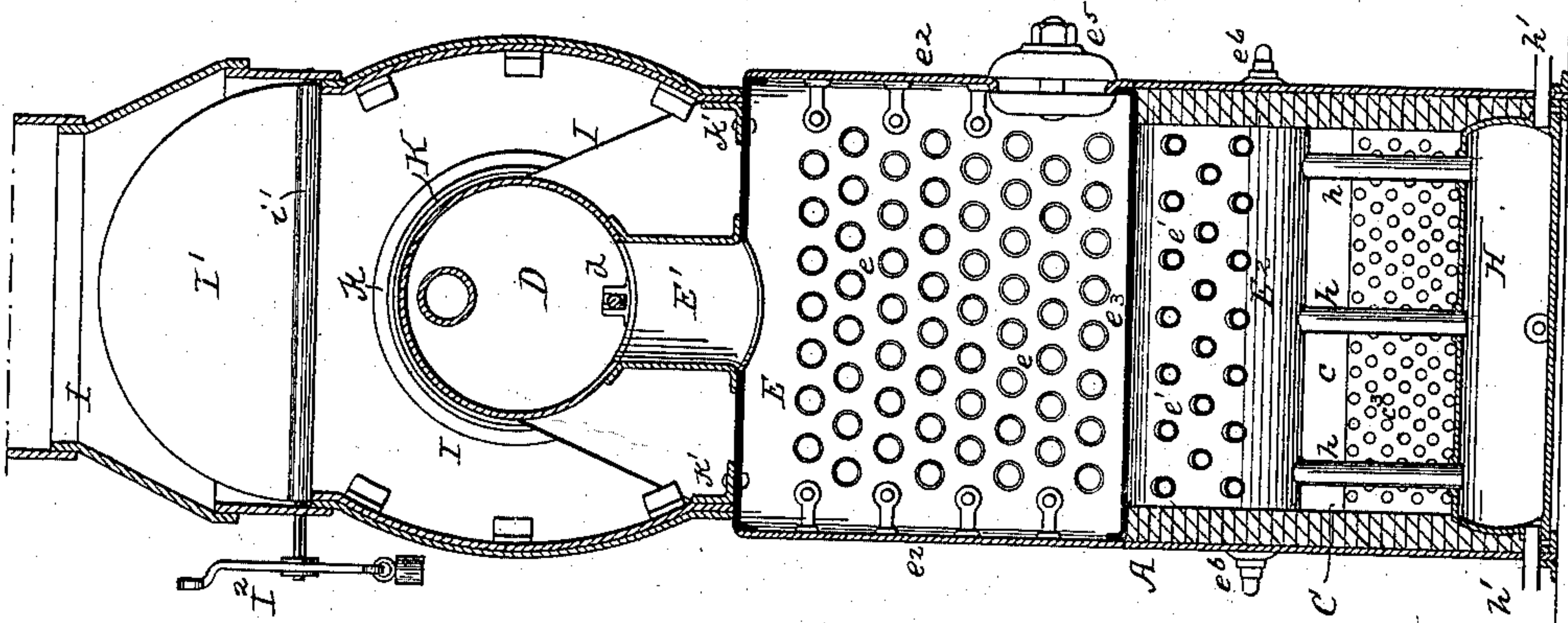
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4 Sheets—Sheet 3.



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4 Sheets—Sheet 4.

FIG. 7.

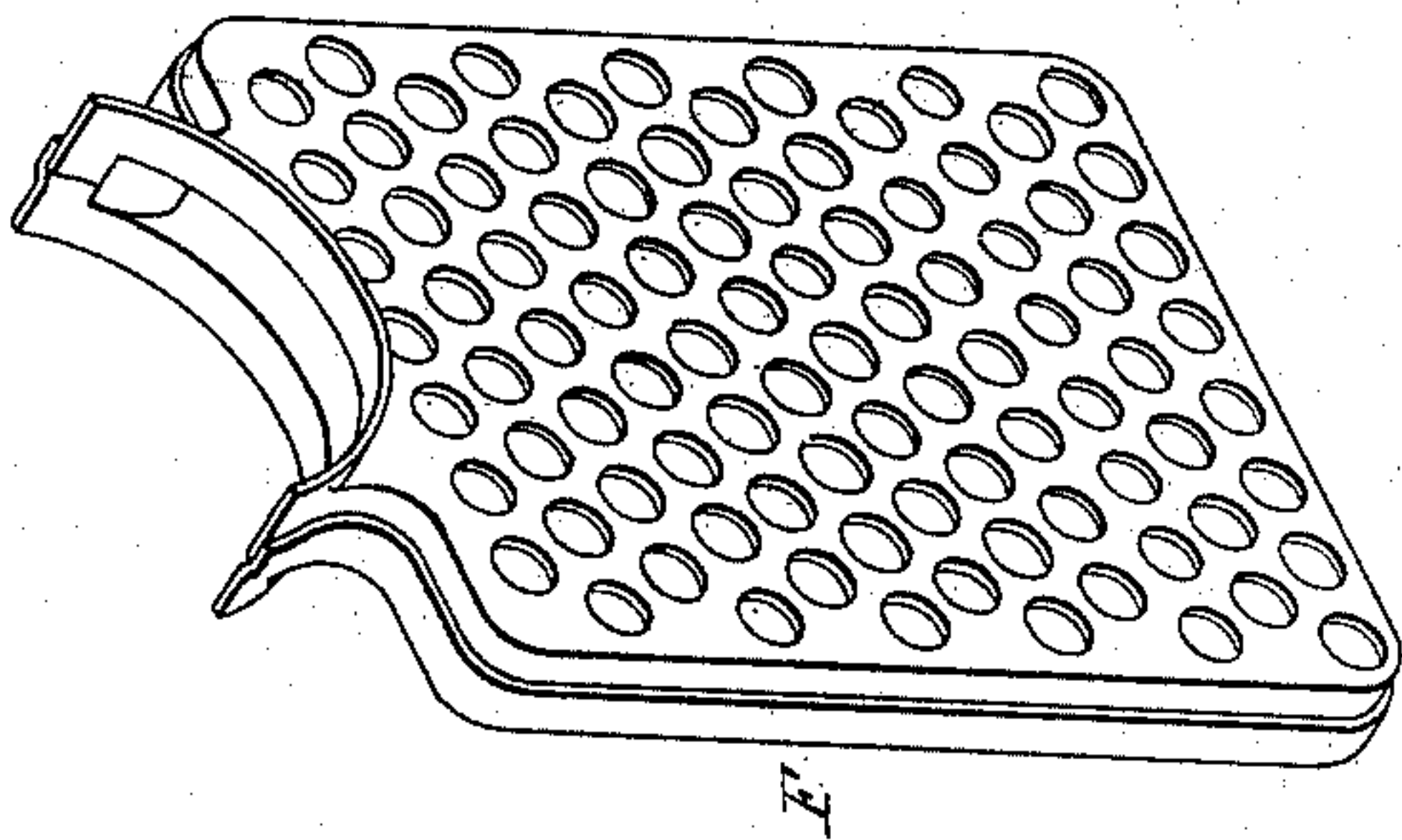


FIG. 6.

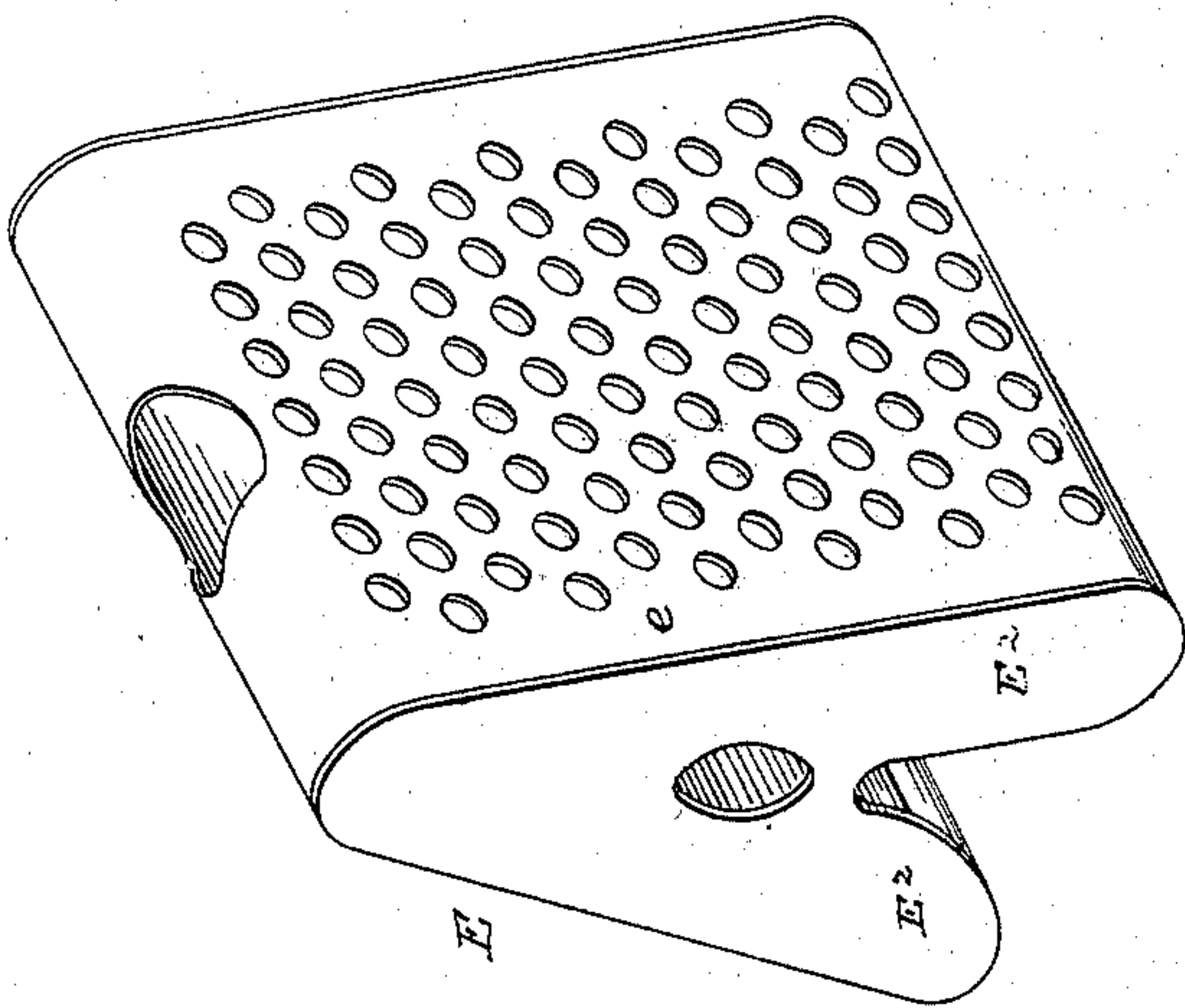


FIG. 12.

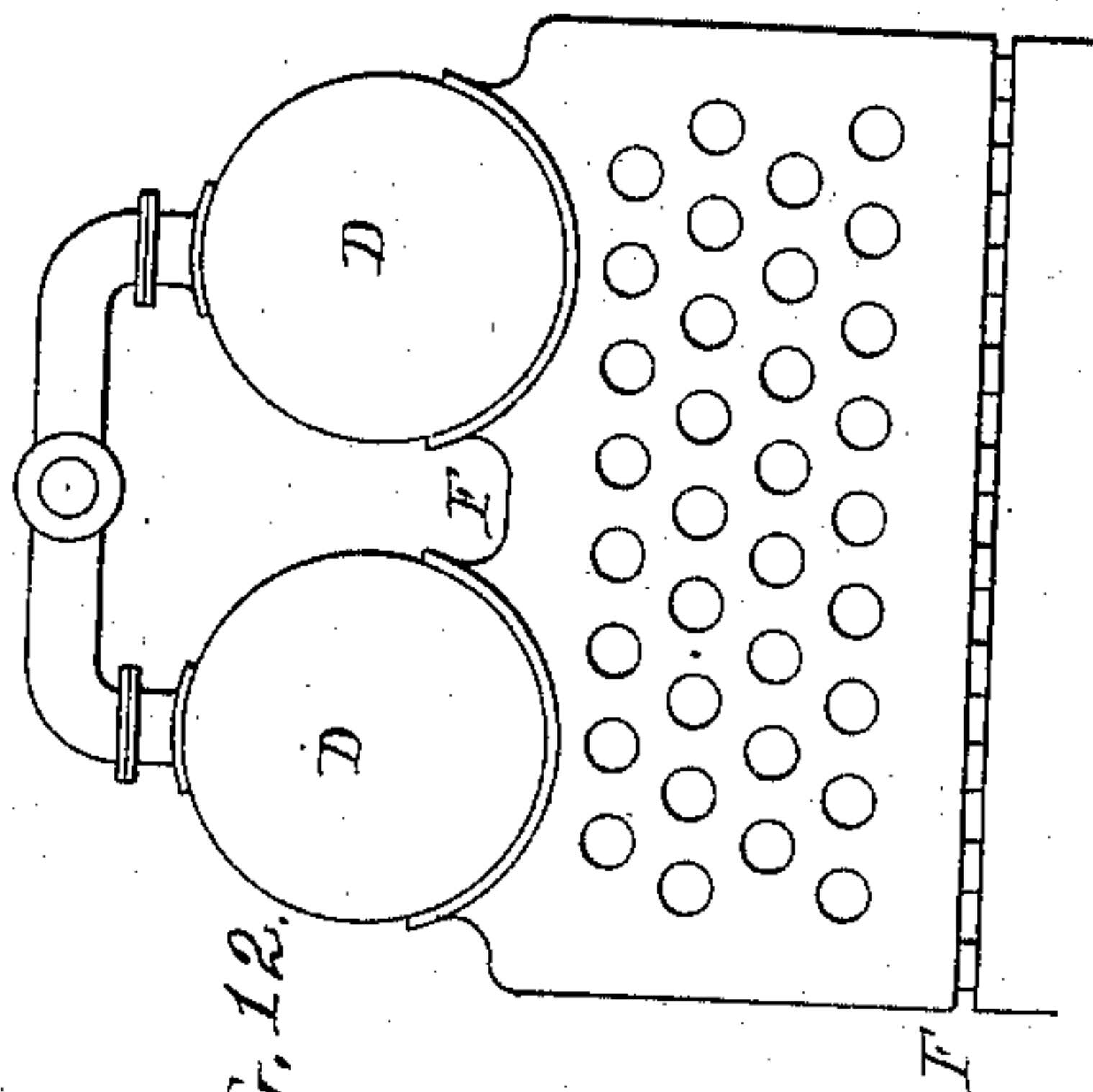


FIG. 13.

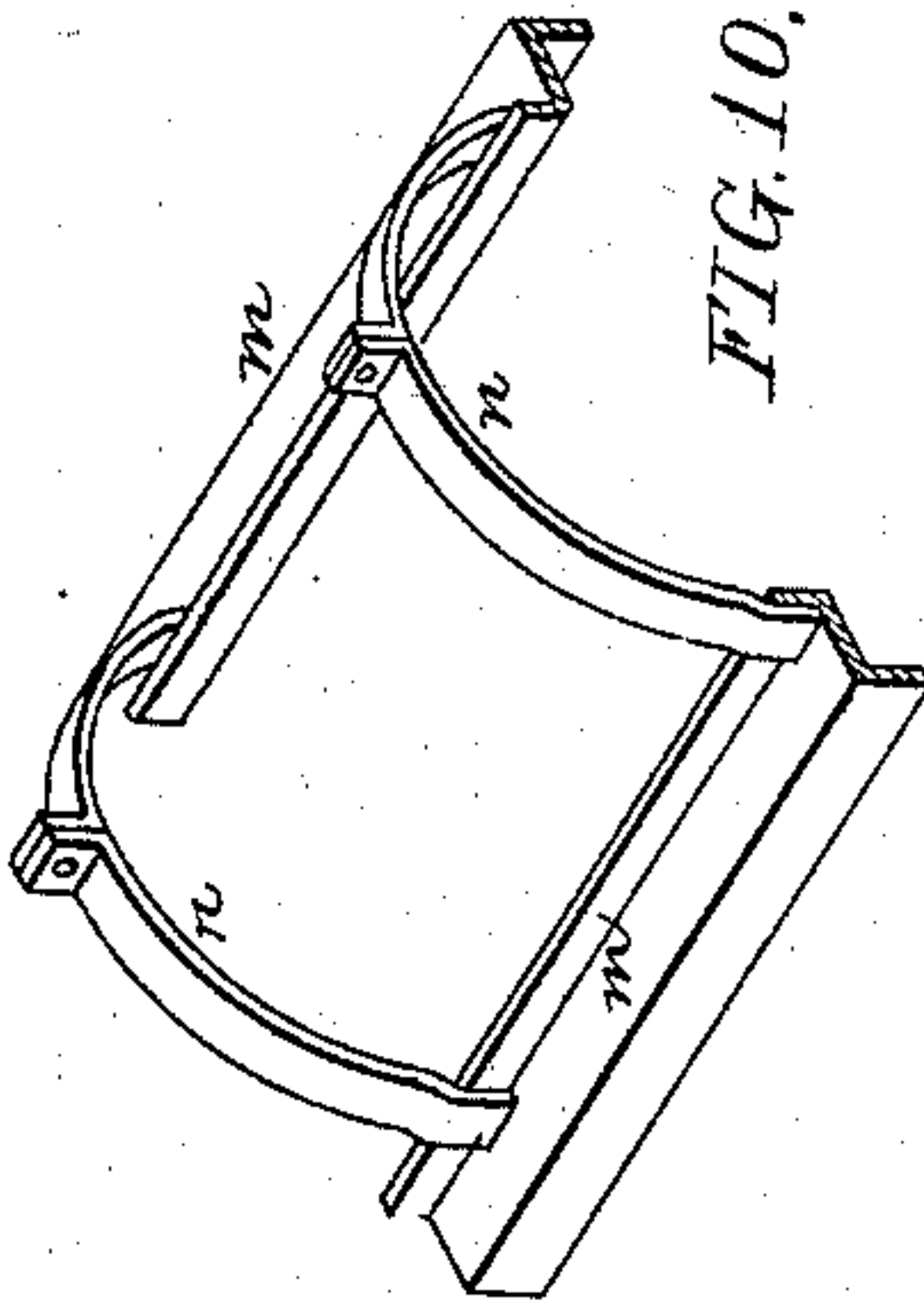
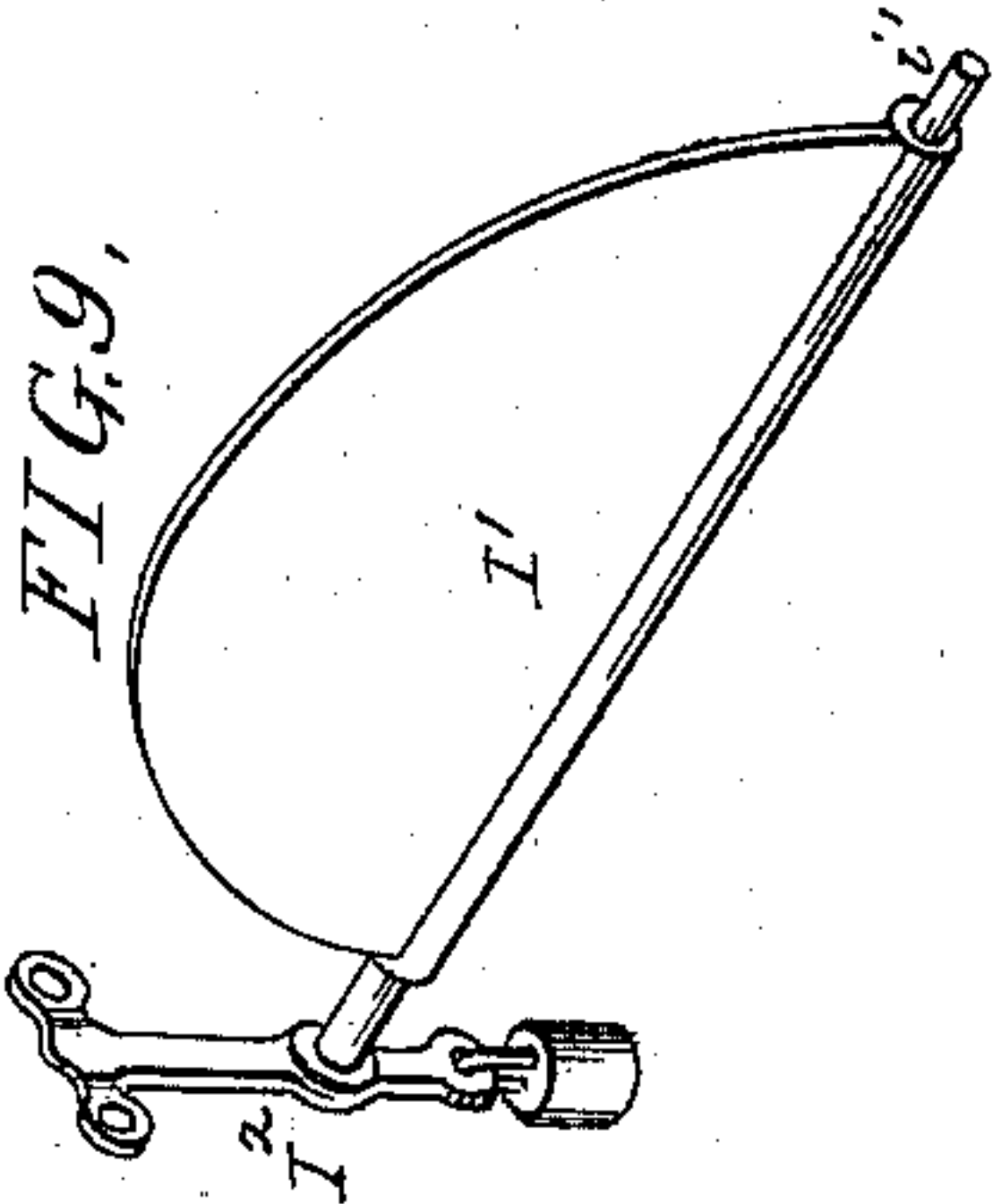
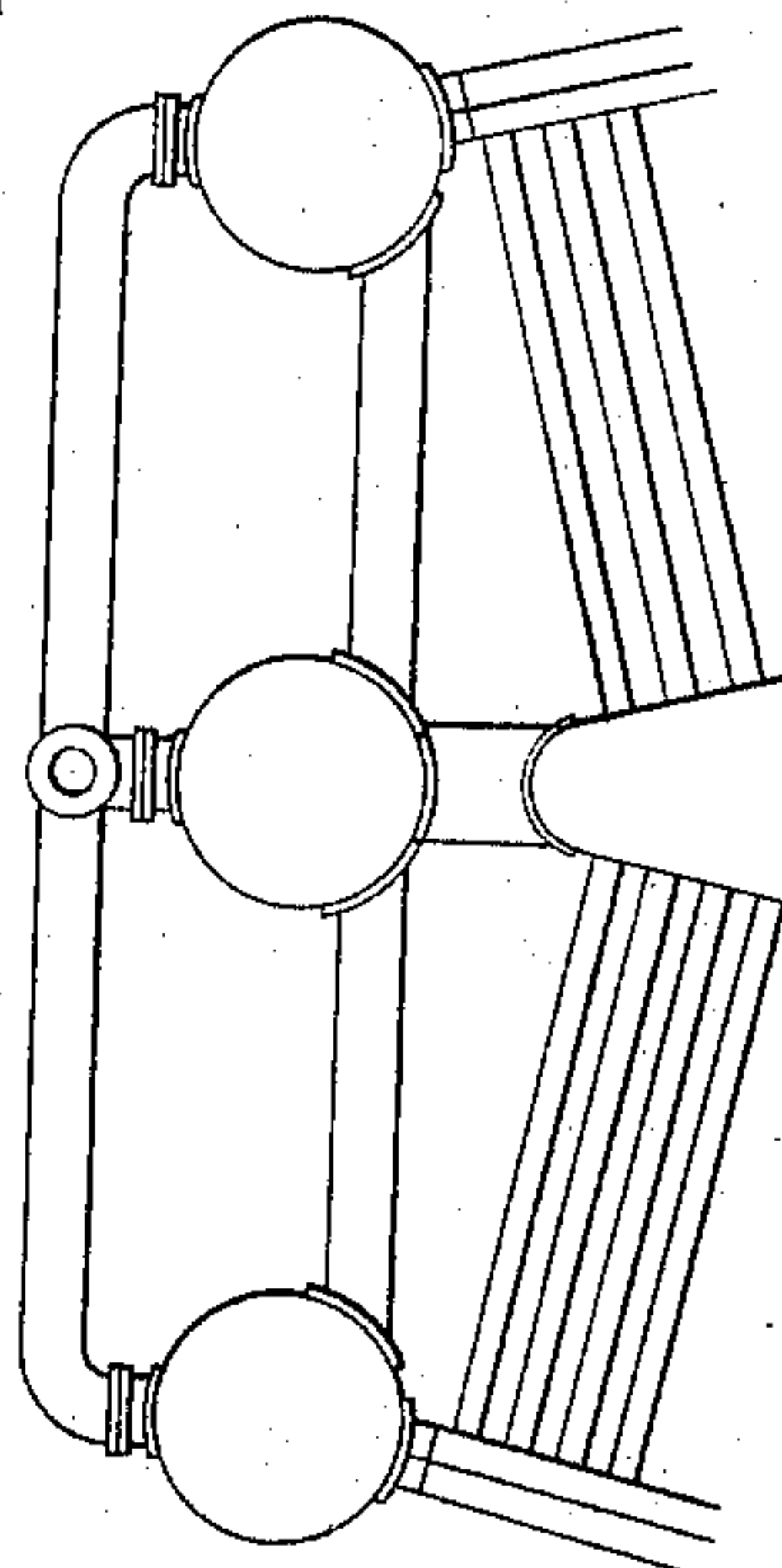
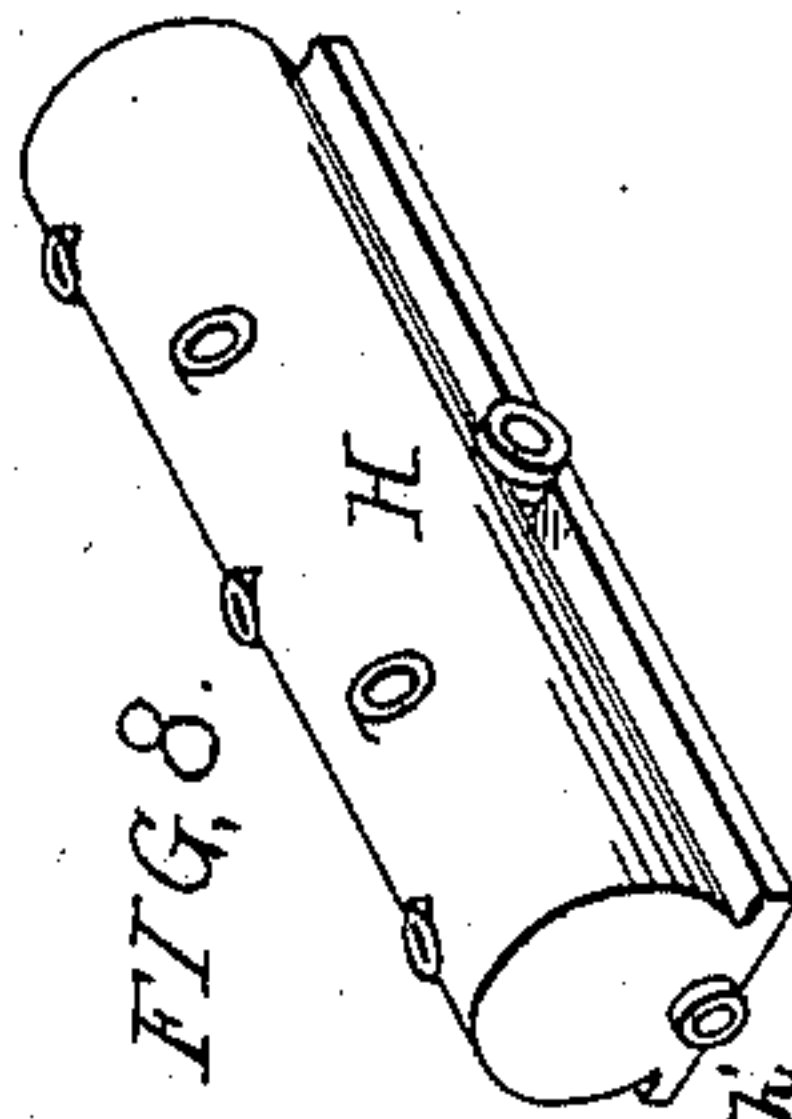


FIG. 8.



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UNITED STATES PATENT OFFICE.

EDWARD J. MOORE, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 608,065, dated July 26, 1898.

Application filed December 4, 1897. Serial No. 660,770. (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.

My invention relates to certain improvements in tubular steam-boilers, especially of the marine type, and while my invention is
10 especially designed as a marine boiler it will be understood that it may be used as a stationary boiler.

The object of my invention is to provide the greatest amount of heating-surface in the
15 least amount of space and to so arrange the parts that the boiler is kept at an even temperature at all times.

A further object of the invention is to so arrange the parts that the gases arising from
20 the layer of fuel when first spread will be thoroughly consumed; and a still further object of the invention is to so arrange the parts that access may be had to all vital parts of the boiler. These objects I attain in the fol-
25 lowing manner, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of my improved steam-boiler, the tubes, headers, and drum not being in section, so as to
30 more clearly illustrate the passage of the products of combustion. Fig. 2 is a longitudinal sectional view through the boiler, including the tubes, headers, and drums to illustrate the water circulation. Fig. 3 is a
35 transverse section on the line 3 3, Fig. 1. Fig. 4 is a transverse section on the line 4 4, Fig. 1. Fig. 5 is a sectional plan view through the central header. Fig. 6 is a detached perspective view of the central header. Fig. 7
40 is a perspective view of one of the end headers. Fig. 8 is a perspective view of the mud-drum. Fig. 9 is a perspective view of the damper. Fig. 10 is a perspective view of the saddle and side bars. Fig. 11 is a sectional
45 view of a portion of the central header. Fig. 12 is a view showing an arrangement when two drums are used; and Fig. 13 is a view illustrating a modification, showing three
50 transverse drums instead of the longitudinal drum or drums.

My improved boiler may be termed a "twin" boiler, as it has two fireplaces, two

sets of heating-tubes, and one or more water and steam drums common to both sets of heating-tubes.

A is the casing of the structure, made in the present instance of sheet metal and ma-
55 sonry.

a a are the two front plates, having fire-
60 doors *a'* and ash-pit openings *a''*.

B B' are the two fire-chambers, having
65 grates *b b'*, and below the grates are the ash-pits B² B³. Separating the two fire-chambers is a central combustion-chamber C, communicating with the fire-chamber B through
70 passage *c* and communicating with the fire-chamber B' through passage *c'*.

Below the combustion-chamber C are two
75 air-chambers C' C², separated from the combustion-chamber by perforated partitions *c''*
80 *c'''*. These partitions are of the form shown in Fig. 1, so as to give the products of combustion as they pass through the combustion-chamber a rolling motion. The perforations
85 in the partitions are tapered, so that the air will pass from the air-chambers to the combustion-chamber in the form of jets, and, furthermore, the openings are so proportioned
90 that dust will readily pass through the openings and into the air-chambers, while coal or
clinkers that in some instances pass beyond the grates will be collected in the combustion-chamber C and may be removed either from
95 the fire-chambers or from one side, if a doorway is made, as shown by dotted lines in
Fig. 1.

D is the water and steam drum, extending the full length of the boiler and supported in any suitable manner.

Depending from the drum D is a central
100 header E and two end headers F F'. These end headers are connected, respectively, to the central header by inclined heating-tubes G G', so that the circulation of the water in the boiler is down the central header E, through
95 the inclined heating-tubes G G', up the end headers F F', and through the drum D to the central header.

The central header E is connected to the drum D by a large tube E'. This tube is suffi-
100 ciently large to admit of a man passing from the drum to the header when repairs are necessary.

The edges of the drum at the openings are

connected by one or more tie-rods d , detachably secured to lugs on the drum. One end of the rod or rods may be uncoupled when access is to be had to the headers and turned back, so as to provide an uninterrupted opening.

The header E is made in the form shown in Figs. 2 and 4, so as to provide two flat tube-plates e for the tubes G and G', arranged at right angles to the tubes. Consequently the central header is of greater width at the bottom than at the top, and in order to insure the proper circulation of the water in this header I so form it at the base as to make two legs E², the space between the legs forming a portion of the combustion-chamber C. I preferably extend circulating-tubes e' from one leg to the other, and these tubes are curved in the present instance. From the fork of the two legs I may extend a vertical partition within the central header, as shown by dotted lines, if desired.

The side plates e^2 of the central header E, which are preferably dished, are made in single sheets and are secured to the flanged tube-sheets e and to the flanged bottom sheet e^3 . The two tube-sheets are curved at the top and overlap, forming a doubly-riveted seam, and each tube-sheet overlaps the bottom sheet near the bottom of each leg, forming a doubly-riveted seam. In order to stiffen the structure, corner-braces e^4 are placed at intervals, which tie the tube-sheets to the side plates. By dishing the side plates stays are dispensed with.

I preferably make a manhole e^5 in one of the side plates e^2 and also make clean-out openings e^6 in the side plates near the bottom of each leg.

Directly below the central header E is a mud-drum H, having a flat base, so that it will not tilt or roll. I preferably make this of cast metal.

The mud-drum H is connected to the legs E² by pipes h , so that any sediment or dirt settling in the legs will pass through the pipes h to the mud-drum H, which is provided with blow-off pipes h' h' . The pipes h extend through the combustion-chamber C and are preferably staggered, and the mud-drum H is below the combustion-chamber and between the two air-chambers C' C². The drum has one or more clean-out openings accessible from one of the air-chambers.

The end headers F F' are made in the present instance of two sheets of metal suitably punched and pressed to receive the ends of the heating-tubes and caps. The flanges of the two sheets overlap at the edge and are united by a single or double row of rivets. They are also united at intervals by tubular stay-rods.

The upper portion of each end header is shaped and flanged to conform to the drum to which it is attached, and the drum has a series of openings in it where the end header is attached, so as to allow for free circulation and without materially weakening the drum. The end header may be made in two sections

nipped together, as shown in Fig. 12, in some instances.

The drum D may be slotted the entire width of the header and reinforced, if necessary, or tie-rods may be used.

The boiler is supported at several points, the central header at xx on the foundation A', the end headers on the boxes a^3 , which extend across the furnace above the fire-door a' , and the drum is not only supported by the several headers, but rests on the frame at yy . It will be seen that the structure is well supported and balanced and the parts can freely contract and expand. Shoes are provided on each side of the central header at the foundation, so as to prevent the header from sliding.

I is the flue, which extends on each side of the drum D, as shown in Fig. 4, and communicates with the main combustion-chambers of the furnace, as shown in Fig. 1. In the upper portion of the flue is a half-damper I', pivoted at i' , and extending from the pivot to the top of the central header E is a partition i , dividing the lower portion of the flue into two separate flues, either one of which can be closed by the damper I'.

The pivot-shaft i' of the damper extends out at one side beyond the casing and has a counterweighted arm I², to which are connected the two operating-cords i^2 i^3 . These cords pass under guide-wheels i^4 and over wheels i^5 and extend within easy reach of the stokers.

The damper is normally vertical, so that the products of combustion travel up from the fire-chambers between the tubes around the drum to the flue.

When one of the furnaces is freshly charged with fuel—say, for instance, the furnace B'—then the damper I' is turned down, as shown in Fig. 1, to cut off the direct passage to the flue from the furnace B' and the smoke and unconsumed gases are drawn through the central combustion-chamber C, where they are mixed with heated air from the air-chamber C², which receives its hot air from one of the ash-pits, a damper being open, so that the air will pass to the combustion-chamber. The gases and hot air are thoroughly mixed in the combustion-chamber C and are drawn into the fire-chamber B, where they mingle with the products of combustion from the fire therein and are consumed, giving off the desired heat.

In order to prevent the gases passing up in close contact with the central header, I place deflectors jj at each side of the header, so as to make the gases pass directly over the bed of fuel. When the smoke is consumed, the damper I' is released and it resumes its vertical position, allowing the products of combustion from each furnace to pass up independently to the flue.

The dampers b^2 and b^3 are hung to the framework of the furnace, and each damper is operated by a rod b^4 within reach of the stoker, and the rod has a series of ratchet-teeth

b^5 , which engage with a lug on the frame, so that the damper can be set in any position.

The flue I is so formed as to straddle the drum and rests upon two saddles k k thereon and also upon two saddles k' k' on the central header. It is thus supported by the boiler structure.

A protecting-plate K is placed over the upper portion of the drum D within the flue I, so as to protect it. This plate extends down on each side of the boiler and is secured to the flues by the saddles k k .

As shown in Fig. 5, the end plates of the central header E are preferably dished, thus dispensing with internal stays, although in some instances they may be flat and stays used without departing from the essential features of my invention.

I mount on the drum D a series of saddles n , preferably made in two pieces flanged and secured together at the center. These saddles extend down on either side of the drum and are secured to longitudinal bars m m , having reversely-arranged flanges. The saddles are attached to one flange and the side plates of the boiler attached to the other flange. Suitable non-conducting covering can be placed above the drum and supported by the bars m m , as shown in Fig. 3. The drum by this arrangement is not punctured with a series of rivet-holes and it is allowed to expand freely and independently of the casing.

It will be understood that in large-sized boilers the tube-plates of the central header may be made in two sections riveted together, as shown in Fig. 11, and that the end headers may be made in two or more sections coupled together, and two or more drums may be used with the central and end headers, as shown in Fig. 12. In the modification, Fig. 13, I have illustrated three transverse drums connected together in the place of one or more longitudinal drums.

I prefer to make the two lower rows of heating-tubes somewhat larger than the others, so as to allow more water to circulate in the lower portion of the boiler, thus preventing these lower tubes from giving out first, as is the case when all the tubes are of the same diameter.

While I have shown the fire and ash-pit openings at the ends of the structure, they may be at one side in some instances, depending altogether on the location of the boiler.

I claim as my invention—

1. The combination in a steam-boiler, of a drum, a single central header and two end headers suspended from said drum and closed at the bottom, heating-tubes extending from each side of the central header to the end headers, a fire-chamber under each set of heating-tubes, and a passage under the central header communicating with the two fire-chambers, substantially as described.

2. The combination in a steam-boiler, of a drum, a single triangular central header having tube-plates at each side, end headers

raked on a line with the tube-plates of the central header and closed at the bottom and inclined tubes extending from the tube-plates of the central header to the end headers, substantially as described.

3. The combination in a steam-boiler, of a drum, a single triangular central header having tube-plates at each side and communicating at the top with the drum and forked at the bottom to form legs, two end headers and inclined tubes extending from the central header to the two end headers, substantially as described.

4. The combination in a steam-boiler, of a drum, a triangular central header, and heating-tubes, a neck connecting the header with the drum, lugs on the drum at each side of the neck-opening, and one or more pivoted stays extending across the drum at the opening and detachably secured to the lugs so that access can be had to the neck, substantially as described.

5. The combination in a steam-boiler, of a drum, a single central header and heating-tubes extending from each side of said header, and a vertically-arranged partition in the lower portion of the header, substantially as described.

6. The combination in a steam-boiler, of a single central header and heating-tubes, said tubes extending from each side of the central header, a fire-chamber under each set of tubes at each side of the central header, and a combustion-chamber directly under the central header and communicating with both fire-chambers, substantially as described.

7. The combination in a steam-boiler, of two fire-chambers, a central combustion-chamber, a central header forked at the bottom to form two legs, and an enlargement of the central combustion-chamber, substantially as described.

8. The combination in a steam-boiler, of a single central header, heating-tubes connected thereto, two fire-chambers, a central combustion-chamber under the central header, and air-ducts opening into the said combustion-chamber, substantially as described.

9. The combination in a steam-boiler, of a single central header, heating-tubes connected thereto, fire-chambers, a central combustion-chamber communicating with the fire-chambers, two air-chambers under the combustion-chamber and communicating therewith, and dampers for each chamber, substantially as described.

10. The combination in a steam-boiler, of a central header, heating-tubes connected thereto, two fire-chambers, a central combustion-chamber communicating with the said fire-chambers, and two air-chambers, one communicating with the ash-pit of one fire-chamber, the other with the ash-pit of the other fire-chamber, and both communicating with the central combustion-chamber, substantially as described.

11. The combination in a steam-boiler, of a central header, heating-tubes connected thereto, a central combustion-chamber, under the said header, a mud-drum at the bottom of the combustion-chamber and tubes connecting the header with the drum, substantially as described.

12. The combination in a steam-boiler, of a central header, heating-tubes connected thereto, said header being forked at the base to form two legs, and tubes extending from one leg to the other, substantially as described.

13. A triangular header for steam-boilers, forked at the base to form two legs, the top of the header and the bottom of each leg being rounded, said header having its inclined sides in the form of flat tube-sheets, substantially as described.

14. A triangular header adapted to be suspended from a drum, of a steam-boiler, said header having dished end plates and flat tube-sheets at each side secured to the end plates, said tube-sheets adapted to receive heating-tubes, substantially as described.

15. A triangular header for steam-boilers, forked at the bottom forming two legs, flat tube-sheets and bottom sheets flanged at each end, and end plates secured on the outside to the flanges of the tube-sheets and bottom sheets so that all the flanges will be within the header, substantially as described.

16. The combination in a triangular header for steam-boilers, having flat tube-sheets at each side, and end plates with a series of corner-braces securing the side plates to the end plates in addition to the rivets, substantially as described.

17. The combination in a steam-boiler, of a drum, a central triangular header, inclined end headers, heating-tubes extending from the triangular header to the end headers, a mud-drum below the triangular header and tubes connecting the mud-drum with the base of the header, substantially as described.

18. The combination of a triangular header, and inclined heating-pipes, a mud-drum connected to the header, said mud-drum having a flat base as and for the purpose specified.

19. The combination in a steam-boiler, of two fire-chambers, a drum, a single central header, two end headers, heating-tubes extending from the central header to the end headers, a combustion-chamber between the two fireplaces and under the single central header, said combustion-chamber being depressed at the center, air-chambers, and openings in the depressed portion of the combustion-chamber communicating with the air-chamber, substantially as described.

20. The combination in a steam-boiler, of two fire-chambers, a combustion-chamber between the two, said combustion-chamber being depressed, tapered openings in the bottom of said combustion-chamber, and air-chambers communicating with said openings, substantially as described.

21. The combination in a steam-boiler, of

a drum, a central header, end headers, heating-tubes, two fireplaces, a central combustion-chamber enlarged at the center and narrow passages connecting the said combustion-chamber with the fire-chambers, substantially as described.

22. The combination in a steam-boiler, of a central header and heating-tubes, a central combustion-chamber under the central header, a fire-chamber at each side of the central combustion-chamber, air-chambers communicating with the combustion-chamber, and one air-chamber communicating with the ash-pit of one fire-chamber and the other air-chamber communicating with the ash-pit of the other fire-chamber, and handled dampers for each air-chamber, the handles of said dampers extending to the outside of the furnace, substantially as described.

23. The combination of two fire-chambers, a single central header and heating-tubes, a passage under the central header forming a communication between the two fire-chambers, two outlet-passages for the products of combustion, and means for closing one or other of said outlets so that the gases from one fire-chamber will pass under the central header to the other fire-chamber and over the fuel therein, substantially as described.

24. The combination of two fire-chambers, a single central header, heating-tubes in the combustion-chamber of each fire-chamber, a passage under the central header communicating with both fire-chambers above the grates, a single stack, a partition extending above the central header and into the stack so that the gases from one fire-chamber will pass over the fuel in the other fire-chamber to the stack, substantially as described.

25. The combination of a casing of a steam-boiler, having a central frame or foundation A' , bearing-boxes a^3 , and bearings $y y$, two fire-chambers on each side of the foundation A' , a drum resting on the bearings $y y$, a central header resting on the frame or foundation A' , and end headers resting on the boxes a^3 and connected to the central header by heating-tubes, substantially as described.

26. The combination of two fire-chambers, a passage communicating with the two chambers, a drum, a central header and end headers connected to the drum, heating-tubes, with deflectors at each side of the central header, substantially as described.

27. The combination in a steam-boiler, of one or more drums, a series of saddles mounted on the drum or drums, and longitudinal bars at each side of the drum or drums and secured to the saddles for sustaining a suitable covering, substantially as described.

28. The combination in a steam-boiler, a drum, a series of saddles mounted thereon, a longitudinal bar on each side of the drum, each bar having reversely-arranged flanges, the said saddles being secured to one flange, and the side plates of the frame secured to the other flange, substantially as described.

29. The combination in a steam-boiler, of a drum, a single central header connected to the drum, a flue for the products of combustion directly above and extending on each side of the drum and communicating with the two combustion-chambers, a partition-plate extending from the central header up into the flue, substantially as described.

30. The combination in a steam-boiler, of two fire-chambers, a drum, a single central header connected to the said drum, end headers and heating-tubes, and a flue for the products of combustion adapted to straddle the drum and rest upon the central header, substantially as described.

31. The combination in a steam-boiler, of two fire-chambers, a drum, a central header, end headers, and heating-tubes, a flue adapted to straddle the drum and to rest upon the central header, leaving passages on each side of the drum, and a vertical partition extending from the central header up to a point above the drum so as to divide the lower portion of the flue, substantially as described.

32. The combination in a steam-boiler, of two fire-chambers, a drum, a single central header connected to the drum, heating-tubes, a flue cut away so as to straddle the drum and leave passages at each side thereof, with a saddle-plate extending over the drum within the flue and secured to the flue, substantially as described.

33. The combination of a drum, a central header, and end headers, heating-tubes, a

flue extending down on each side of the drum and communicating with the combustion-chambers of the boilers, a central partition-plate extending from the central header up to a point above the drum, with a damper, and means for operating said damper to cut off one or the other passage, substantially as described.

34. The combination of a drum, central header and heating-tubes, a flue circular in cross-section and cut away so as to straddle the drum, said flue being larger in diameter than the drum so as to form passages on each side thereof, said flue also enlarged at the center and having saddles resting on the drum and central header, substantially as described.

35. The combination of a drum, central header and heating-tubes, of a flue, a partition dividing the flue into two parts, a pivoted damper adapted to open both parts of the flue or close one or the other, a lever and weight for keeping the damper normally vertical, and ropes or chains extending over sheaves to a point easy of access to the stokers, 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.