

A. W. METCALFE & J. S. D. SHANKS.

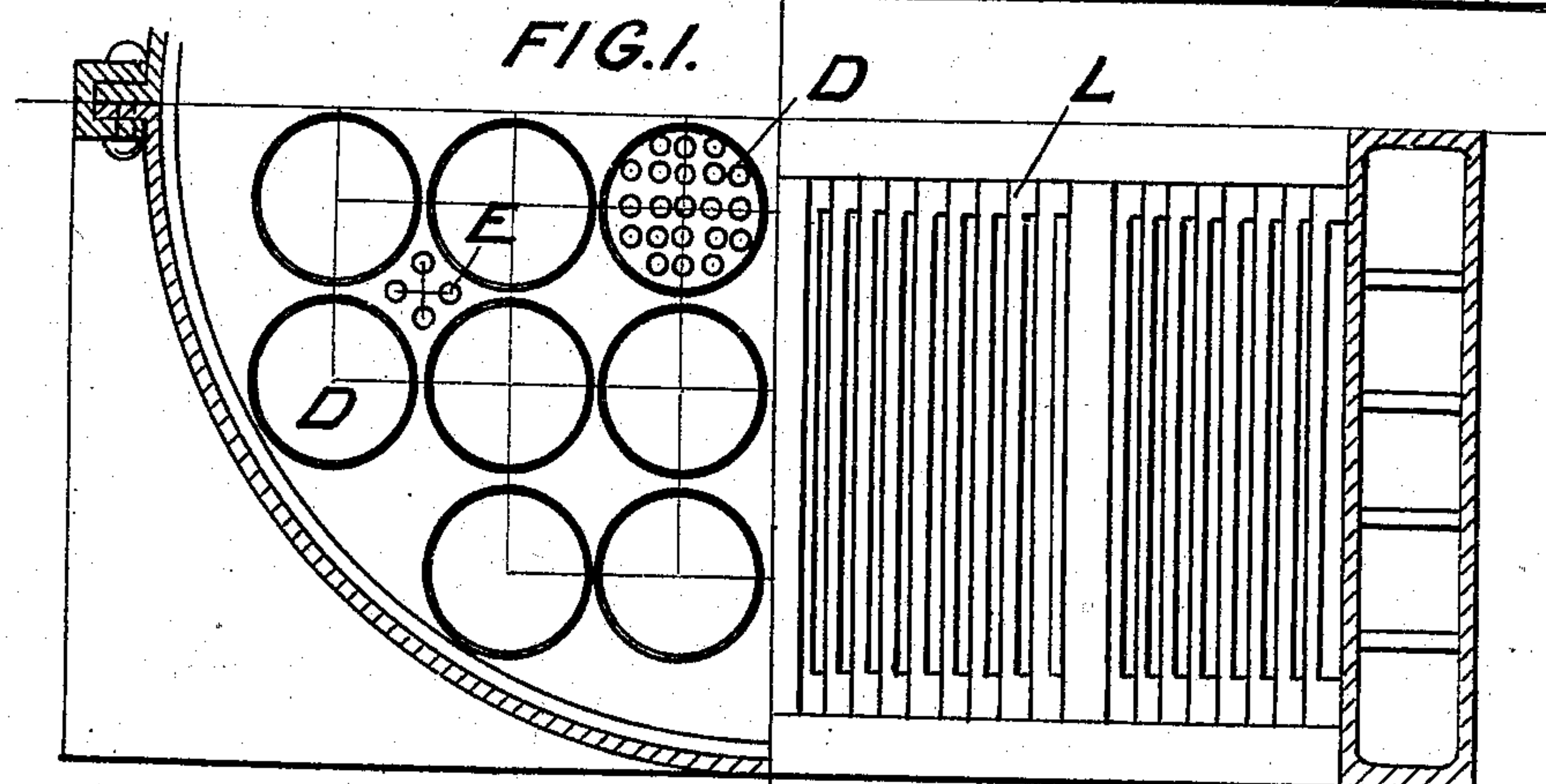
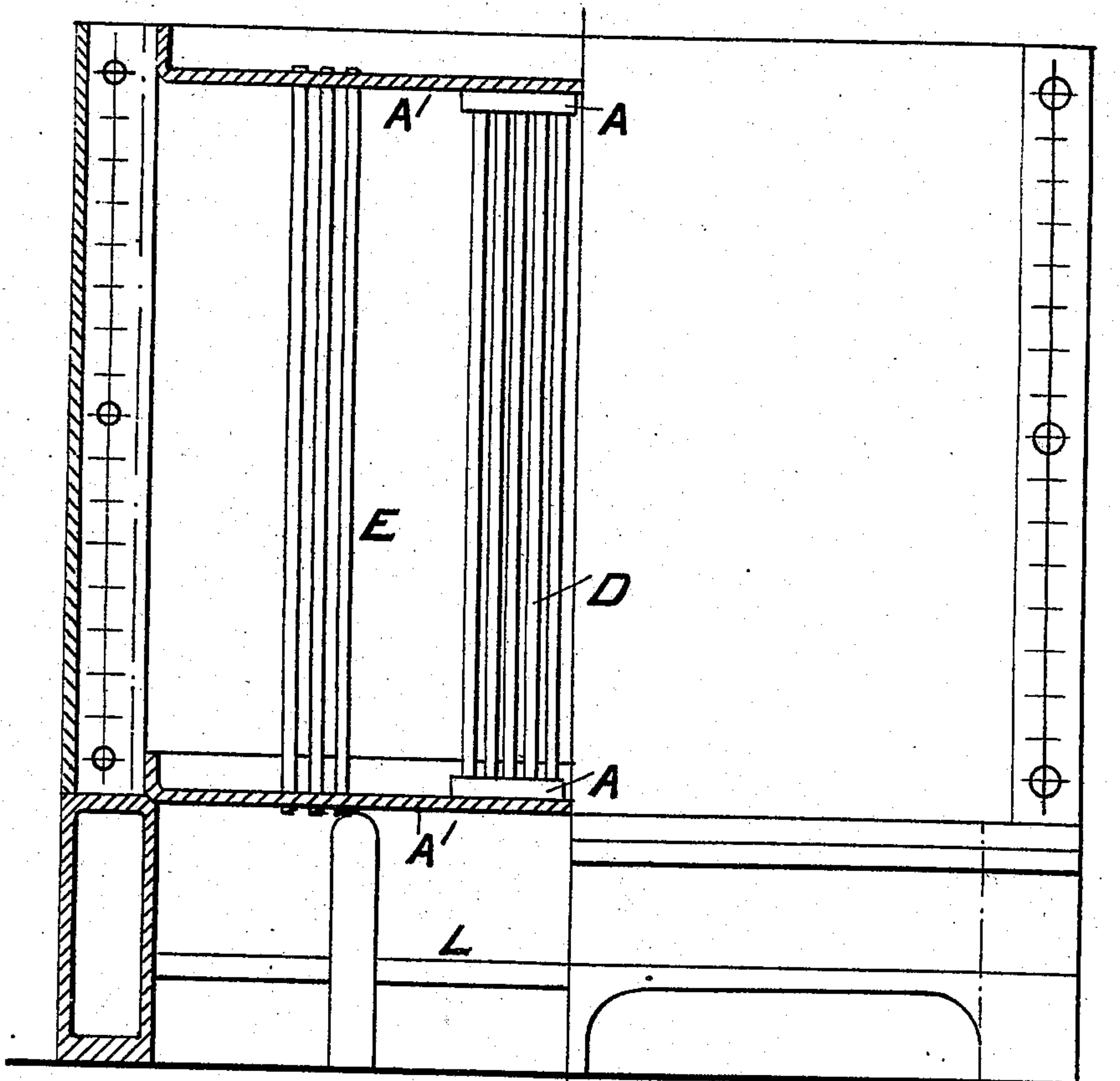
CONSTRUCTION OF STEAM BOILERS.

APPLICATION FILED FEB. 18, 1905.

907,841.

Patented Dec. 29, 1908.

6 SHEETS—SHEET 1.



WITNESSES.

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FIG. 2.

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6 SHEETS—SHEET 2.

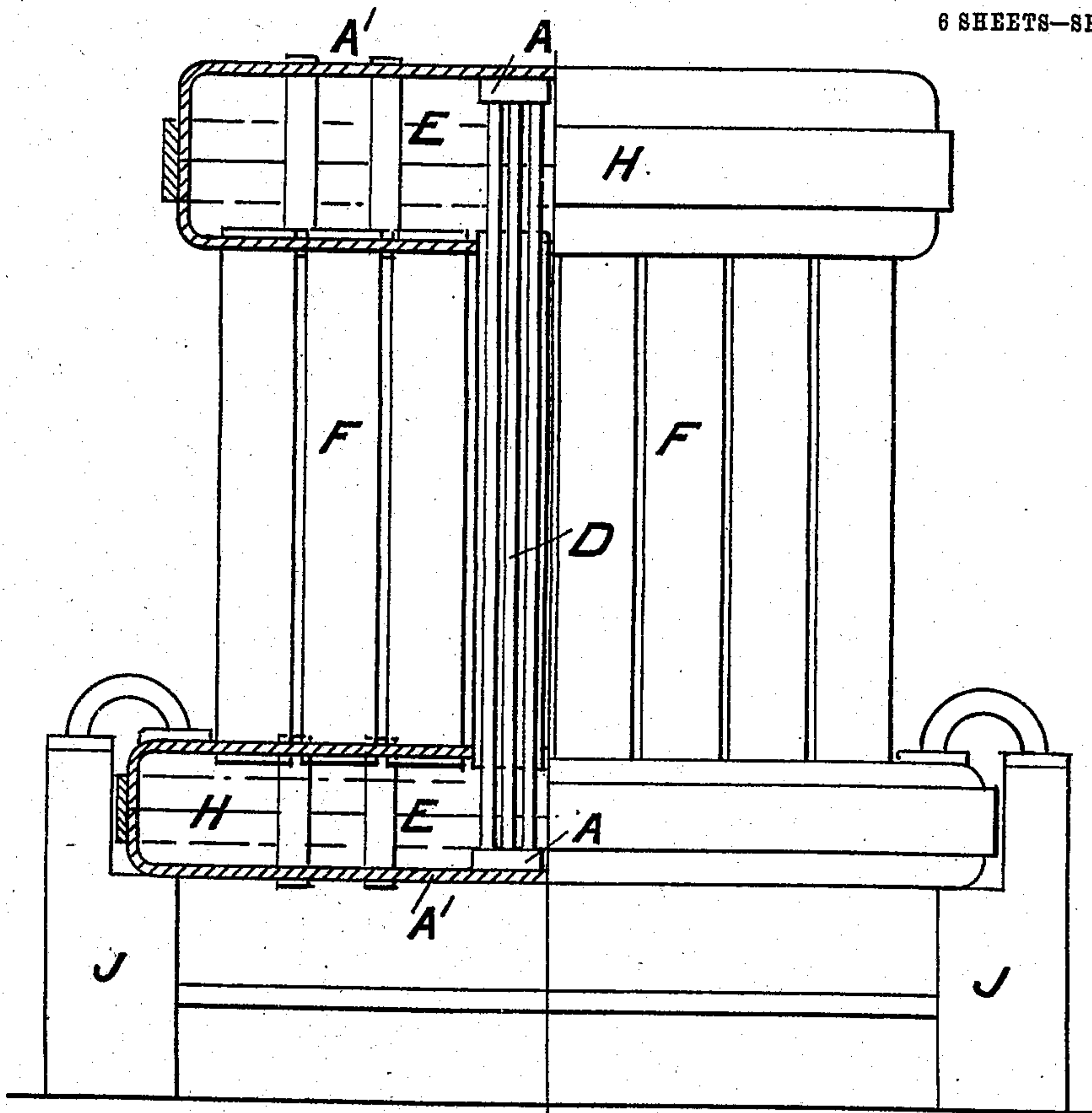


FIG. 3.

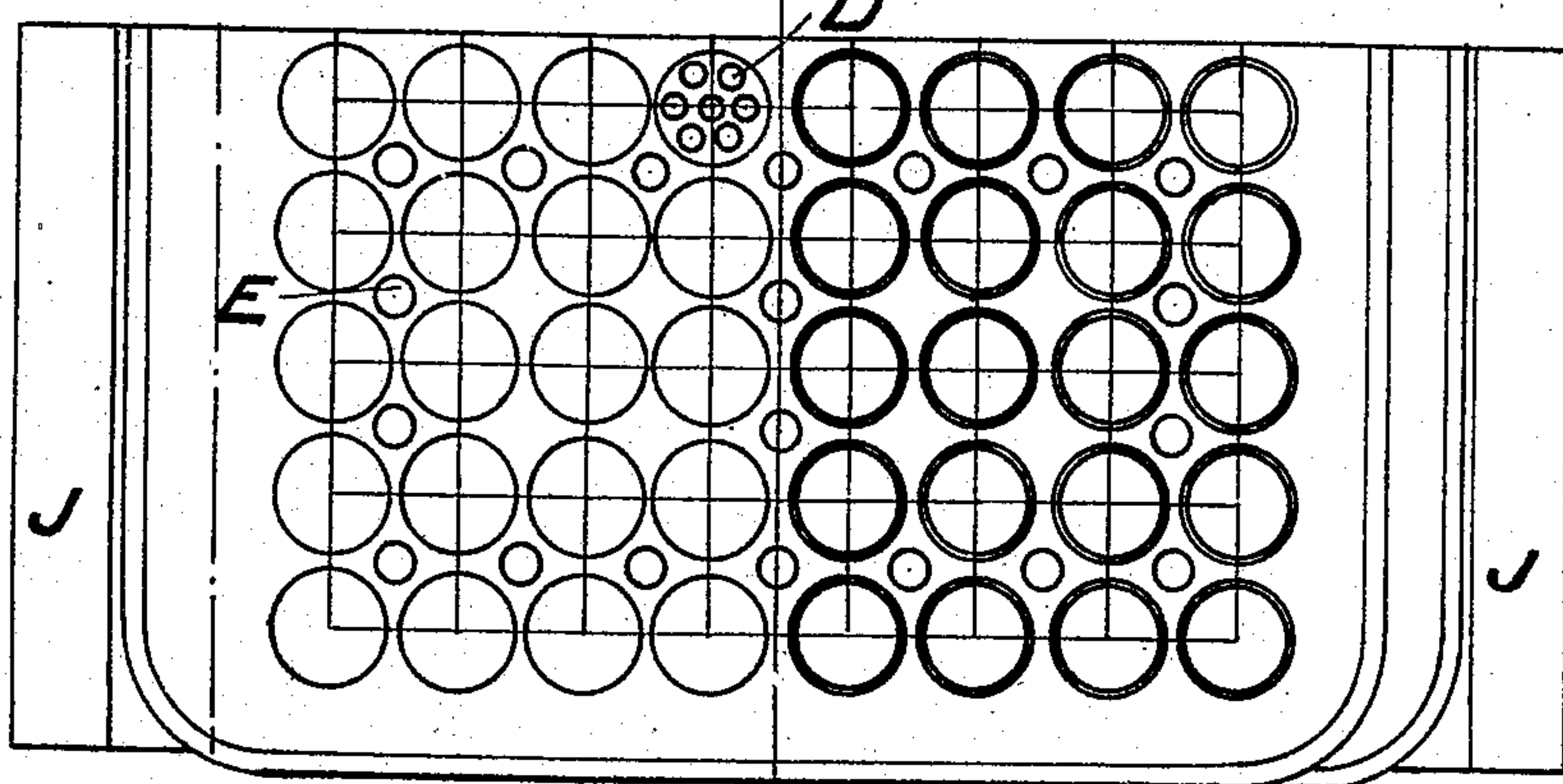


FIG. 4.

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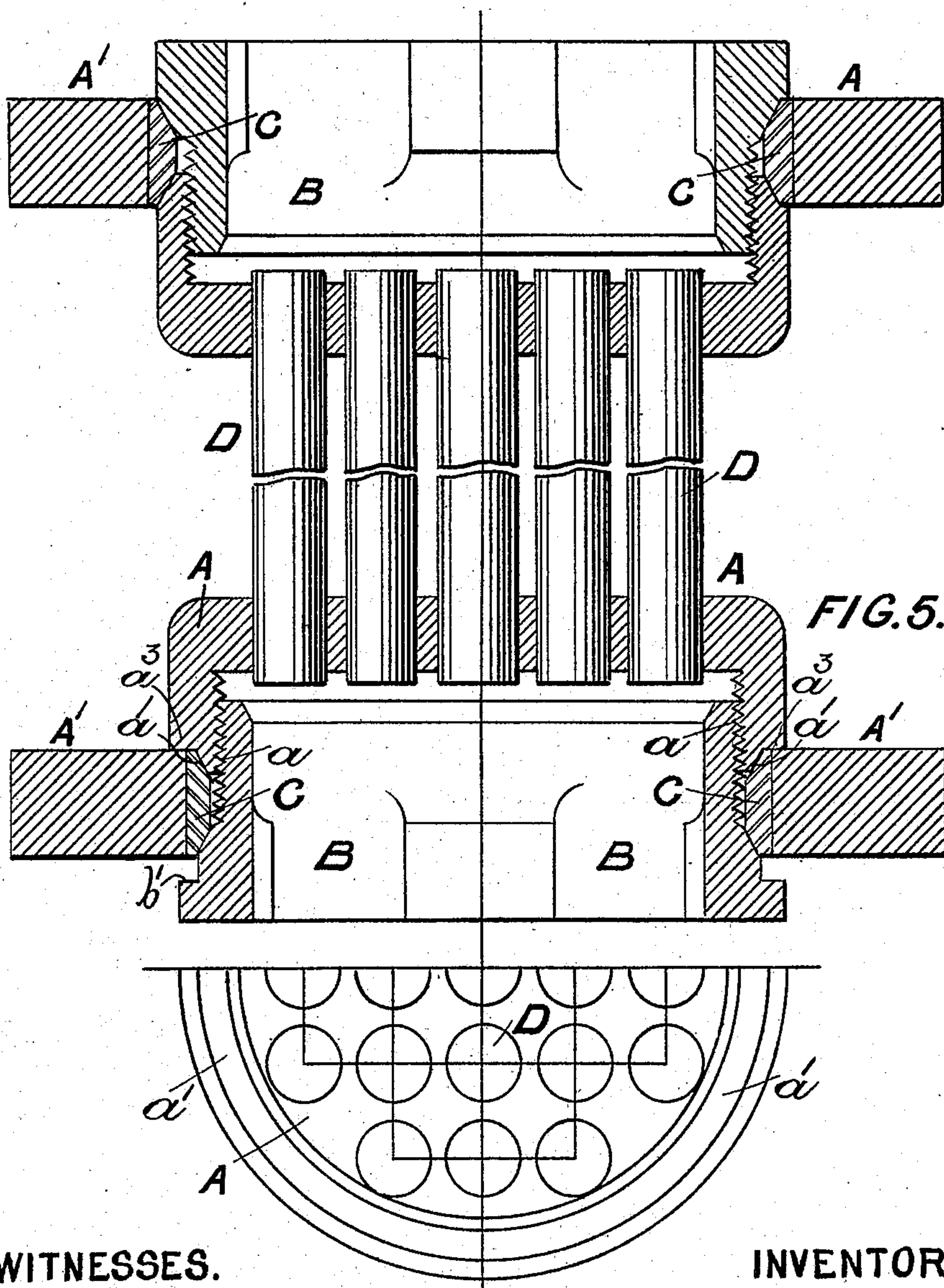
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FIG. 6.

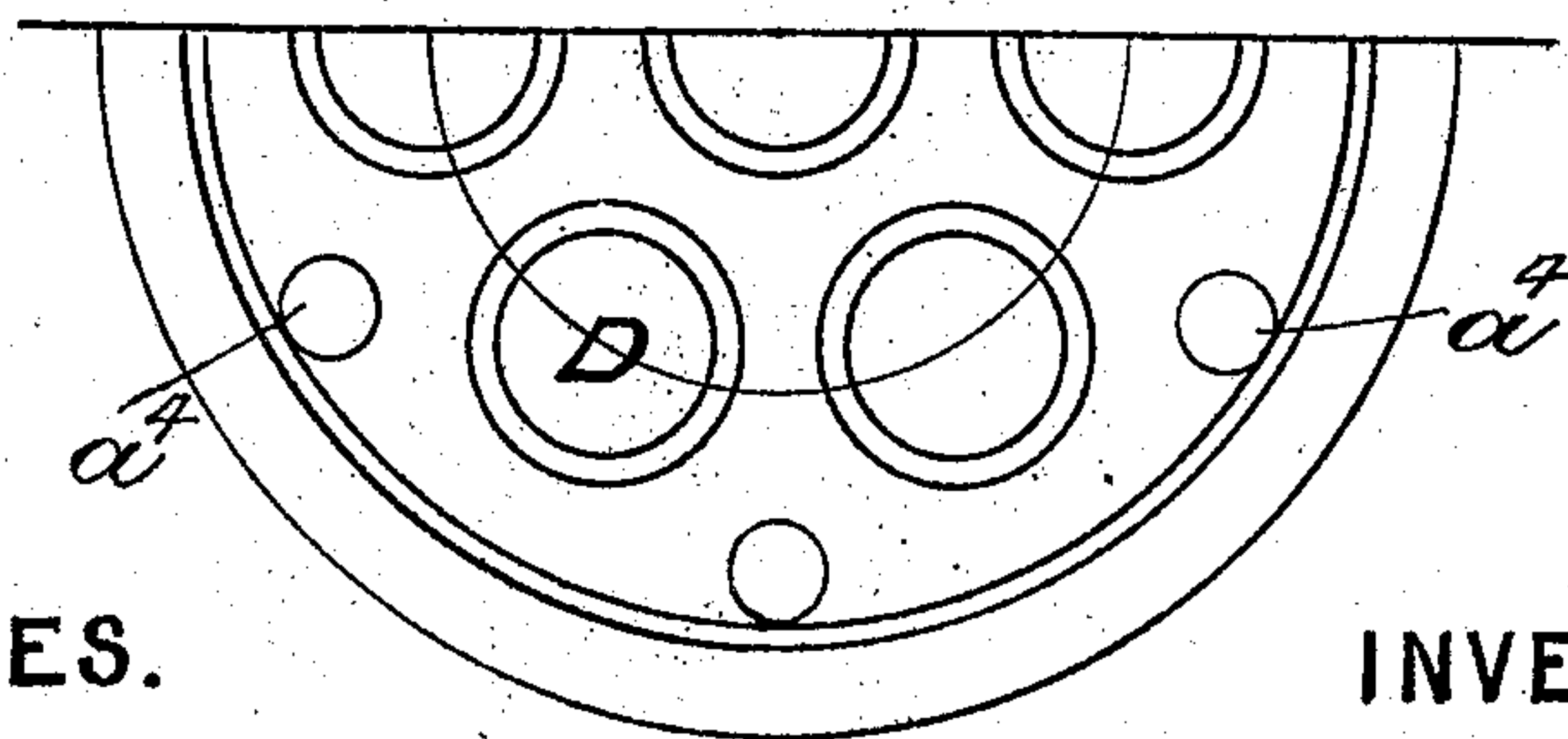
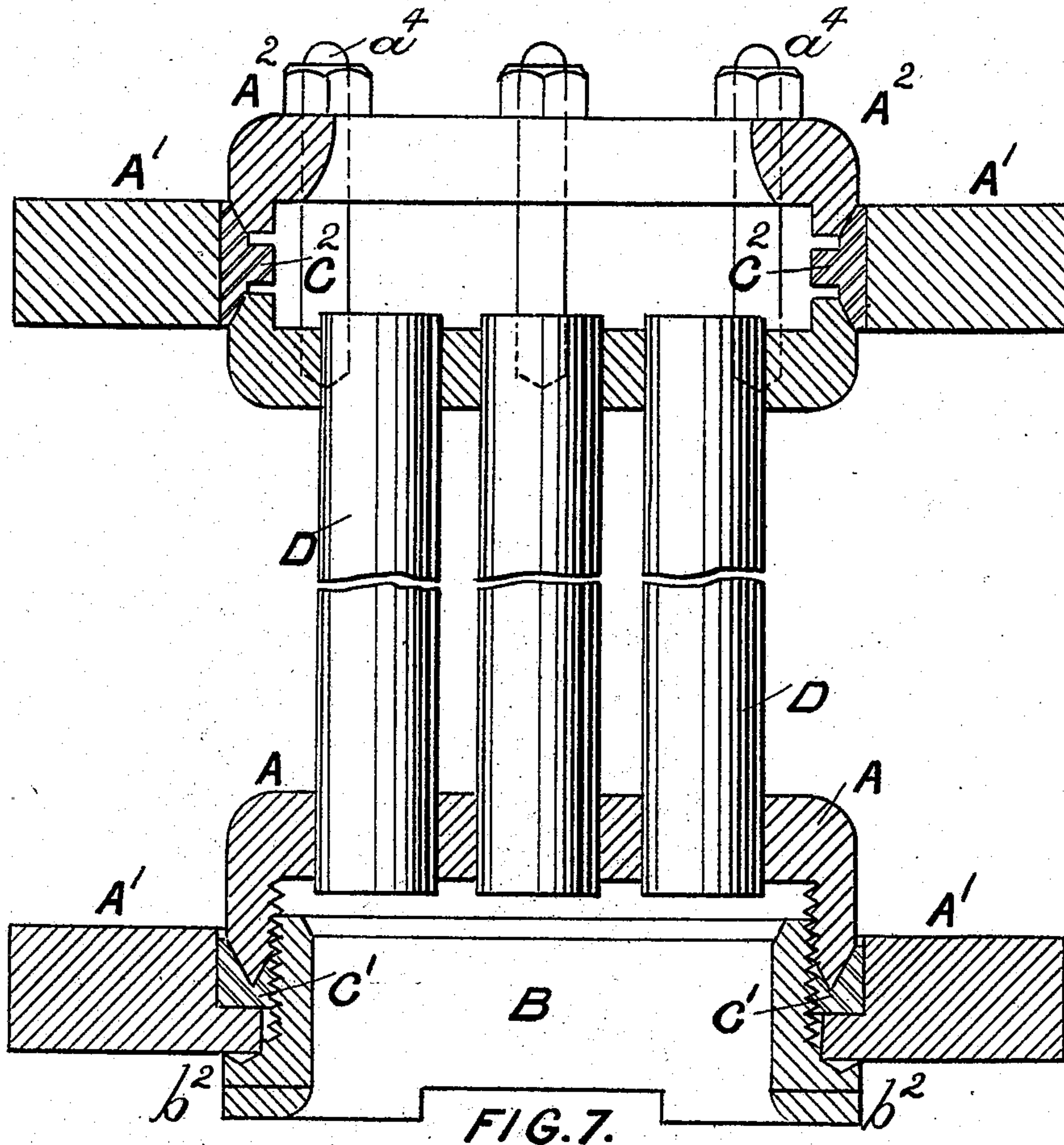
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6 SHEETS—SHEET 4.



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FIG. 8.

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6 SHEETS—SHEET 5.

FIG. 9.

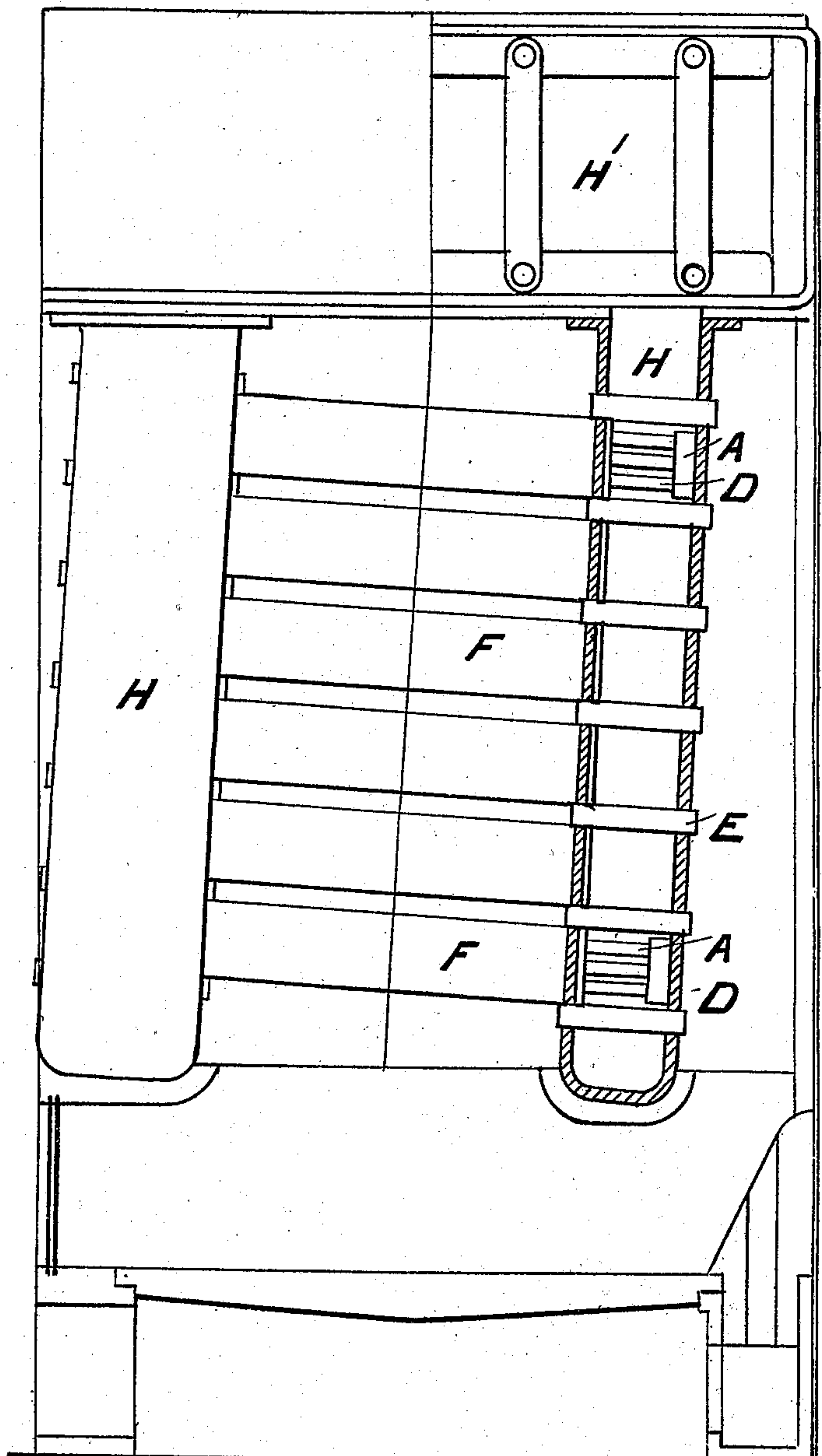
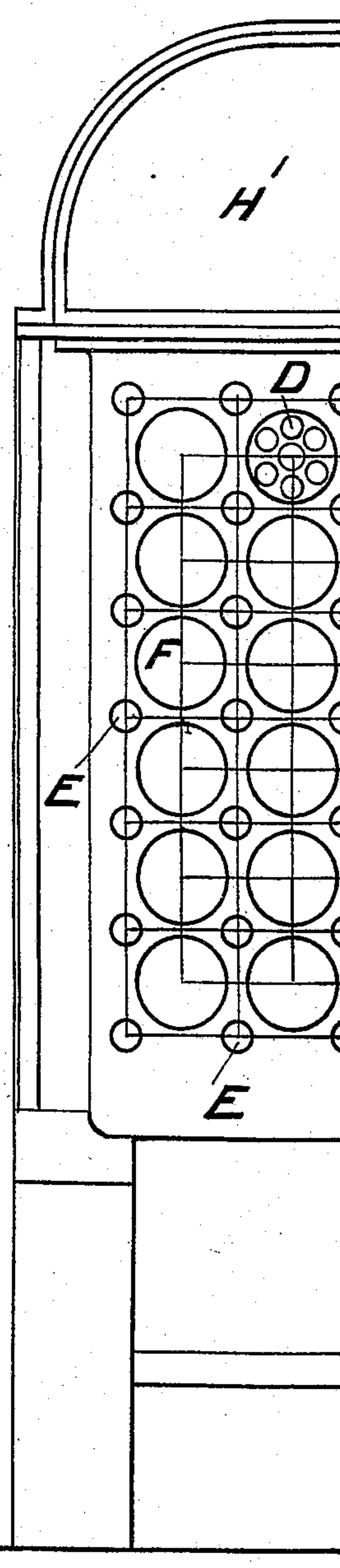


FIG. 10.



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6 SHEETS—SHEET 6.

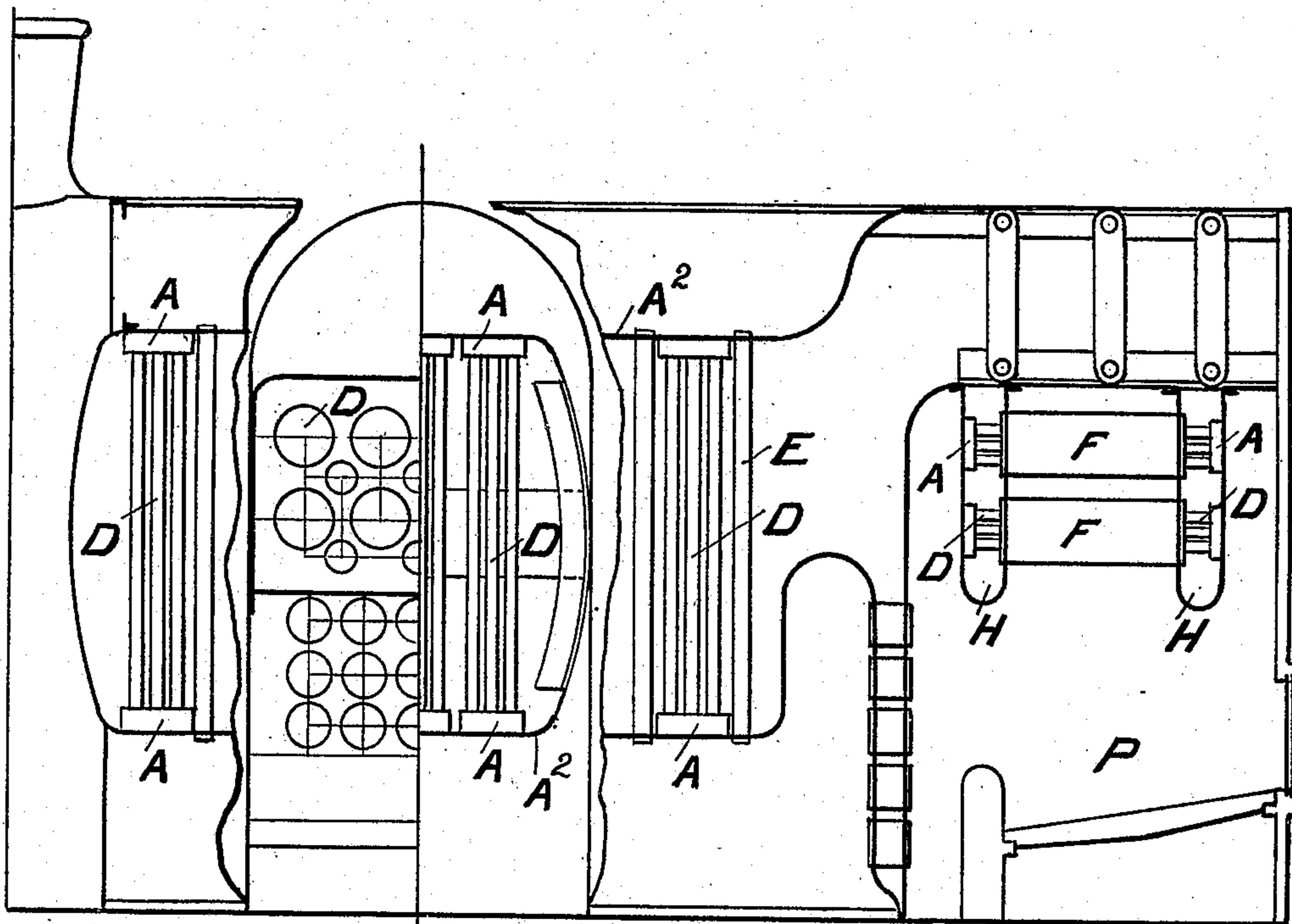


FIG. 12.

FIG. 11.

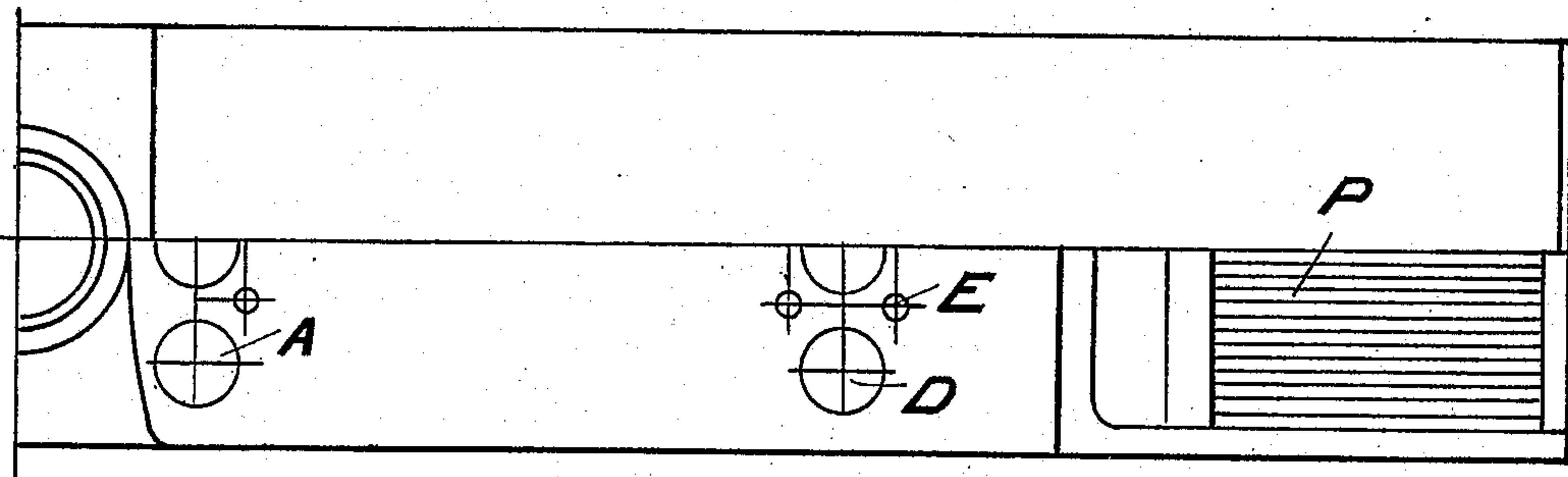


FIG. 13.

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UNITED STATES PATENT OFFICE.

ARTHUR W. METCALFE AND JOHN STEEL DIXON SHANKS, OF BELFAST, IRELAND.

CONSTRUCTION OF STEAM-BOILERS.

No. 907,841.

Specification of Letters Patent.

Patented Dec. 29, 1908.

Application filed February 18, 1905. Serial No. 246,348.

To all whom it may concern:

Be it known that we, ARTHUR WILSON METCALFE and JOHN STEEL DIXON SHANKS, British subjects, and residents of Belfast, county of Antrim, Ireland, have invented certain new and useful Improvements in the construction of Steam-Boilers, of which the following is a specification.

This invention relates to tubular boilers and is designed to provide for more easily fitting, removing and renewing the tubes than has hitherto been the case.

Hitherto in the construction of tubular boilers each tube has been separately fitted into the plate which renders the fitting and removal difficult and provides no means for the expansion and contraction of the tubes.

Our invention consists essentially in constructing the tubes in sets or groups or nests fitted into suitable coupling plates at both ends by which they are fitted to the boiler plates each unit so constructed containing any desired number of tubes say from 12 up to 100 more or less according to the size of the boiler and the size of the units or sets of tubes.

The invention will be fully described with reference to the accompanying drawings in which as examples the invention is shown applied to various descriptions of boilers some of which have been specially designed for the purpose.

Figure 1 is a sectional elevation of a vertical boiler showing the invention applied thereto. Fig. 2 is a sectional plan of same. Fig. 3 is a sectional elevation of special design of vertical boiler with the nests or units of tubes applied thereto. Fig. 4 is a sectional plan of same showing the position of the nests of tubes. Fig. 5 is a sectional elevation of one unit or set of tubes with the coupling for fastening same into the plates of the boiler. Fig. 6 is a half plan of the coupling plate into which the set or nest of tubes is fixed. Fig. 7 is a sectional elevation of one unit or set of tubes showing a modified construction of coupling plates. Fig. 8 is a half plan of same. Fig. 9 is an elevation of water tube boiler constructed with units of tubes within larger water tubes. Fig. 10 is an end elevation of same showing spacing of tubes and units. Fig. 11 is a sectional elevation of special design of locomotive boiler constructed with both horizontal and vertical nests of tubes. Fig. 12 is a half end

elevation in section through fire box. Fig. 13 is a plan.

The invention may be applied to any ordinary form of tubular or water tube boilers either vertical or horizontal the tubes being grouped together in nests or sets D the ends being fitted into coupling plates A to attach them to the plates of the boiler each nest or set forming a unit of tubes D which can be handled and easily and readily placed in position or removed therefrom.

The coupling plate A is preferably in the form of a dish-shaped metallic casting or forging into which the tubes are secured in any ordinary way by drifting or expanding by screwing or by nuts or in any other manner. The inner wall *a* is chased or screwed to receive an annular nut B (see Fig. 5) and the outer edge *a'* is beveled as is also the edge of the annular nut. A steam and water tight joint between the coupling plates A and a corresponding hole in the boiler plates A' is obtained by a metallic or other packing ring C placed in the hole in the boiler plate and interposed between the conical or beveled edge *a'* of the coupling plate A and the beveled or conical edge *b* of the annular nut B.

The metallic packing ring C is preferably soft copper and when the annular nut B is screwed into the coupling plate A the ring C is expanded between the two beveled faces making a steam or water tight joint with the hole in the plate A'. The packing ring C can move in the hole in the plate A' as the tubes D contract or expand.

To insert and fix the unit of tubes in position the hole in one plate A' is preferably made larger than that in the other and one coupling A is made with a shoulder *a³* to rest against the plate and the nut is also made with a shoulder to limit the movement of the tubes. If desired both nuts B may have a shoulder such as *b'*. The coupling is passed through the larger hole and secured in the smaller one with the shoulder *a³* resting against the plate and the other coupling is then secured in the hole in the other plate through which it has passed by screwing the nut B down upon the packing ring C.

In a modification shown in Fig. 7, the dished coupling plate A at one end of the unit of tubes D is drawn down onto a soft metallic packing ring C' by the annular nut formed with a shoulder or head *b²* which

rests against the plate A', and coupling plate A at the other end is provided with screwed studs or bolts a^1 by which a metallic packing ring C² is clamped between it and a plate or
 5 cover A² and expanded against the sides of the hole in the plate A'. It will be evident that the soft metallic packing ring C may be clamped and expanded between the coupling plate A and the sides of the hole in the
 10 plate by any other suitable means.

Referring to Figs. 1 and 2 the unit of tubes D are shown attached by the coupling plates A to the top and bottom horizontal plates A' of a cylindrical vertical multitubular boiler. The horizontal plates A' are
 15 riveted to the cylinder at the top and bottom and are supported by stays or stay tubes E of ordinary construction expanded into or otherwise attached to the plates. A
 20 fire grate L is placed below the boiler as described and a smoke box may be placed above the tubes.

Referring to Figs. 3 and 4 another special construction of boiler is shown for utilizing
 25 the units or nests of tubes D. Two headers or chambers H are placed horizontally one above the other and connected together by the large tubes F through which the units of tubes D pass and secured to the outer plates
 30 A' of the headers by coupling plates A as hereinbefore described. Stay tubes E expanded into the plates A' of the headers support them in position. Water tanks J may be connected with the lower header through
 35 which the feed water passes.

Referring to Figs. 9 and 10 another special construction of boiler is shown for utilizing the units or nests of tubes D. Two
 40 chambers or headers H are constructed connected by the large tubes F secured in the plates in any ordinary way. Through the headers or chambers H and the larger tubes F the units or nests of small tubes D are passed and secured as hereinbefore de-
 45 scribed to the outer plates of the headers H. The headers H are connected to a steam and water tight chamber H' placed above them. The headers H may be vertical with horizontal tubes or they may be horizontal with
 50 vertical tubes or at any other inclination.

In either of the special designs of boilers described the boiler may rest upon steel tanks forming two or more sides of the furnace and the feed water may be first injected

into the tanks and from thence to the boilers 55 by one or more tubes.

Referring to Figs. 11, 12 and 13 a special construction of locomotive boiler is shown having horizontal and vertical tubes. The
 shell A² is horizontal and of oblong form. 60 The shell is fitted in with units or nests of tubes D placed vertically and in the fire box are two headers H with units of tubes D placed horizontally passing through large
 tubes F. The units of tubes D are secured 65 in position by coupling plates A as hereinbefore described. The furnace P in this boiler is placed at one end of shell and depending from the roof of furnace are the two headers
 H having tubes extending from the one to 70 the other. The heat and gases of combustion in these boilers, where the large tube system is used, by passing through the stay tubes which are surrounded by water, and
 surrounding the large tubes which contain 75 water, and passing directly through the inclosed small tubes which are like the stay tubes also surrounded by water are pre-
 sented to a large heating surface in a comparatively small space and very rapid evapo- 80 ration is the result.

What we claim as our invention and desire to protect by Letters Patent is:—

1. In a steam boiler the combination with a unit comprising a plurality of tubes of a
 85 dishd coupling plate A at each end to which the tubes are secured, a loose coupling ring B by which the coupling plate is drawn into position and a soft metallic ring C compressed between the two substantially as de- 90 scribed.

2. In a steam boiler the combination with a unit comprising a number of tubes D, of a
 dishd coupling plate A at each end in which the ends of the tubes are secured provided 95 with an internal screw thread, an annular nut B to engage the said screw to draw the coupling plate into position and a soft metallic packing ring C to form a joint between the two parts substantially as described. 100

In witness whereof, we have hereunto signed our names in the presence of two subscribing witnesses.

ARTHUR W. METCALFE.

JOHN STEEL DIXON SHANKS.

Witnesses:

JOHN MOORE,

THOMAS DIXON.