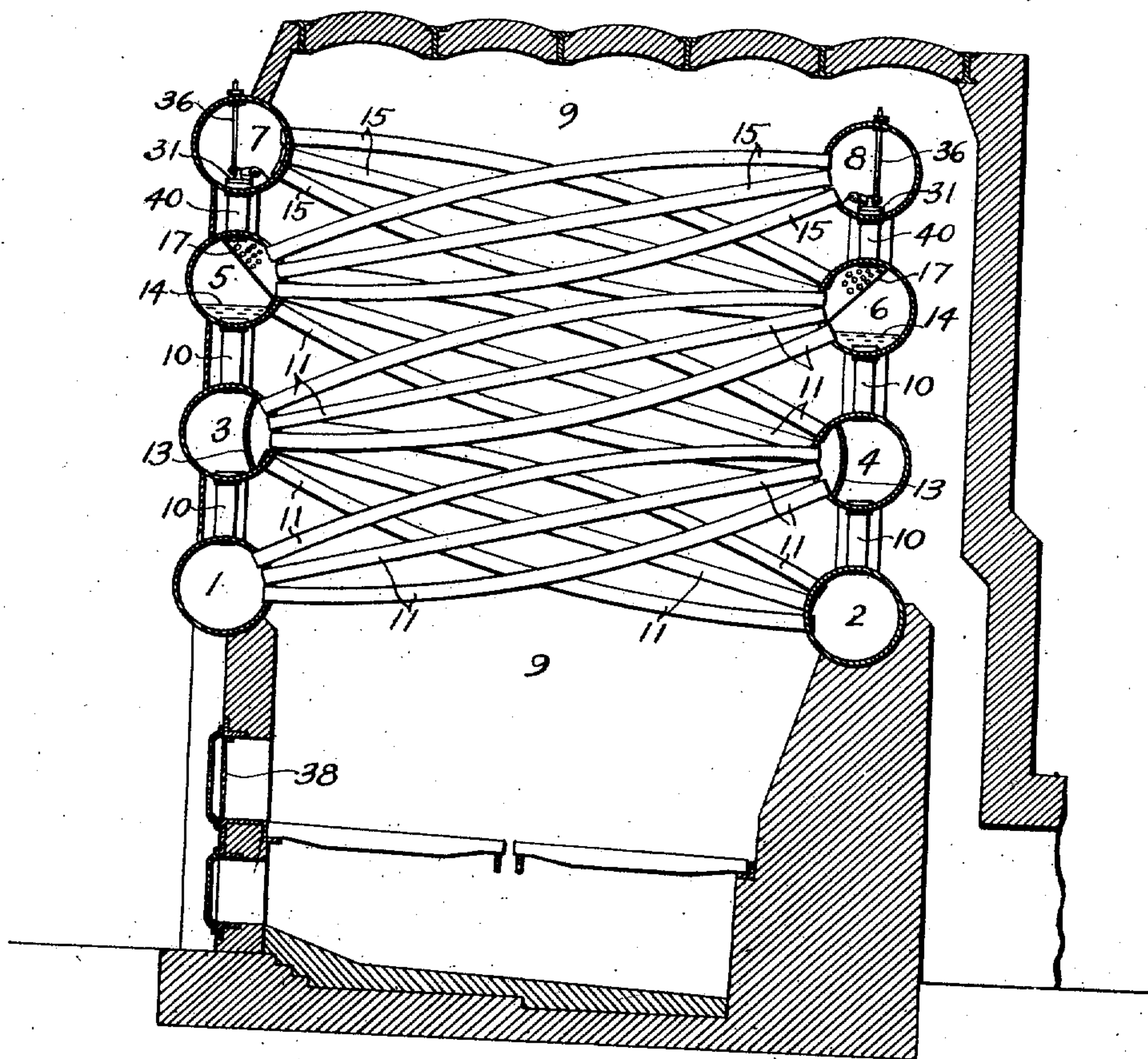


973,541.

J. MIYABARA.
WATER TUBE BOILER.
APPLICATION FILED DEC. 14, 1909.

Patented Oct 25, 1910.
4 SHEETS—SHEET 1.

Fig. 1



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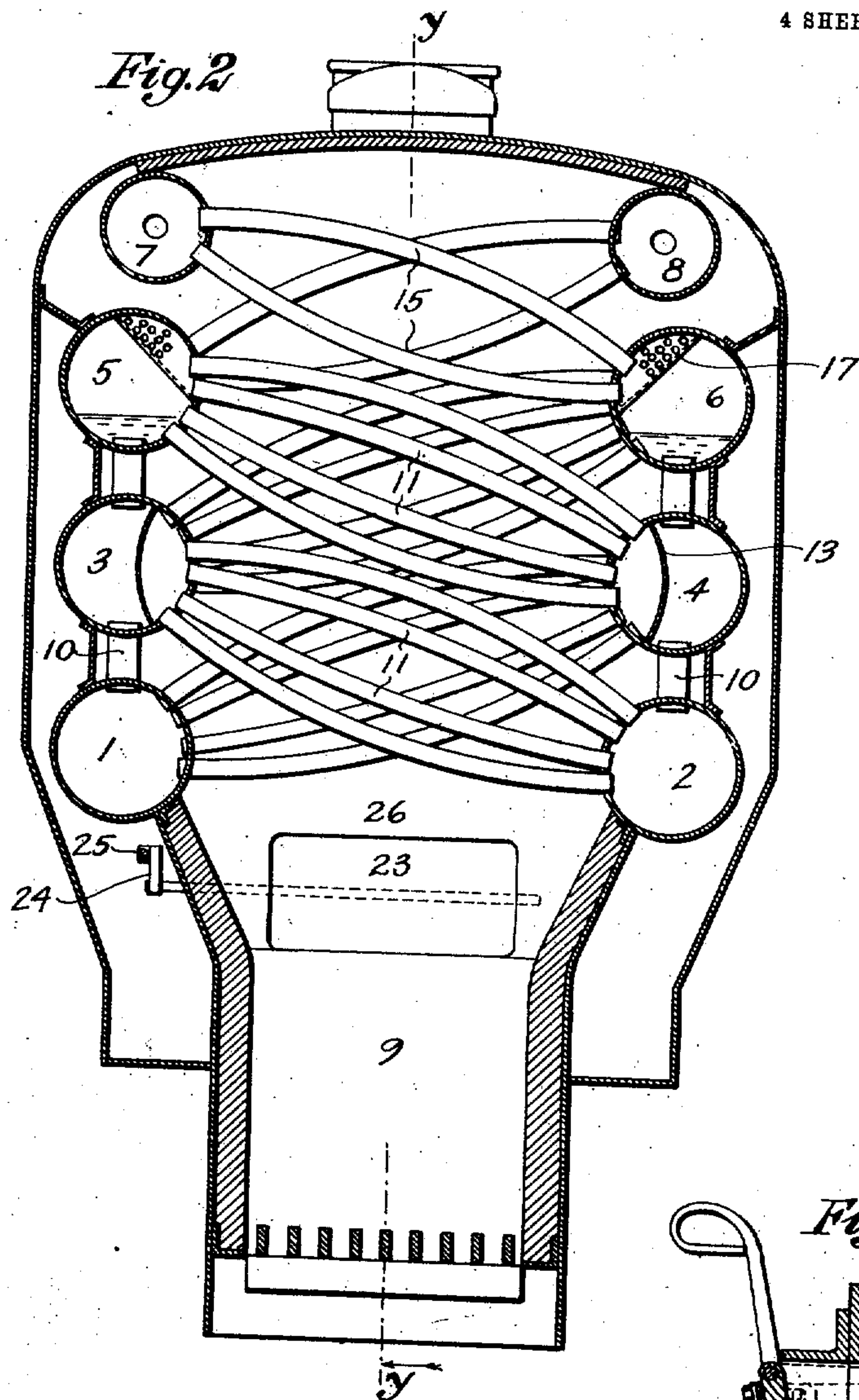


Fig. 8

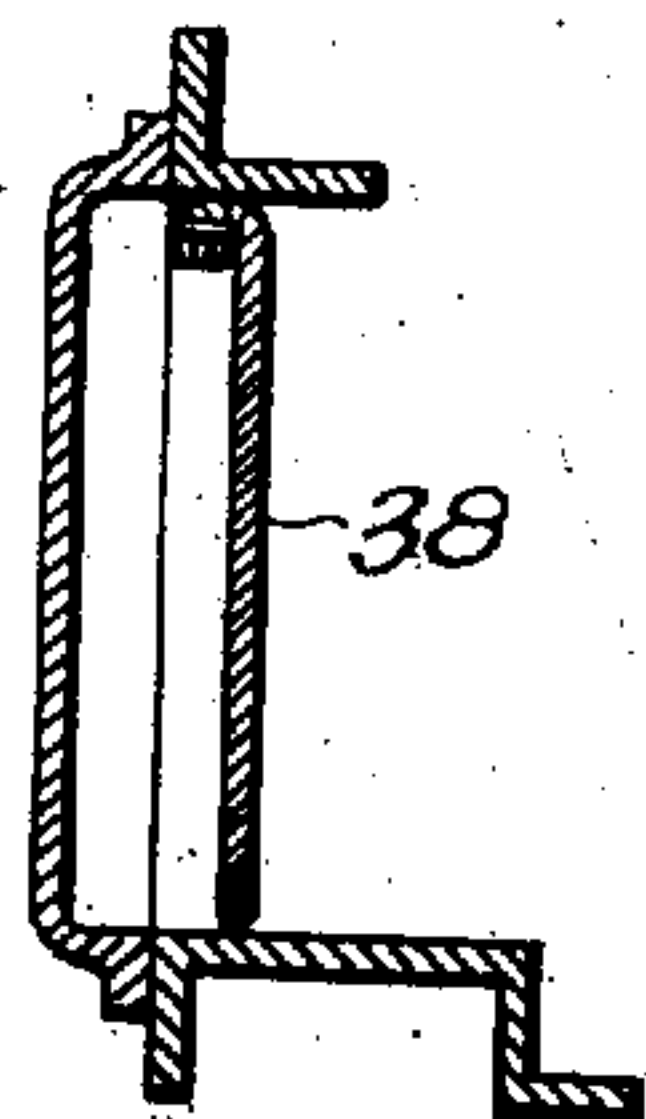


Fig. 10

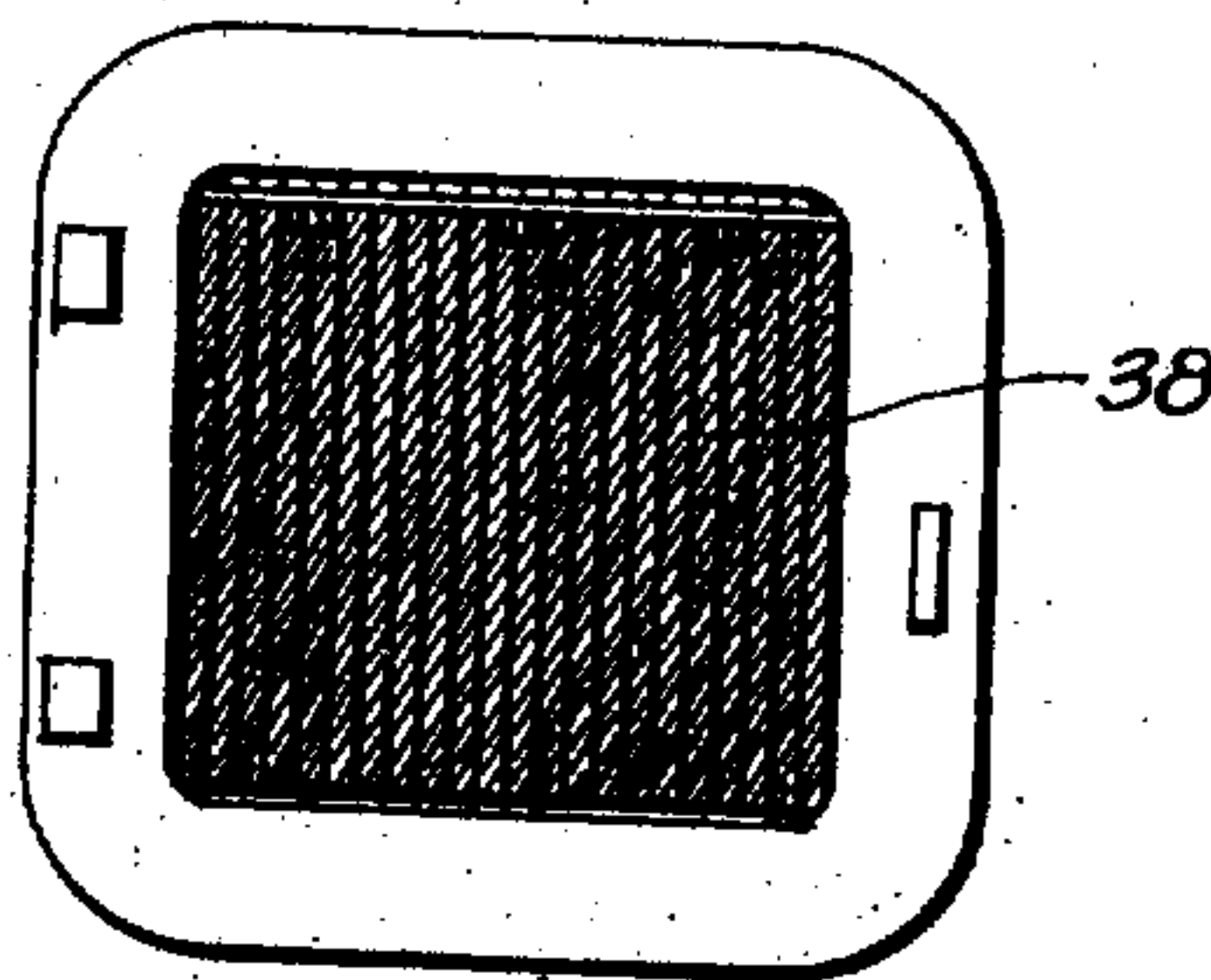
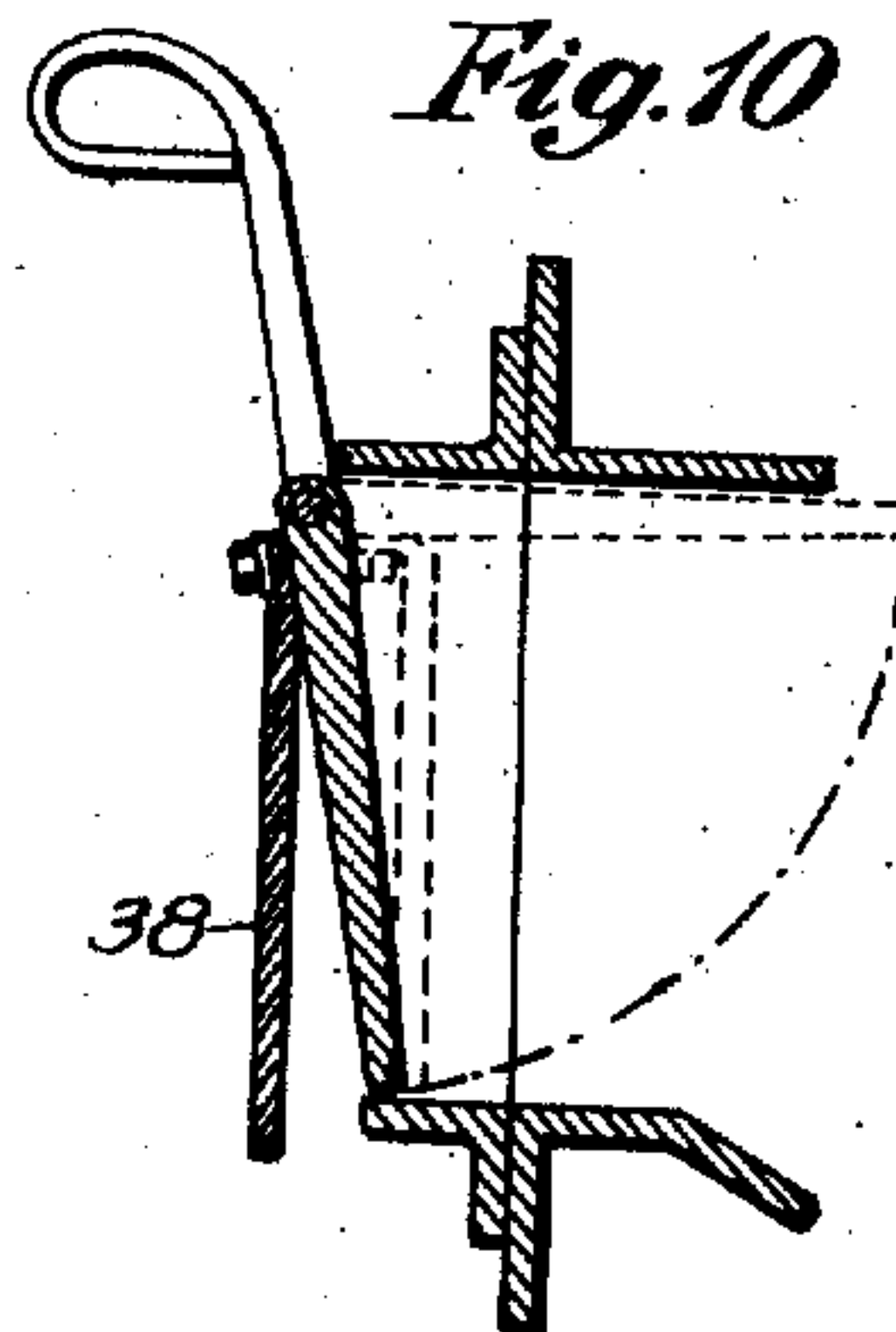


Fig. 9

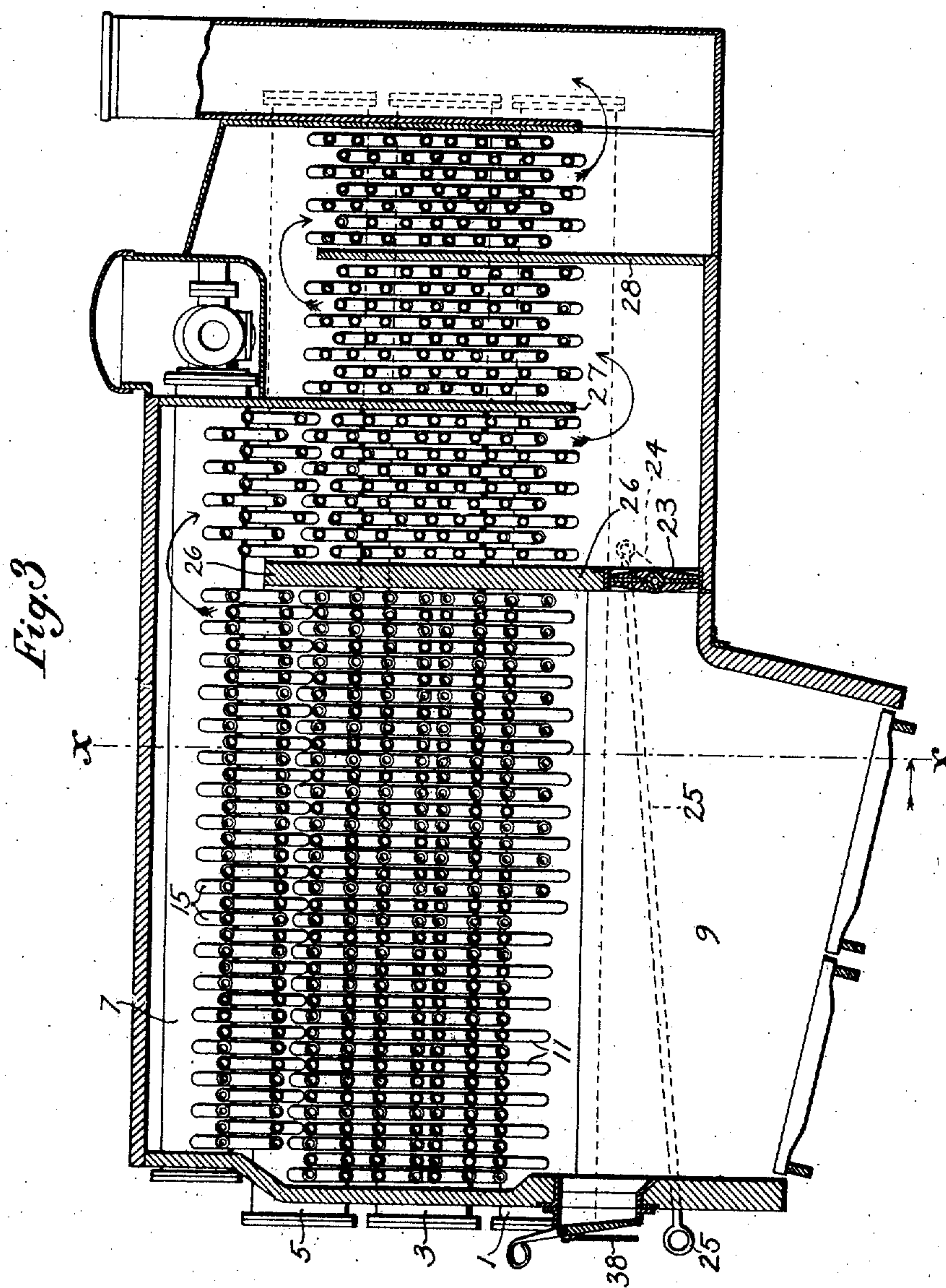
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

Fig. 4

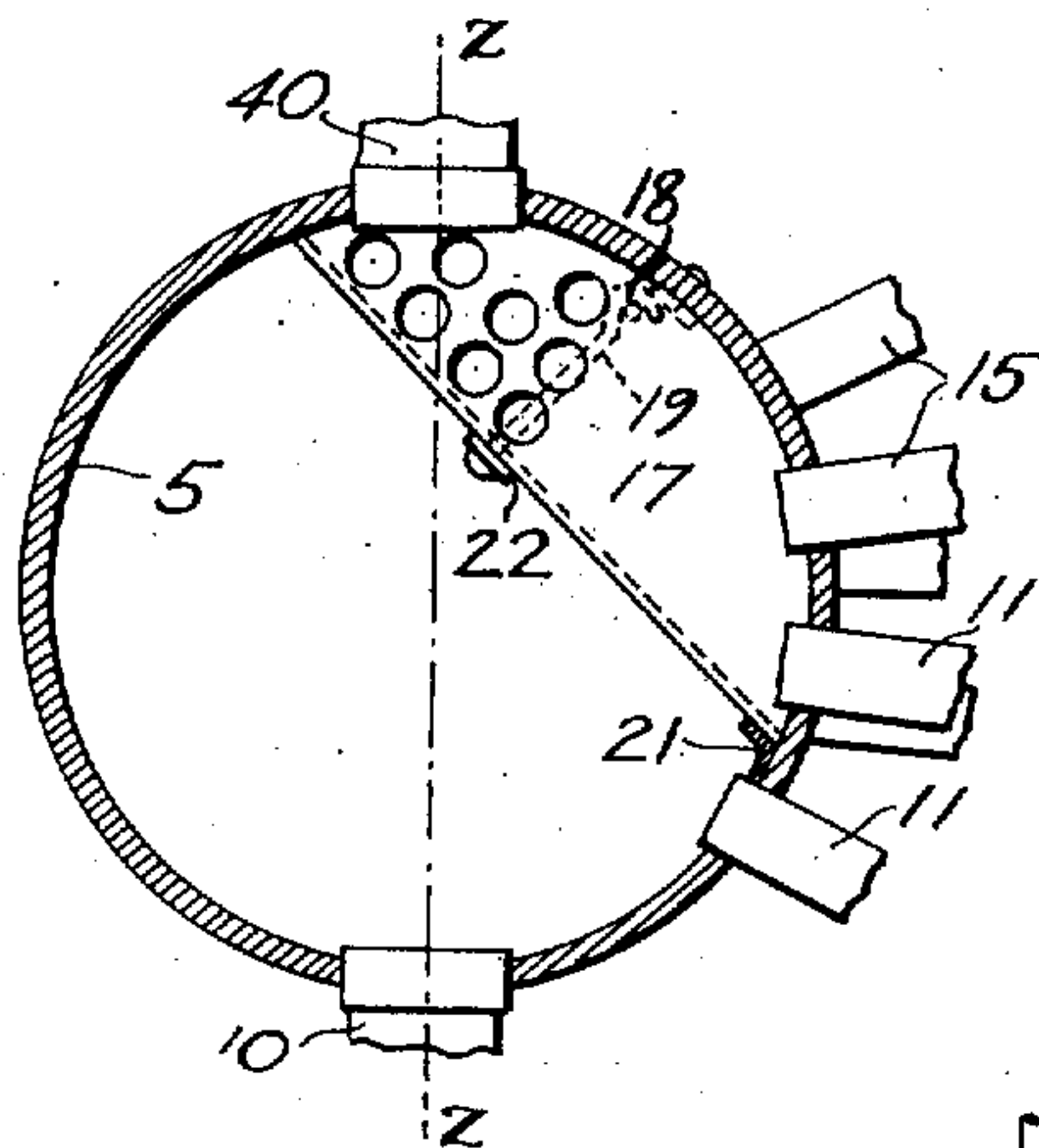


Fig. 5

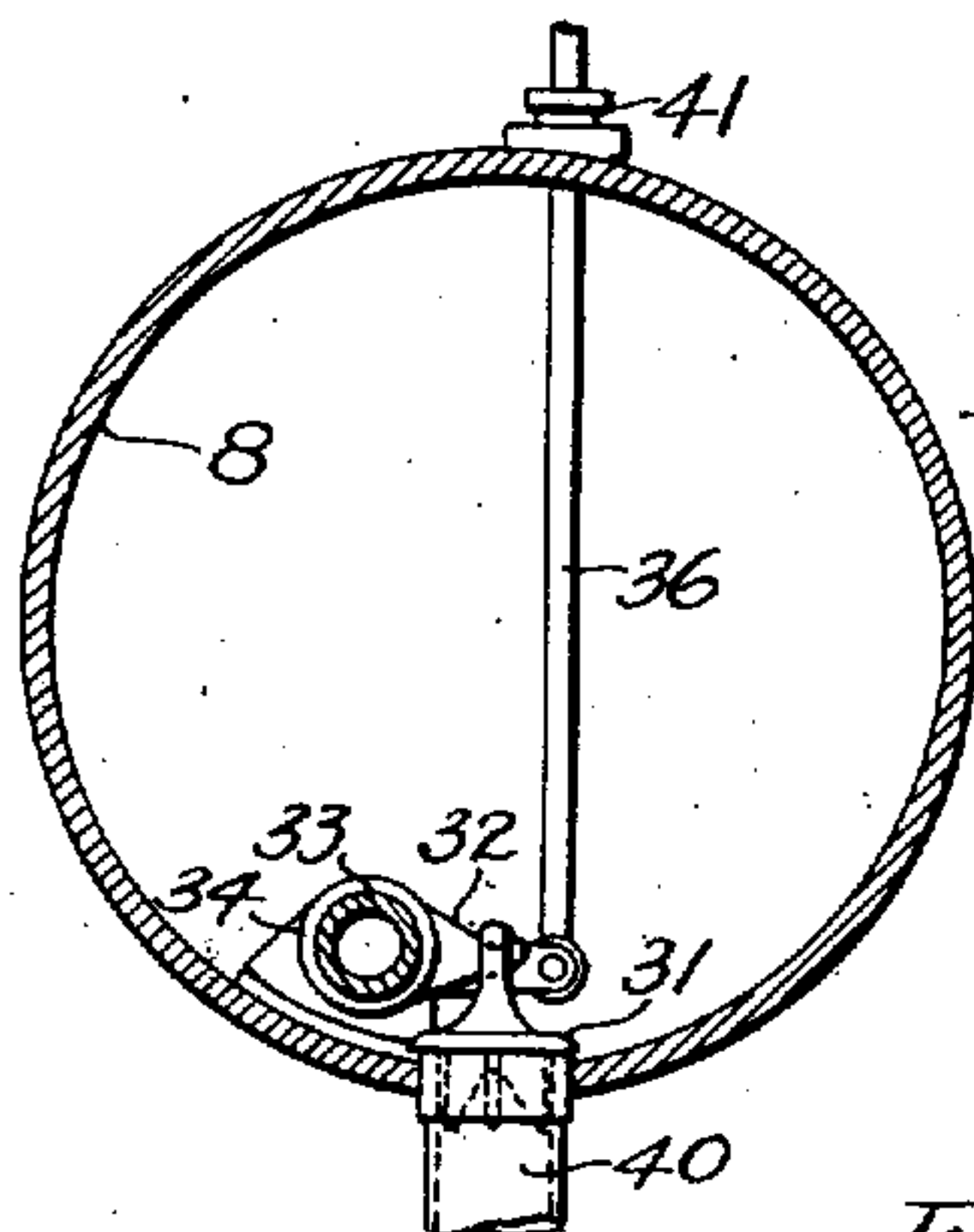
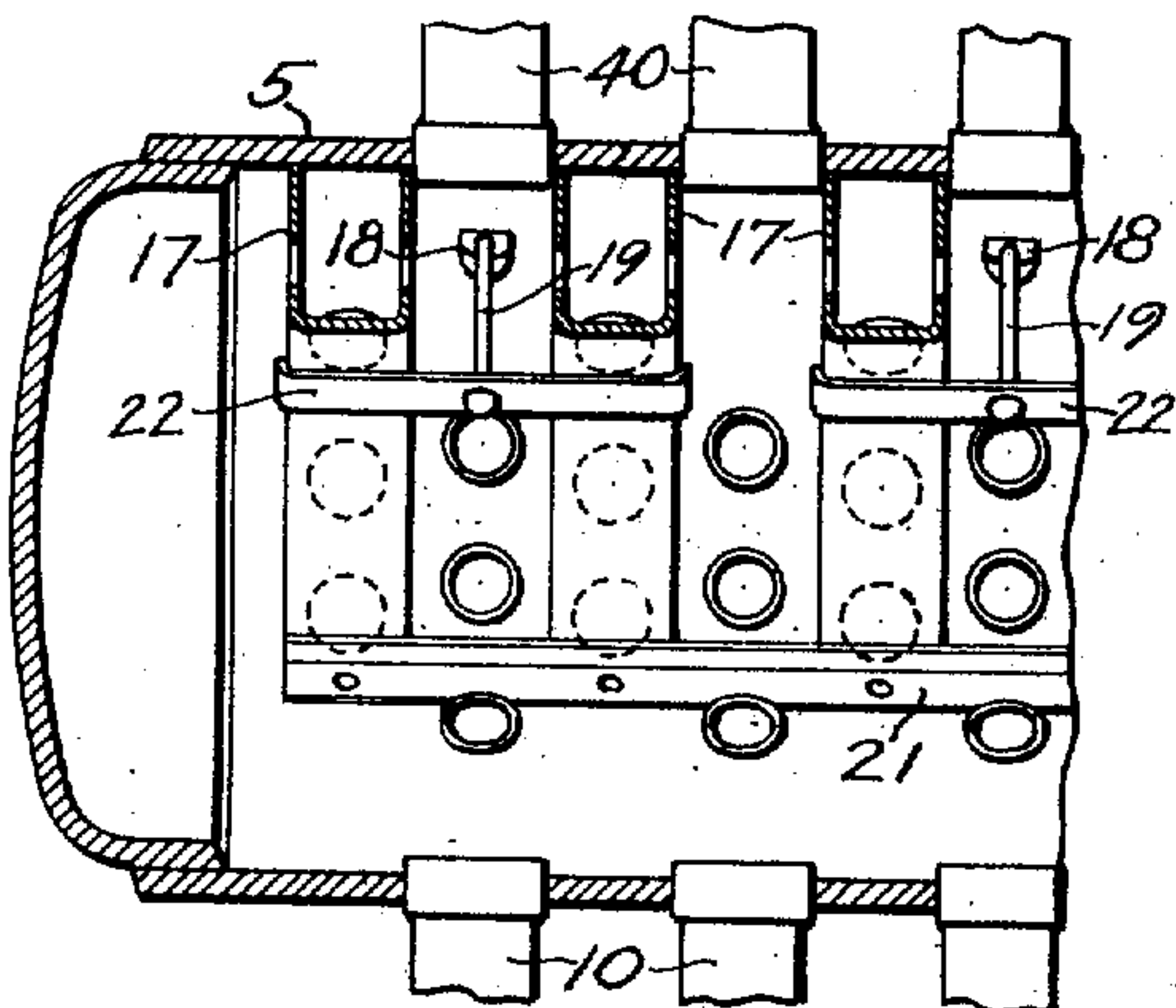
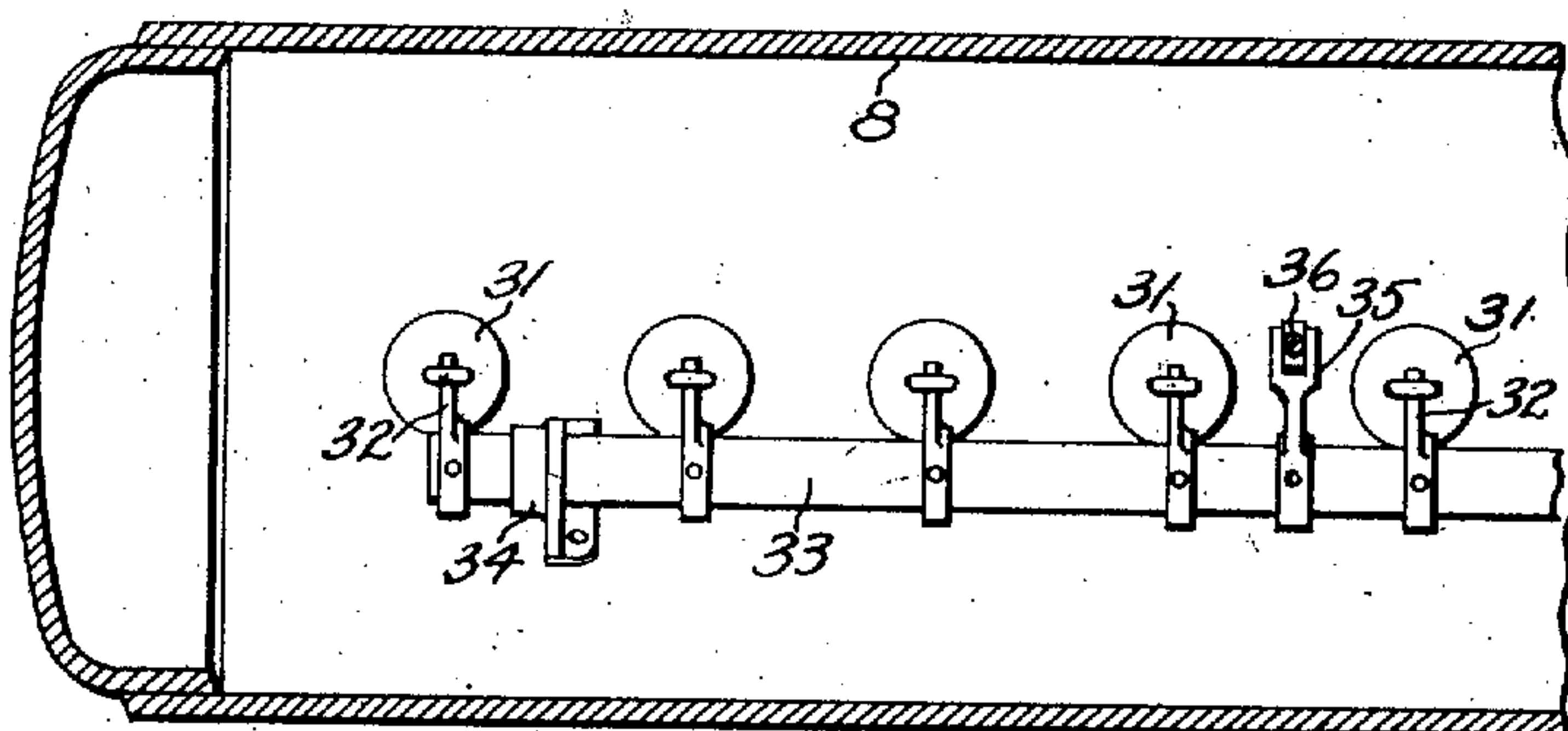


Fig. 6

Fig. 7



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UNITED STATES PATENT OFFICE.

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WATER-TUBE BOILER.

973,541.

Specification of Letters Patent.

Patented Oct. 25, 1910.

Application filed December 14, 1909. Serial No. 533,017

To all whom it may concern:

Be it known that I, JIRO MIYABARA, a subject of the Emperor of Japan, and a resident of Tokyo, Japan, have invented a new and useful Improvement in Water-Tube Boilers, of which the following is a specification.

My invention comprises several improvements in construction and operation, of which some are applicable to boilers in general, while others are applicable particularly to boilers of the type disclosed in my Letters Patent of Great Britain, dated April 30th, 1896, No. 9131.

One object of my invention is to provide a boiler, having provision for producing superheated steam, with means whereby the products of combustion by which the superheating means are normally heated may be diverted from said means when, for any reason, the steam consumption is interrupted or greatly reduced, in order that overheating of the superheating means may be avoided.

Another object of the invention is to produce a water-tube boiler which may be readily arranged to produce either superheated steam or saturated steam, and which may be converted at will from one mode of operation to the other.

A third object of the invention is to provide a boiler with means for diminishing the influx of air when the fire door is opened, for the purpose of stoking the boiler.

Other objects of the invention, and the means by which the several objects are carried out, will be noted in connection with the description of the illustrated embodiment of the invention.

Two preferred embodiments of the invention are illustrated in the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a boiler of the stationary type embodying certain features of the invention. Fig. 2 is a transverse sectional view, on line $x-x$ in Fig. 1, of a locomotive boiler embodying certain features of the invention. Fig. 3 is a section on line $y-y$, in Fig. 2, looking from right to left. Fig. 4 is a detail view, in sectional elevation, showing the devices for separating steam and water in the water walls of the boiler. Fig. 5 is a section, on line $z-z$ in Fig. 4, looking from left to right. Fig. 6 is a transverse section of one of the superheating drums. Fig. 7 is a

plan, partly in section, of one of the superheating drums. Fig. 8 is a sectional detail view illustrating the application of the air curtain in connection with an outwardly-opening fire door. Fig. 9 is a front view of the doorway with the curtain in place. Fig. 10 is a sectional view showing the application of the air curtain in connection with an inwardly-opening fire door.

The boiler illustrated in Fig. 1 has front and rear water walls, each wall comprising a number of drums connected by rows of vertical tubes. The front wall comprises drums, 1, 3 and 5, connected by vertical tubes 10, and the back wall comprises drums 2, 4 and 6, similarly connected. The combustion space 9 of the boiler is crossed by inclined water tubes 11, which connect each drum with the one next above on the opposite wall. The water walls constitute down-takes for the water while the water tubes act as uptakes for water and steam. In order to maintain the circulation through these parts, the drums 3 and 4 are provided with diaphragms 13, which separate the ascending currents from the descending currents. These diaphragms, together with the inner portions of the drums 3 and 4, constitute means for coupling the oppositely-inclined water tubes which terminate at the drums 3 and 4.

When the boiler is used to produce superheated steam the drums 5 and 6 constitute the uppermost drums of the water walls, and these drums also constitute steam drums, as the water is maintained at the level indicated at 14 in the drawing. The steam is superheated in tubes 15, which are connected with the drums 5 and 6, and which cross the combustion space in the same manner as the water tubes. The superheating tubes 15 terminate in two drums, 7 and 8, which are arranged, respectively above the front and rear water walls. From these drums the steam is drawn off for use.

To separate the steam from the water in the drums 5 and 6, the ends of the superheating tubes 15 are covered by separator boxes 17. These boxes are shown in detail in Figs. 4 and 5, and they are perforated in their upper portions to admit the steam, while their lower portions are made imperforate to exclude the water. The separator boxes rest, at their lower extremities, upon flanges 21 riveted upon the inner surfaces of the drums, and they are further secured

in place by means of hooks 19 which engage eyes 18 on the walls of the drums. Each hook secures a strap 22, which engages two separator boxes, as shown in Fig. 5.

- 5 To permit the use of the boiler for producing saturated steam, means are provided for connecting the drums 7 and 8 directly with the drums 5 and 6, so that the former may constitute parts of the water walls.
- 10 These means comprise vertical tubes 40 similar to the tubes 10 hereinbefore described. When the boiler is used for producing superheated steam, the upper ends of the tubes 40 are closed by mushroom valves 31, so as
- 15 to prevent the direct passage of the steam from the lower drums into the superheating drums, but when the boiler is used to produce saturated steam, the valves 31 are opened and the water level is raised to fill
- 20 the tubes 40 and to partly fill the drums 7 and 8 and the superheating tubes 15. The valves 31 are simultaneously operated, in each of the drums 7 and 8, by means of a rock shaft 33 which turns in lugs 34 on the
- 25 inside of each drum. The rock shaft carries short arms 32 to each of which one of the valves is loosely connected. The rock shaft is actuated by means of a rod 36 which is pivoted to an arm 35 on the rock-
- 30 shaft. The rod 36 slides through a stuffing box 41 at the top of the drum, and is moved, by any convenient means, to operate the valves. When the valves 31 are opened, the tubes 40 act as water down-takes in the same
- 35 manner as the tubes 10, and the tubes 15 act as water-tubes, in the same manner as the tubes 13, and the drums 7 and 8 act as collectors of saturated steam. When, on the other hand, the valves 31 are closed and the
- 40 water level is lowered, the saturated steam, which collects in the drums 5 and 6, passes above the water level, through the tubes 15 and collects in the drums 7 and 8 in superheated condition.
- 45 The application of the invention to a locomotive boiler is illustrated in Figs. 2 and 3. These figures show also the device for diverting the products of combustion from the superheating tubes when the consumption of
- 50 steam is interrupted temporarily, as by the stopping of the locomotive. To this end the combustion space is divided by a transverse wall 26, which normally serves as a baffle, causing the products of combustion to pass
- 55 first upwardly among the tubes in the rear of the wall, then over the top of the wall, and thence downwardly among the tubes in front of the wall. At the bottom of the wall is an opening normally closed by a pivoted
- 60 door or valve 23, which is covered with suitable fire-proofing material. The door 23 is actuated, however, by means of an arm 24

and a rod 25, and when it is opened by these means, a direct passage is opened for the products of combustion, which permits them 65 to pass to the front of the wall 26 without passing over the wall and between the superheating tubes. Two other baffle walls, 27 and 28 are provided in the front portion of the boiler. No superheating tubes are located 70 between these walls, and it is therefore unnecessary to provide a passage at the bottom of the wall 28. When the fire door of a boiler is opened for the purpose of feeding or dressing the fire a considerable indraft of 75 air ordinarily takes place, and this cold air, mingling directly with the products of combustion, checks the generation of steam as long as the door is open. To reduce the flow of air through the doorway, I have pro- 80 vided my improved boiler with a device in the form of a curtain consisting of heavy ropes or chains 38 of incombustible material, such as asbestos, these ropes or chains, as shown in Figs. 8 and 9, being suspended 85 in the doorway, and hanging close together. The interstices between the ropes or chains are sufficient to permit inspection of the fire, and the curtain yields readily when coal or stoking implements are introduced, but the 90 curtain serves to reduce to a considerable extent the flow of air through the opening. Where an inwardly-opening door is used, as shown in Fig. 10, the curtain is fastened to the outside of the door, so as to assume the 95 position shown in dotted lines when the door is opened.

Certain features of my invention, such as the fire-door curtain, are applicable to boilers of various types in addition to the par- 100 ticular type of water-tube boiler, which I have illustrated and described.

Various modifications may be made in the illustrated embodiment of the invention, within the nature and scope of the inven- 105 tion, as it is defined in the following claim:

I claim:

A water-tube boiler having, in combination, two water walls on opposite sides of the combustion space of the boiler inclined water 110 tubes connecting the water walls, a superheated steam chamber located above each water wall, inclined superheating tubes connecting each water wall with the opposite superheated-steam chamber, and steam sep- 115 arators located at the lower ends of the superheating tubes to prevent the entrance of water.

In witness whereof, I have hereunto set my hand this ninth day of November, 1909.

JIRO MIYABARA.

In the presence of—

GENJI KURIBARA,

MASATARO OKASAWA.