

No. 639,973

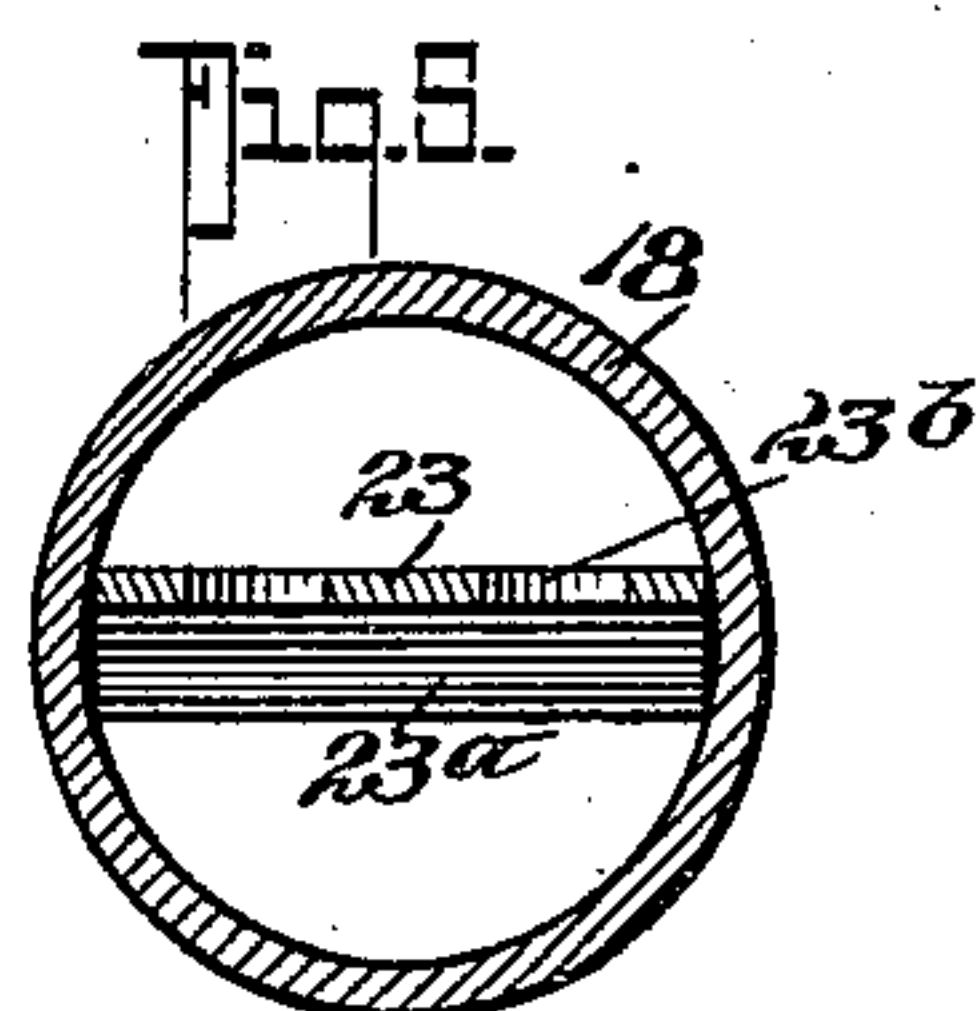
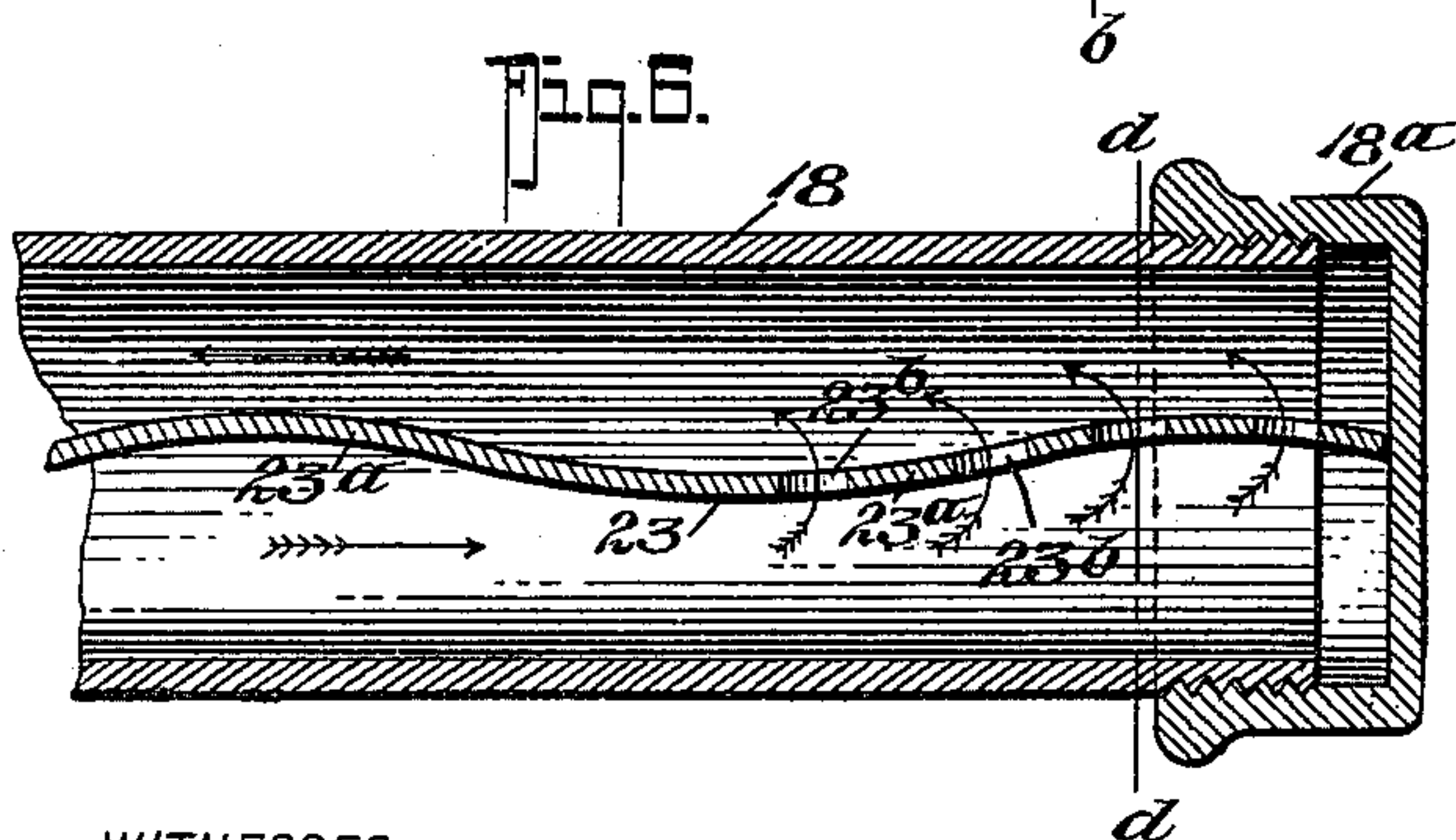
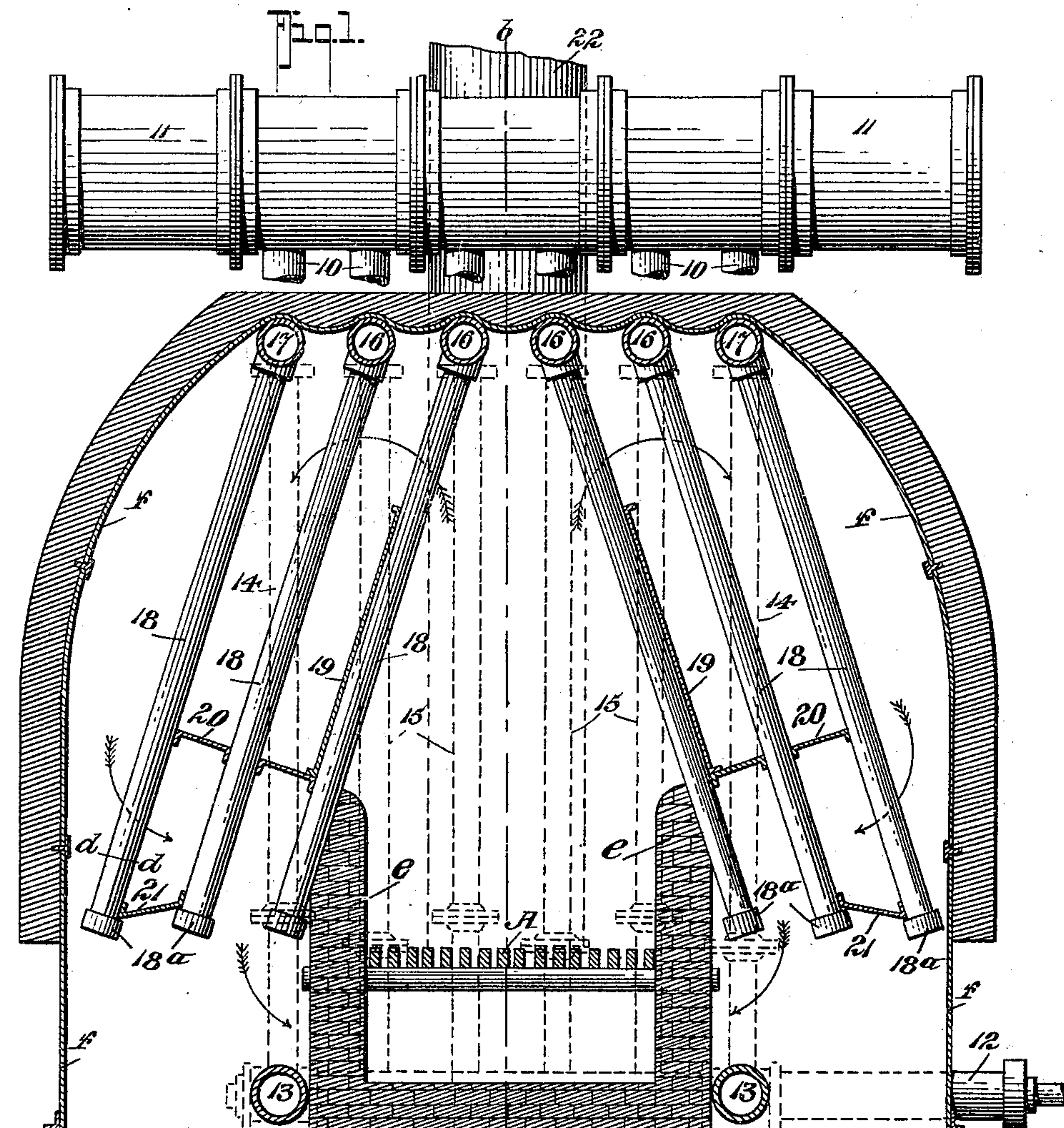
Patented Dec. 26, 1899.

G. H. HARDIE & N. THOMPSON.
STEAM GENERATOR.

(Application filed Apr. 26, 1899.)

(No Model.)

4 Sheets—Sheet 1.



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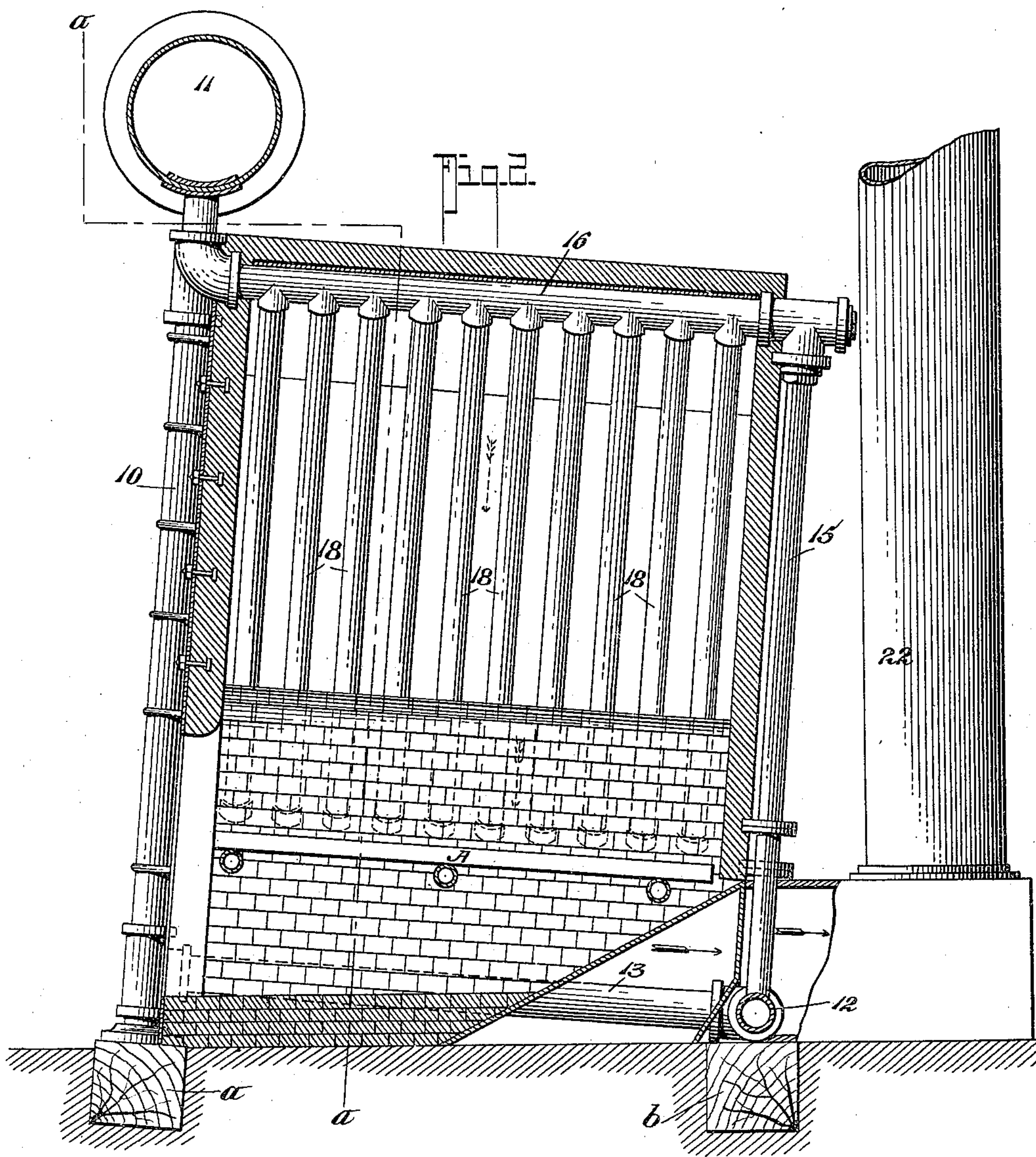
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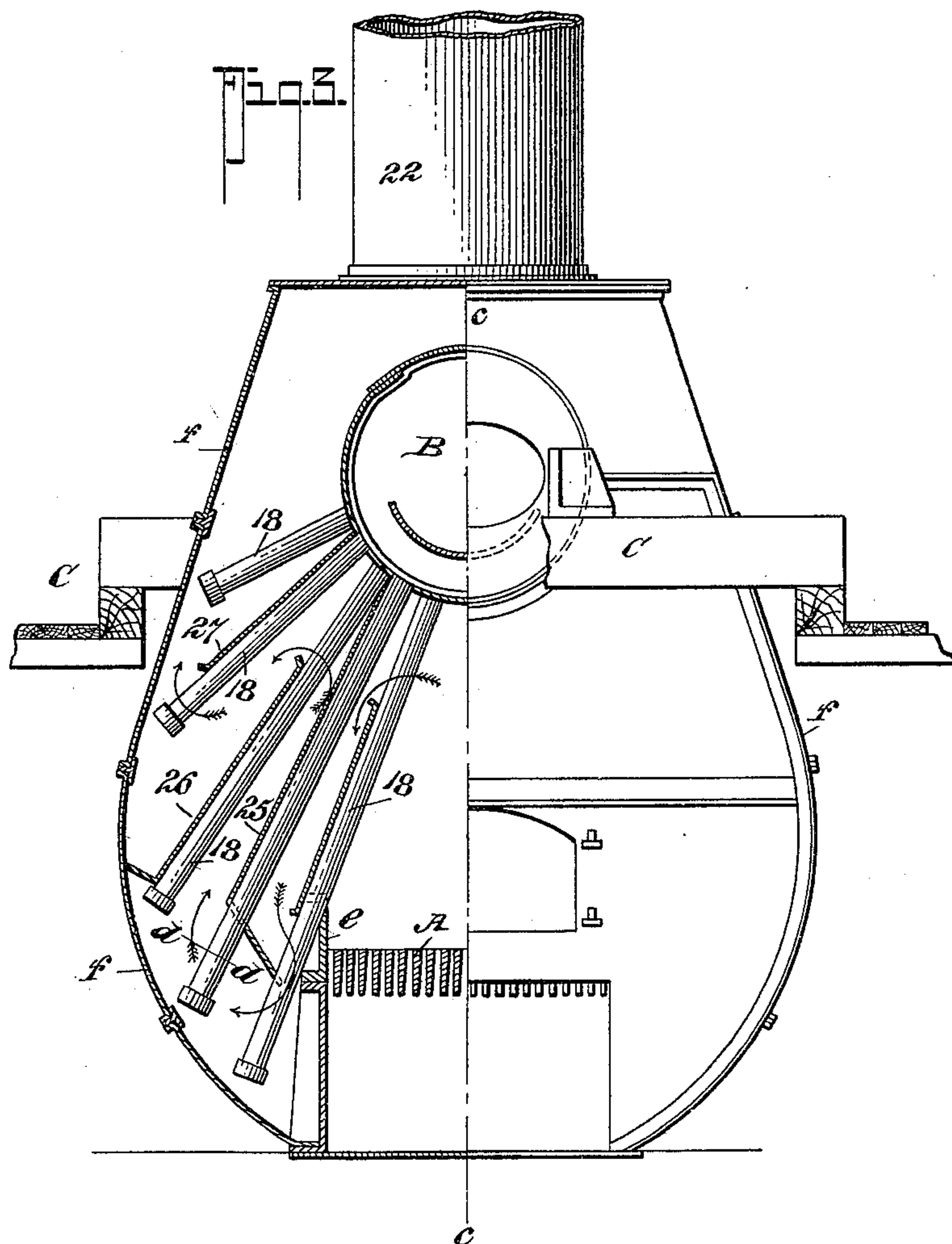
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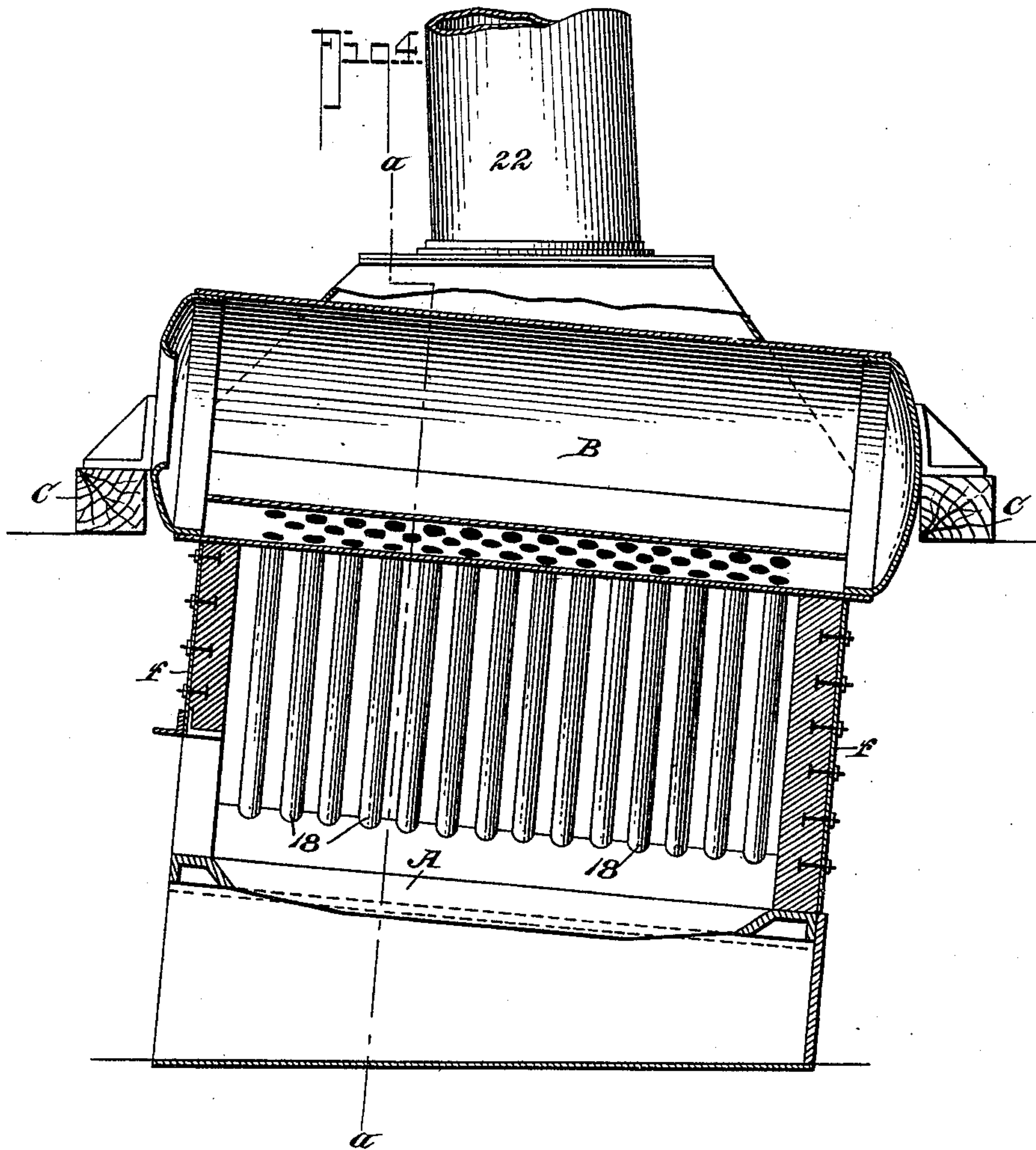
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UNITED STATES PATENT OFFICE.

GORDON HENRY HARDIE AND NICHOLAS THOMPSON, OF VANCOUVER,
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STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 639,973, dated December 26, 1899.

Application filed April 26, 1899. Serial No. 714,549. (No model.)

To all whom it may concern:

Be it known that we, GORDON HENRY HARDIE and NICHOLAS THOMPSON, citizens of the Dominion of Canada, residing at Vancouver, in the Province of British Columbia, Canada, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

Our invention relates to improvements in that class of steam-generators known as "pipe" or "portable" boilers, in which we employ down-pipes projecting outward on each side of the furnace-grate, said pipes being either connected with a main drum suspended over the furnace or with a series of header-pipes, according to the work for which the generator is intended; and the primary objects of our invention are to arrange the down-pipes on each side of the furnace-grate in such a manner that their lower depending ends will be below the greatest generating heat and to provide facilities for a free circulation from the bottom of said down-pipes, so that the danger of burning out the tubes will be reduced to a minimum, as will now be fully explained, and pointed out in the appended claims. We attain these objects by the general arrangement of the parts illustrated in the accompanying drawings, in which—

Figure 1 shows a front sectional elevation of our generator, taken on the line *a a* in Fig. 2. Fig. 2 is a side sectional elevation taken through the center on the line *b b* in Fig. 1. Fig. 3 shows a front elevation and part section on line *a a* of Fig. 4 of a modified type of our invention to be applied as a marine generator, the down-pipes in this, as in Figs. 1 and 2, being the same in relation to the furnace, which gives the result that we wish to obtain in the different modes of application. Fig. 4 is a side sectional view of the same on the line *c c* in Fig. 3. Fig. 5 is a section of one of the down-pipes, as indicated by line *d d* on Figs. 1, 3, and 6. Fig. 6 is a longitudinal section of the lower end of the same.

Similar numerals and letters refer to similar parts throughout all the views.

The construction leading up to our improved steam-generator, when it is to be used as a boiler specially designed for transportation, consists of main vertically-placed pipes

10, having their lower ends provided with T's and closed and resting on a support-frame *a* and arranged on opposite front sides of the furnace. Connecting the tops of these vertical pipes 10 and providing a free communication from one to the other is a main steam-reservoir in the form of a drum 11.

A horizontally-placed pipe 12, resting on a support *b*, is arranged to the rear of the furnace-grate *A* and approximately on a horizontal plane with the support *a*, and 13 are pipes communicating between the vertical pipes 10 and the horizontal pipe 12. Connecting with the pipe 12 at regular intervals and passing upward are pipes 14 and 15. These pipes 14 and 15 pass up the rear outer side of the furnace and communicate with horizontally-disposed pipes 16 and 17, respectively.

(See Fig. 1.) The pipes 16 and 17 are a continuation of the pipes 14 and 15, and they communicate with the drum 11, the horizontal portions being known as "header-pipes," and the two opposite side ones 17 communicate with the vertical pipes 10, they being in alignment with such pipes, and therefore are susceptible of being connected with the drum by means of elbows, as is the case with the others.

(See Fig. 2.) And now comes the important feature of our invention, which consists of arranging series of down-pipes 18 pendent from the header-pipes 16 and 17, diverging outwardly so that their closed ends are on a plane, approximately, with and on each side of the furnace-grate *A*. The opposite walls of the furnace, as *e*, are carried for a distance upward, and continuing up in proximity with the rear or outer sides of the inner series of pipes are baffles 19, which cause the flame from the furnace to pass upward, as shown by arrows, and through the other series of down-pipes to the outer side of same. Other baffles 20 and 21, placed between the said down-pipes at the proper positions, as shown, below the tops of the baffles 19, prevent the gases from passing downward between the pipes, but cause them to flow back and forth until the spaces below the depending ends of the down-pipes are reached, whence they are carried off by the uptake 22. In this case the header-pipes, the down-pipes, and the furnace are inclosed in a suitable covering *f*,

which is preferably a non-conductor of heat, as is the case in the constructions of this kind, and the uptake is connected from the rear beneath the furnace. To provide for free circulation in the down-pipes 18 and cause the water to flow up one side and down the other, we place diaphragms 23 in the pipes, having their flat sides to the furnace. These diaphragms 23 are not of sufficient width to engage the opposite sides of the tubes; but they are crimped or corrugated, as 23^a, sufficient for each alternate deflection or curve to engage the opposite sides of the tubes, and such engaging edges of each of the diaphragms will form a chord on each side of the tube it occupies, and the spaces between the chords, made large or small according to the relative width of the diaphragms to the diameter of the tubes, provide the means for the bubbles formed on the lower side of the pipe, next to the furnace, to pass to the upper side of the pipe. This causes the flow in the pipe to be reversed to what it would be if the tubes were completely divided into distinct and independent compartments except at the ends. The crimples 23^a also hold the diaphragms in their place and at the same time allow of their being withdrawn by removing the caps 18^a. To provide for free circulation in case the lower ends of the diaphragms should slip down close to the caps 18^a, such ends are perforated, as 23^b.

As shown by the arrows in Fig. 1, the intense heat of the furnace passes outward around the pipes near their upper ends and is then passed downward and inward by the particular arrangement of the baffles 20 and 21; but before passing the lower depending ends of the down-pipes the intense heat is spent in the area occupied by the upper portions of the said down-pipes, where the principal steam-generating is taking place. By reason of the above arrangement it is clear that comparatively dirty water may be used without the danger of burning out the tube ends, as the sediment will invariably settle to the lower ends of the pipes, and as the heat is applied the circulation will commence to stir or lift the deposit before the heat has hardened or converted such deposit into scale, and owing to the novel arrangement of the diaphragms in the pipes having their apertures at their lower ends the flow or circulation will commence before the lower ends of the pipes are heated. In fact, the depending ends of the pipes will never become sufficiently heated to cause any damage, even if a heavy coating of sediment should lodge in such tube ends, so that our improvement is well designed to perform the work for which it is intended.

As shown in the marine types, Figs. 3 and 4, the furnace is arranged as in Fig. 1; but the down-pipes 18 are fixed into the opposite lower sides of a drum or reservoir B, this being supported by lugs on cross-timbers C on the deck or frame of the vessel, and the whole

is supported in a convenient manner above the furnace A, with the down-pipes straddling the furnace, as in Fig. 1. Owing to the contracted form of the casing *f* in the marine type the down-pipes 18 as they approach the outer sides are reduced in length, so as to conveniently utilize all of the heating area, and the baffles are arranged to cause the flame and the heated gases to flow downward after passing the baffles 19, and the rest of the baffles are fixed alternately to the drum B and the casing *f*, as 25, 26, and 27, so that the flame will pass back and forth through the said down-pipes and be finally delivered to the uptake 22, which in this case is above the generator.

In the construction of our boiler it is our intention to have the parts as much as possible of standard fittings, so that if a tube is defective it may be replaced without serious delay and at a minimum of cost.

We are aware that prior to our invention various types of pipe-boilers have been employed having the tubes arranged horizontal, pendent, and sloping, their upper ends being connected to header-pipes or main drums, but not having our special arrangement on each side and over the furnace, with the means of protection from the heat for the pendent ends of the down-pipes, which, with the division-strip in such down-pipe, are the features we wish protection in.

Having thus described our improved steam-generator, what we claim as novel, and desire to secure by Letters Patent, is—

1. In a steam-generator of the class described; the combination with the furnace; the main water-feed pipes; and the steam-collecting drum arranged substantially as shown; of drop-pipes projected downwardly upon opposite sides of the furnace, and in a plane below said side walls; the vertical baffle-plates 19, and the horizontal baffle-plates 20 and 21, said plates 19, 20 and 21, being arranged to prevent the heat from passing downward between the pipe and causing it to pass back and forth until the spaces below the pending ends of the rearmost drop-pipes are reached; and an offtake at such end, as set forth.

2. In a steam-generator having a frame comprised of tubes 10, 12, 13, 14, 16, and 17, placed approximately vertical and horizontal, the said tubes providing a means for water circulation, in combination with down-pipes 18 communicating with the tubes 16 and 17, having their lower ends extending approximately on a horizontal plane with a furnace-grate A and diverging on opposite sides thereof, of baffles arranged between such down-pipes for directing the heated gases therearound, and toward the depending ends thereof, as and for the purposes set forth.

3. In a steam-generator; in combination, tubes 10, 12, 13, 14, 16, and 17, arranged in the form of a frame, the same to provide ample circulation for the water, a furnace-

grate arranged in said frame; of down-pipes 18 diverging outward and having their lower ends beneath the intense heating area of the furnace, of diaphragms in such pipes composed of crimped detachable strips 23 having apertures 23^b in their lower ends, substantially as specified.

4. In a steam-generator of the character described; the combination with the furnace 10 and the main water-circulating pipes, and the steam-collector; of drop-pipes divergingly projected downward at each side of the furnace, their lower ends projecting in the plane below the side walls of the furnace, 15 said ends having removable caps; means for causing the heat to circulate about the drop-pipes above the capped lower ends, and flat diaphragms detachably held within the drop-pipes, their flat sides facing the direct heat 20 rays from the furnace, substantially as shown and described.

5. In a steam-generator having down-pipes diverging from their support over the furnace on each side thereof, in combination 25 with crimped diaphragms passing flatwise to the heat of the furnace through said pipes; apertures in the lower ends of said diaphragms, to allow the water to circulate, and of baffles arranged between the said pipes to 30 cause the heat to circulate above the lower ends of the same, as and for the purposes set forth.

6. The combination in a generator of the

character stated; with the main circulating-pipes, and the steam-drum; of a furnace 35 having side walls *e*, extended above the grate, said walls forming rests or bearings for the drop-pipes; and a main water-circulating vessel disposed above the furnace; of drop-pipes hung pendent from the vertical vessel, 40 said pipes being arranged in series, each series extending divergingly over its corresponding side of the furnace, the inner ends of said series of pipes being supported upon the adjacent furnace-wall *e*, the lower ends 45 of the drop-pipes being projected in a plane below the top of the walls *e*; means for providing the direct heat rays flowing about the said lower ends of the drop-pipes, said means consisting of baffle-plates 19, 20 and 21, ar- 50 ranged to deflect the heat around the upper parts of the drop-pipes until the rear end pipes are reached; an offtake connecting with the space below the rear end pipes, the said drop-pipes having removable caps at 55 their lower ends; a flat corrugated diaphragm detachably held within the said drop-pipes, said diaphragms having their lower ends perforated, all being arranged substantially as shown and described.

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Witnesses:

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