

(No Model.)

2 Sheets—Sheet 1.

J. G. COOPER.
STEAM GENERATOR.

No. 558,779.

Patented Apr. 21, 1896.

Fig. 1.

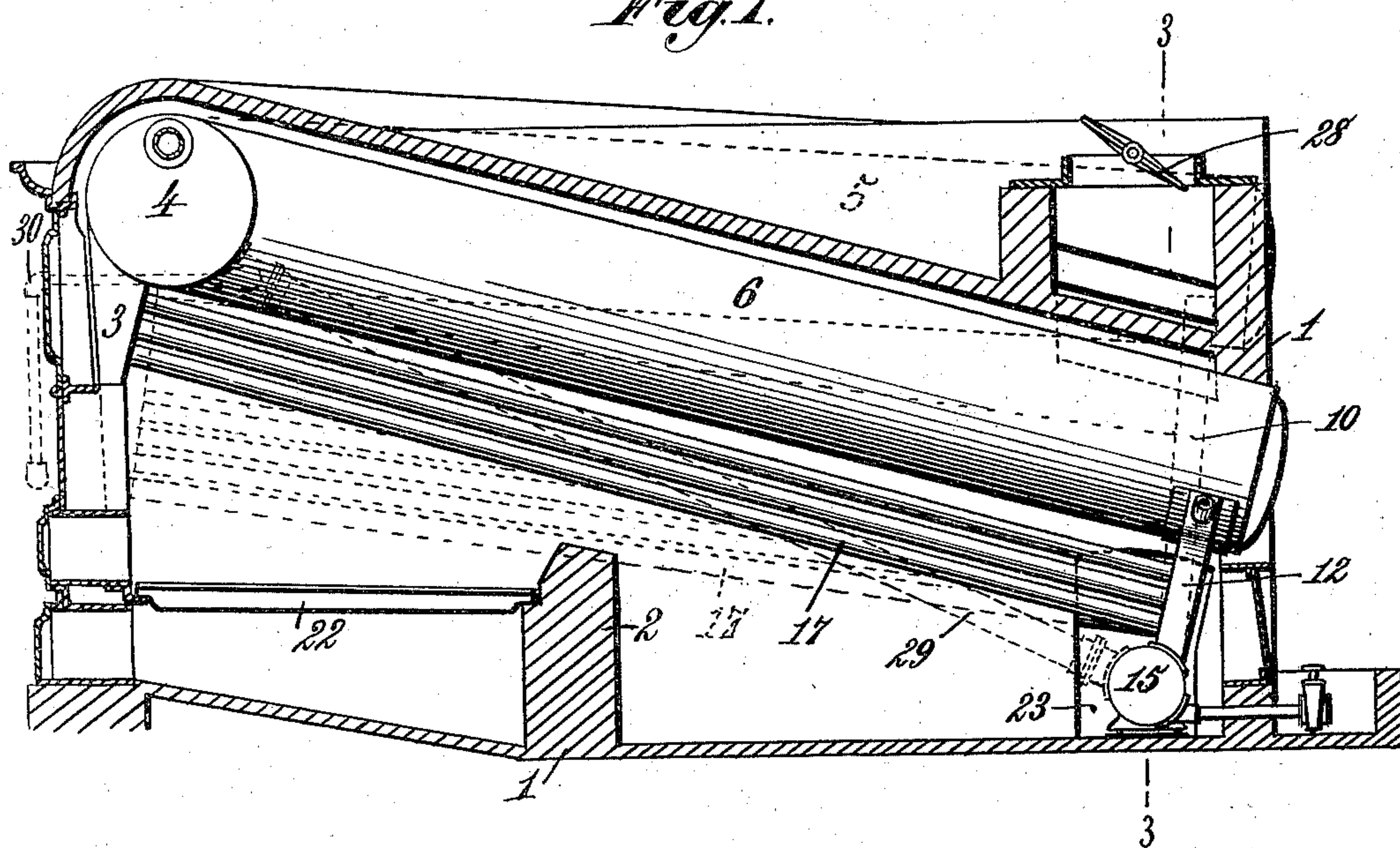
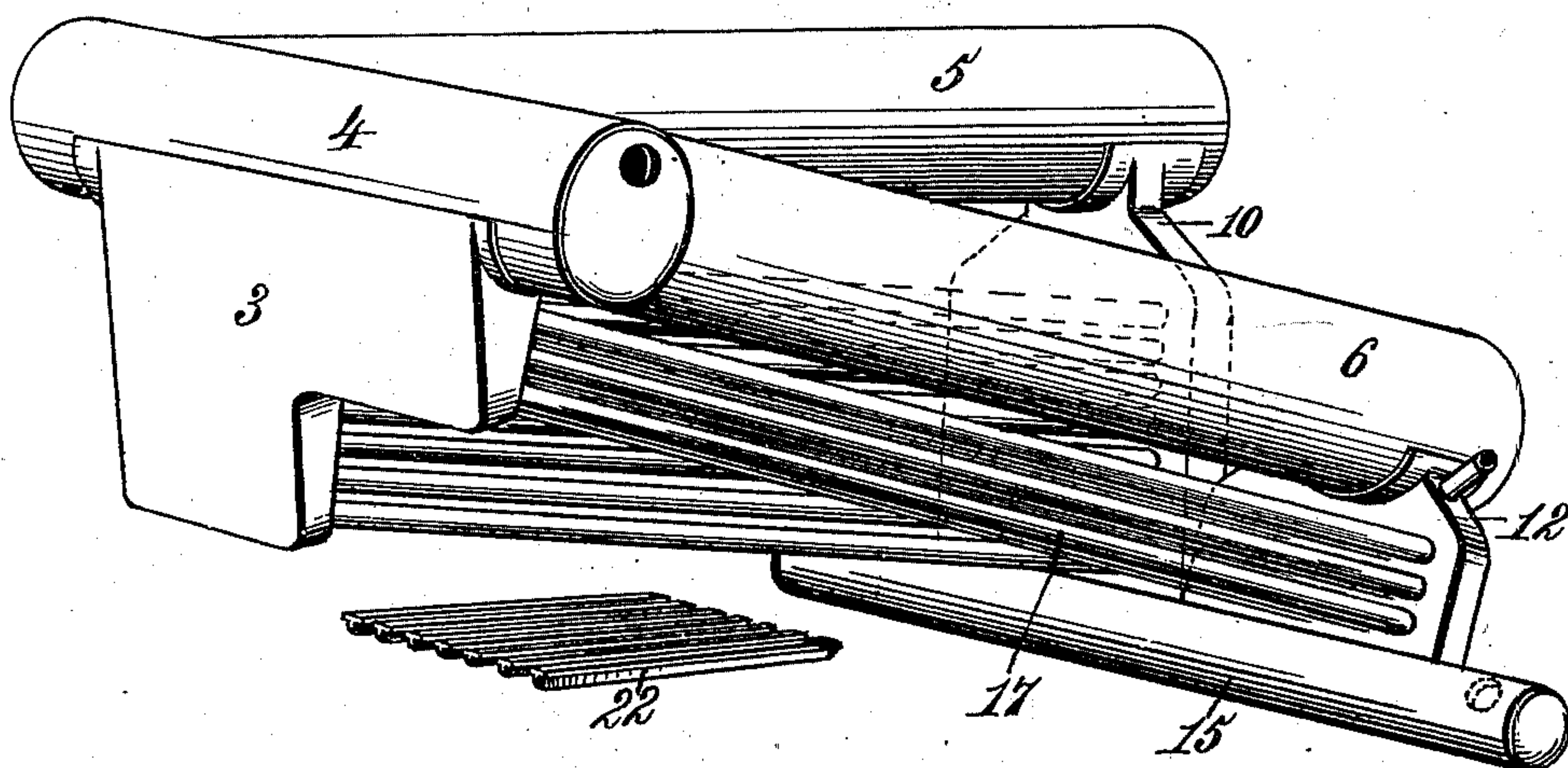


Fig. 2.



Witnesses.
Robert G. Enright,
G. W. Rea.

Inventor:
James G. Cooper.
By James L. Norris.
Atty.

(No Model.)

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Fig. 3.

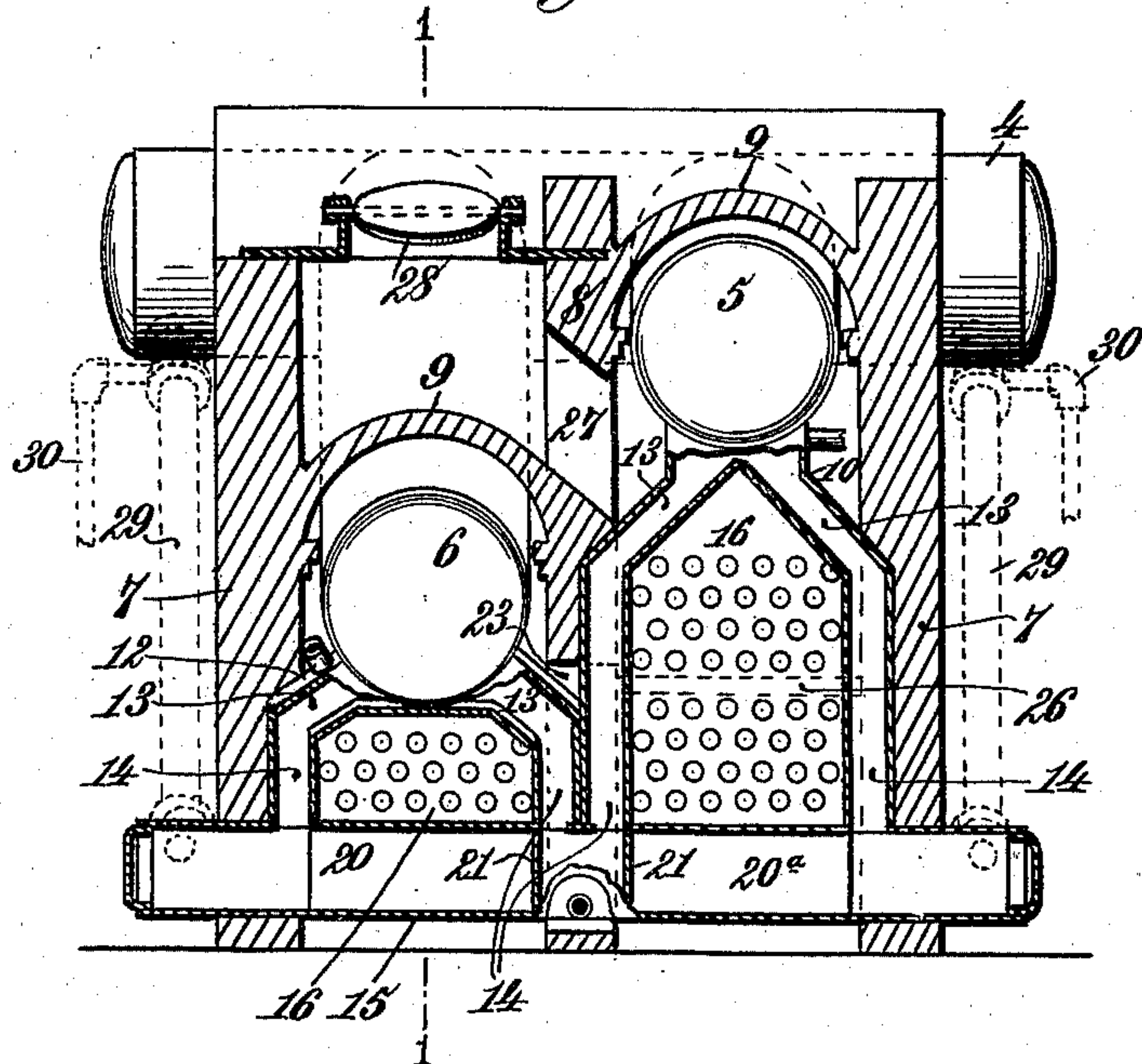


Fig. 4.

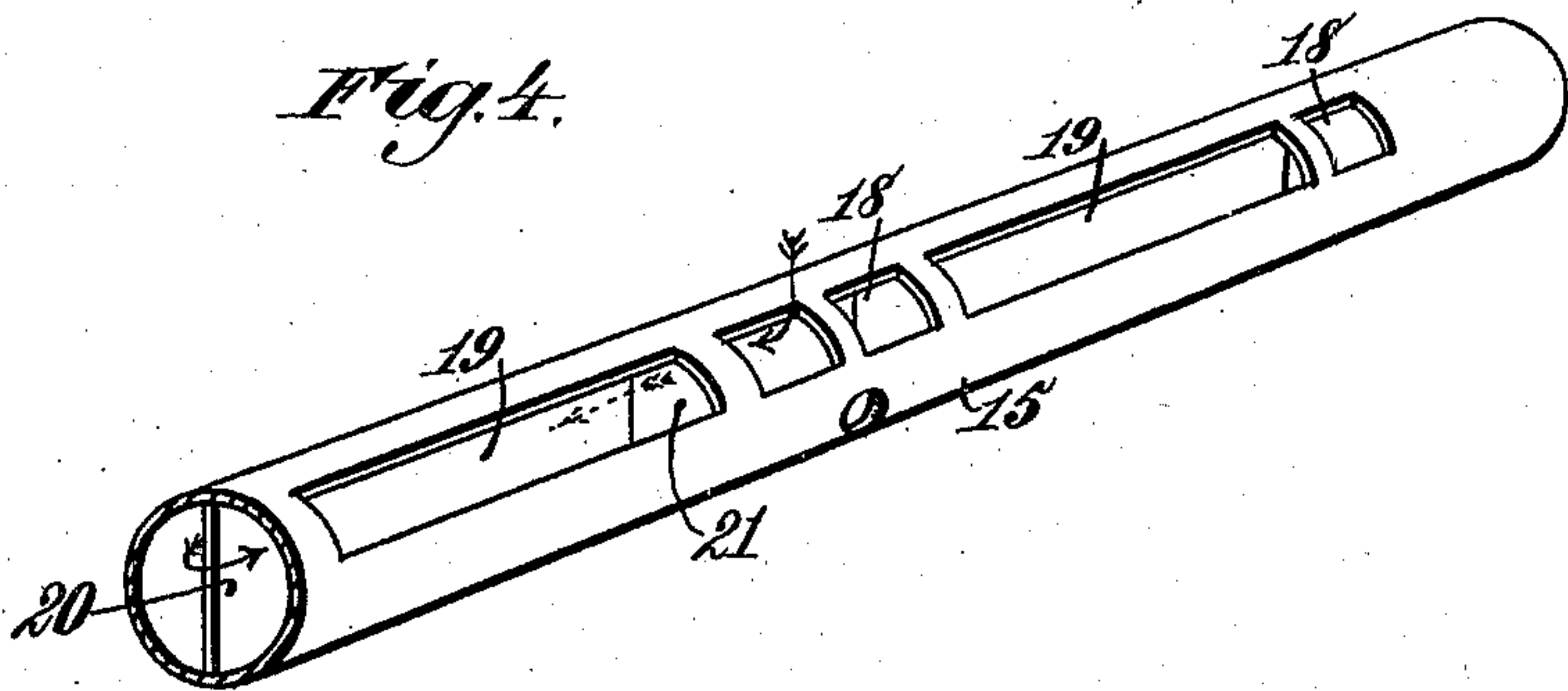
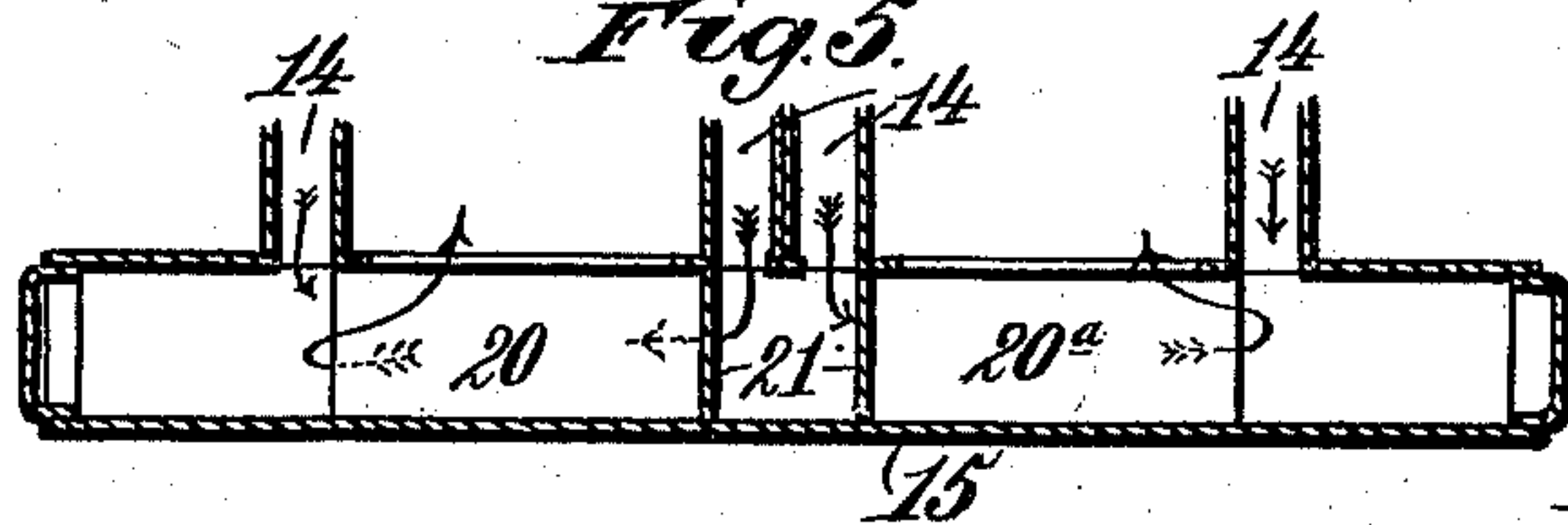


Fig. 5.



Witnesses.
Robert E. Smith,
G. W. Rea.

Inventor.
James G. Cooper.
By *James L. Norris,*
Atty.

UNITED STATES PATENT OFFICE.

JAMES G. COOPER, OF CINCINNATI, OHIO.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 558,779, dated April 21, 1896.

Application filed May 3, 1894. Renewed December 31, 1895. Serial No. 573,971. (No model.)

To all whom it may concern:

Be it known that I, JAMES G. COOPER, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to water-tube steam-boilers, and the purpose thereof is to provide a novel and simple construction whereby the cubic space occupied by a battery of such boilers may be diminished vertically without reducing the capacity of the boilers, thereby enabling the latter to be erected in places where, under other circumstances, the same boilers would be inadmissible.

It is a further purpose of my invention to provide for a rapid and adequate circulation in boilers of this type, to economize the consumption of fuel, to enable the draft to be more accurately regulated, and to so direct the circulation in the mud-drum that accumulating foreign matter shall be diverted from the water-tubes and deposited in the mud-drum.

The invention consists in the novel features of construction and new combinations of parts hereinafter fully described, and then more particularly pointed out and defined in the claims.

To enable those skilled in the art to fully understand my said invention, I will now describe the same in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section upon the line 1 1 in Fig. 3. Fig. 2 is a perspective view of a battery of two boilers constructed in accordance with my invention, the setting of masonry being omitted. Fig. 3 is a transverse vertical section of the two water-drums, the section-plane being indicated by the line 3 3 in Fig. 1. Fig. 4 is a detail perspective view of the mud-drum, one end being sectioned to show the interior, and the connections with the water-tubes detached. Fig. 5 is a sectional diagram showing the course of the water-circulation in the mud-drum and water-legs.

The reference-numeral 1 in said drawings indicates the masonry substructure of the boilers, including the bridge-wall 2. Upon this substructure rests the front of the boilers,

which is made of plate iron or steel, and includes the door-mounts. Upon the top of the boiler-front is the transverse steam-drum 4, its ends projecting somewhat beyond the front 3, and communicating with said steam-drum are the two water and steam drums 5 and 6. Both the latter are arranged by my invention with an inclination from front to rear, that of the drum 5 being at a comparatively small angle, while the inclination of the other drum 6 is at a comparatively large angle. These drums lie in parallel planes, the rearward end of the drum 6 being considerably lower than the corresponding end of the other drum 5. They are inclosed between side walls 7 and separated by an intermediate wall 8, constructed of suitable material, and the boiler-chambers are covered by arches 9, having substantially the same inclinations as the respective drums.

At their rearward ends the two inclined drums rest upon water-legs 10 and 12, the relative height of the latter being controlled by the different elevation of the ends of said drums, due to their difference of inclination. Two channels 13 in the rear water-leg have communication with the drum 5, and they diverge at or near the point of communication, extending downward at an angle of about forty-five degrees with a central perpendicular line and then turning into vertical channels 14, which extend downward and enter the mud-drum 15. Between the divergent channels 13 and vertical channels 14 in the rear water-leg is a large chamber 16, which has communication, like the channels between which it lies, with the mud-drum 15, the line of such communication being along the upper and rearward side of said mud-drum. The rearward extremities of the water-tubes 17 communicate with this chamber, while their forward extremities communicate with the boiler-front 3, the form of which will be fully explained hereinafter.

The mud-drum 15 is provided, as shown in Fig. 4, with separate openings 18 for the lower ends of the channels 14 and elongated openings 19 for the lower ends of the chambers 16. If this drum be regarded as divided into quarter-sections, these openings will all be formed in the upper quarter in rear of the vertical line of division. In its interior the

mud-drum is provided with a substantially vertical diaphragm 20, passing through the axial line of the drum. In length the diaphragm is about coextensive with the width of the chamber 16, beneath which it lies, and at the end which lies nearest the center of the drum a semicircular wall 21 closes the entrance to the space between said diaphragm and the rearward wall of the drum.

10 The water and steam drum 6 has a connection with a rear water-leg 12, which is the same, in all substantial respects, as that described above, the only difference being that its height is much less, as shown in Fig. 1.
15 A separate diaphragm 20^a, but similar in all respects to the diaphragm 20, is placed in the mud-drum, a semicircular wall 21 being provided to close the space between the inner end of said diaphragm and the rear wall of the mud-drum. By reason of this arrangement the water coming from the two vertical channels 13 and 14 into the middle portion of the mud-drum is compelled to flow between the diaphragms 20 and the front of the mud-drum, pass toward the ends of the latter and around the outer ends of the two diaphragms in order to enter the chamber 16, whence it passes into the water-tubes. The water received from the two channels 13 and 14 nearest the ends passes directly into said chambers 16.

At their forward ends the water-tubes pass directly into the boiler-front. This is most clearly shown in Fig. 2, and comprises a chamber having one portion of sufficient depth to receive the ends of the group of water-tubes arranged beneath the drum 5, while its other part is of about half that depth to correspond with the smaller gang of water-tubes beneath the drum 6. This difference permits provision to be made for a doorway beneath the shallow half of the boiler-front, and the furnace-grate 22 is therefore placed beneath the end of the drum 6, its rearward end being supported by the bridge-wall. The products of combustion, after passing over the said wall and around and between the rearward ends of the water-tubes 17, flow through an opening 23 in the intermediate wall 8 and among the rearward portions of the water-tubes beneath the drum 5. These tubes are divided into two groups by means of a baffle-tile 26, which extends from the rearward heading to a suitable point in rear of the forward ends of the tubes. The burning gases and products of combustion after flowing beneath this tile pass upward around its forward end and flow back above the tile to the rear end of the boiler-chamber, where they enter a passage 27 in the intermediate wall 8, by way of which they pass to the stack, the entrance to the latter being provided with a damper 28.

In some instances I propose to introduce the feed-water into circulating-pipes 29, connected at their upper ends with the transverse drum 4 and at their lower ends with the mud-drum 15. The circulating-pipes are each pro-

vided with a feed-water-pipe connection 30. If the water is fed in this manner, the water-legs 10 and 12 and the mud-drum will be constructed as described and shown in my application for Letters Patent, filed May 3, 1894, No. 509,983; but with the water-legs constructed as herein described and shown the feed-water is introduced into the water-legs 10 and 12, either or both, in close proximity to the inclined drums 5 and 6, and therefore the feed-water will descend through the descending channels 14 into the mud-drum, where the feed-water will be baffled and all mineral salts and other impurities deposited. The feed-water will then ascend to the chambers 16 into the rear ends of the water-tubes 17.

The improved construction of front water-leg 3, with the two gangs of water-tubes 17 arranged at different angles of inclination and the grate or fire chamber located under the gang of tubes connected with the longest portion of the front water-leg, may be used in connection with the single drum 4, in which event the feed-water will be introduced into the circulating-pipes 29 through the feed-water-pipe connections 30, and the feed-water will pass to the mud-drum, where it will be baffled and then flow into the water-tubes in any suitable manner, but preferably as in my other application for patent above referred to.

What I claim is—

1. A steam boiler or generator, consisting of a steam and water drum, a front water-leg having two different depths, a group of inclined water-tubes connected with that portion of the front water-leg of greatest depth, and another group of water-tubes arranged at a greater angle of inclination than the group first mentioned and connected with that portion of the front water-leg of least depth, substantially as described.

2. A steam boiler or generator, consisting of a steam and water drum, a front water-leg having two different depths, a group of inclined water-tubes connected with that portion of the front water-leg of greatest depth, another group of water-tubes arranged at a greater angle of inclination than the group first mentioned and connected with that portion of the front water-leg of least depth, and a mud-drum common to both groups of water-tubes and provided with feed-water baffling-partitions, substantially as described.

3. A steam-boiler comprising two water and steam drums, one of which has a comparatively great inclination downward toward the rear, a group of water-tubes under and parallel with each drum, a boiler-front having two portions of different depth, and a fire-grate arranged beneath the forward end of the drum of greatest inclination, the entrance to which is beneath the shallower portion of the boiler-front, substantially as described.

4. A steam-boiler having two water and steam drums communicating at their forward ends with a steam-drum, one of said water and steam drums being downwardly and rear-

wardly inclined at a greater angle of inclination than the other, and a boiler-furnace arranged beneath the forward end of the drum inclined at the greatest angle, substantially as described.

5. A steam-boiler having two water and steam drums arranged in separate but communicating boiler-chambers, one of said drums having a greater angle of inclination than the other, a transversely-arranged, horizontal steam-drum with which the forward ends of both water and steam drums communicate, a group of water-tubes arranged beneath each of the latter drums, water-legs with which the rear ends of said groups communicate, a boiler-front communicating with the forward ends of said groups and having two different depths, a mud-drum communicating with the water-legs, and a fire-grate beneath the forward end of the drum of greatest inclination, substantially as described.

6. A steam-boiler having two water and steam drums arranged side by side in separate boiler-chambers communicating by a draft-passage in the dividing-wall at the rear end, a fire-grate arranged beneath the forward end of one of said drums which is inclined at a greater angle of inclination than the other, a

boiler-front, and a steam-drum, the boiler-front having a portion of less depth than the remaining portion and overhanging the forward end of said grate, substantially as described.

7. In a steam-boiler, a water-leg having a chamber communicating with the water-tubes and inclosed upon its sides by separate channels which communicate with a water and steam drum, and a mud-drum with which said chamber and channels have communication, substantially as described.

8. In a steam-boiler, the combination with two water and steam drums, of a mud-drum, water-legs each having a chamber communicating with a group of water-tubes and with the mud-drum, and channels on opposite sides of said chamber which communicate with the water and steam drum above and the mud-drum below, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

JAMES G. COOPER. [L. S.]

Witnesses:

ALBERT H. NORRIS,
G. W. REA.