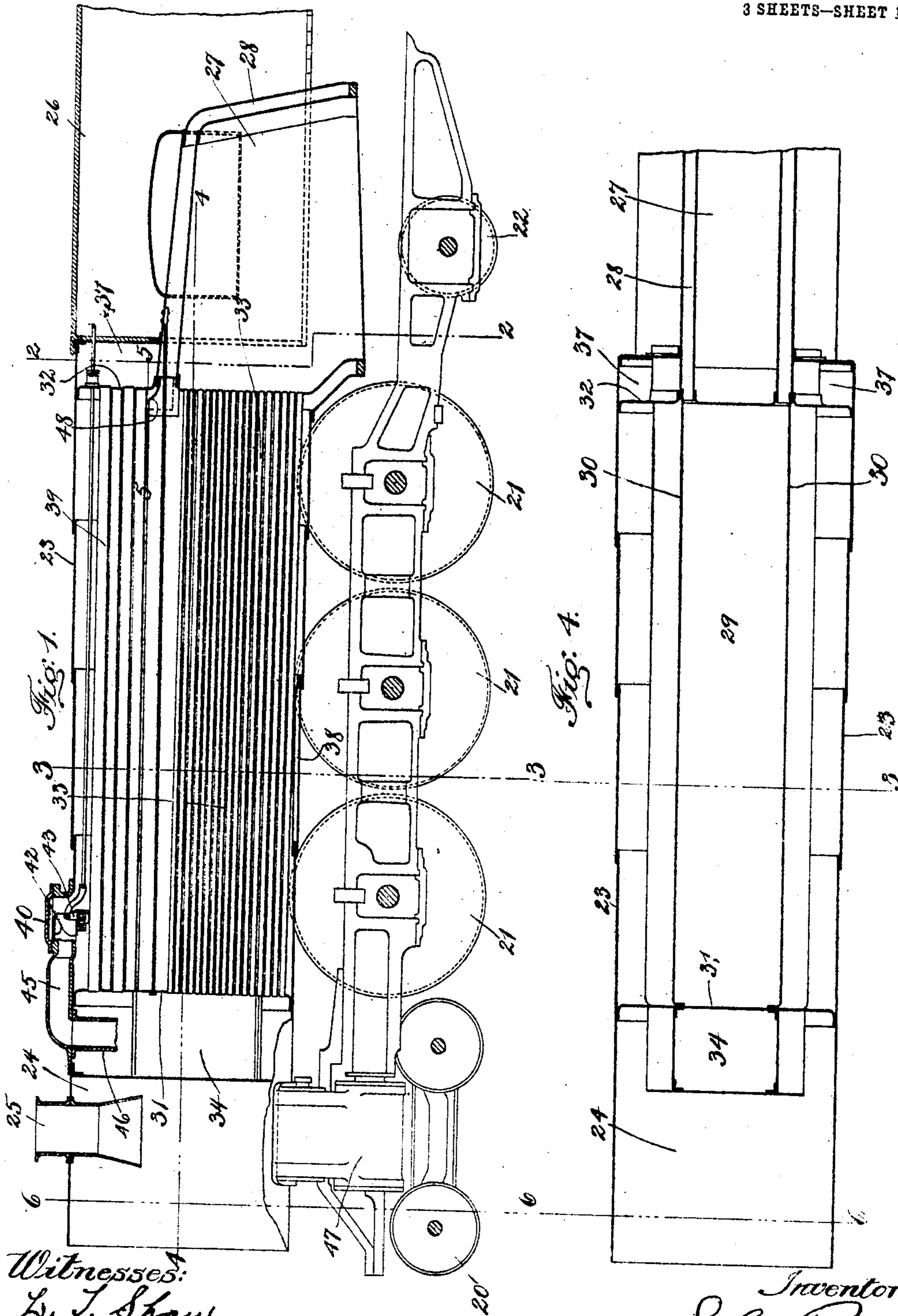


No. 803,788.

PATENTED NOV. 7, 1905.

S. A. REEVE.
LOCOMOTIVE BOILER.
APPLICATION FILED JAN. 6, 1905.

3 SHEETS—SHEET 1.



Witnesses:
L. J. Shaw
M. A. Mober

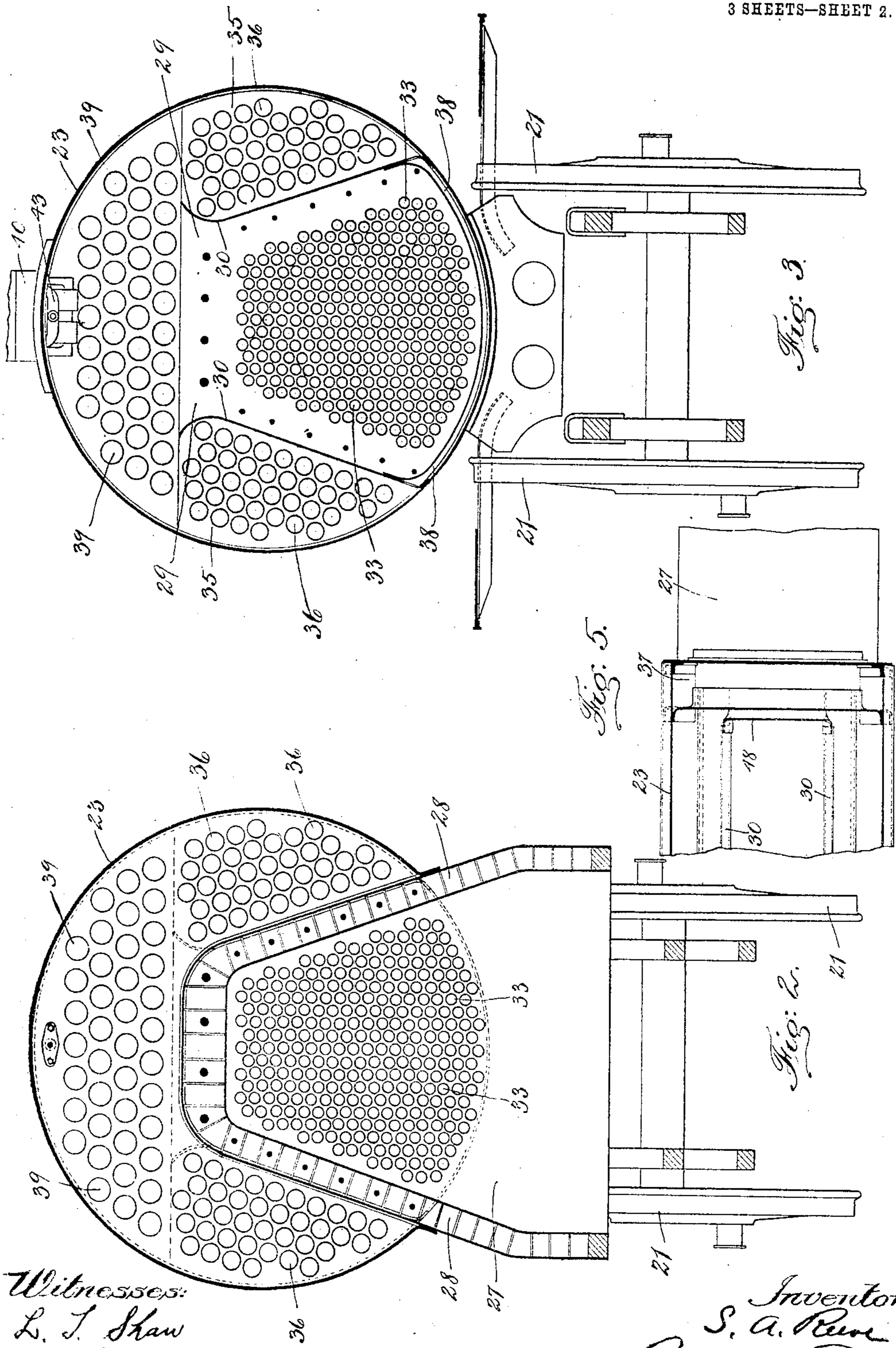
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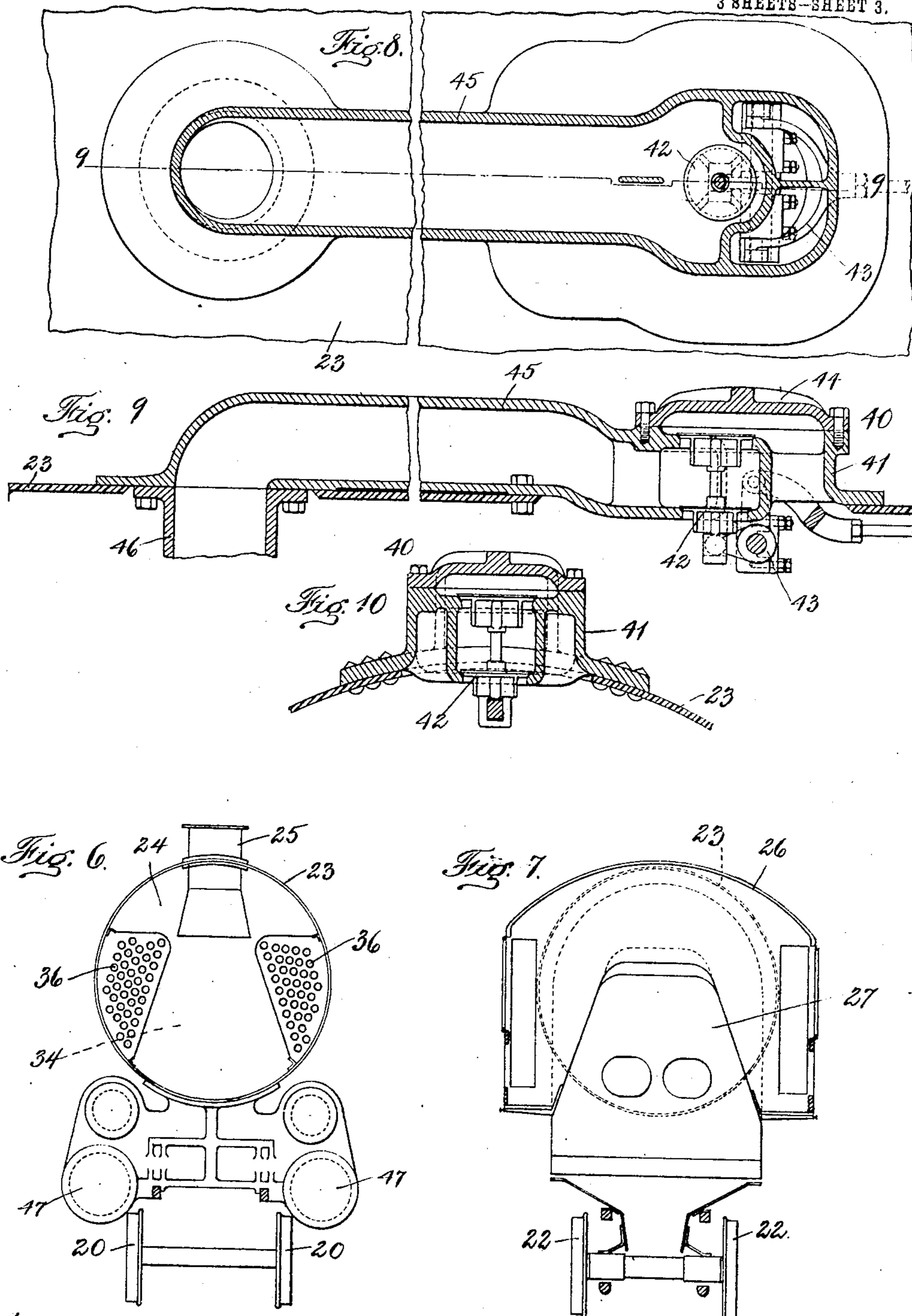


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3 SHEETS-SHEET 3.



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UNITED STATES PATENT OFFICE.

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LOCOMOTIVE-BOILER.

No. 803,788.

Specification of Letters Patent.

Patented Nov. 7, 1905.

Application filed January 6, 1905. Serial No. 239,878.

To all whom it may concern:

Be it known that I, SIDNEY A. REEVE, a citizen of the United States, residing at Worcester, county of Worcester, State of Massachusetts, have invented certain new and useful Improvements in Locomotive-Boilers, of which the following specification and accompanying drawings illustrate one form of the invention which I now regard as the best out of the various forms in which the invention may be embodied.

This invention relates to locomotive-boilers constructed for superheating the steam and for separating the feed-water which is being brought to a boiling temperature from the hot water which is being vaporized.

In a prior application, Serial No. 203,917, I have described a boiler in which the functions mentioned above are performed within the limits of an ordinary boiler-shell of circular section, enabling the invention to be constructed on the outlines of established types of boilers, and especially locomotive-boilers.

The present invention relates more particularly to boilers of the locomotive type; and its objects in general are to provide for an increased amount of heating-surface and grate area within the rigid limits imposed by track-gage and overhead structures along railway-lines.

By partitions within the pressure-retaining shell the vaporizing-space is separated from the space in which the feed-water is preheated. In these spaces are located fire-tubes forming the vaporizing and preheating surfaces. In the steam-space are located superheating-tubes, and arrangements are made by means of flue-chambers at the ends of the boiler for carrying the flame and furnace-gases from the fire-boxes in succession through the three classes of tubes, first, through the vaporizing-tubes, then the superheating-tubes, and, finally, the preheating-tubes, from which latter the gases pass to the stack.

The foregoing is described in my aforesaid application and is not broadly claimed herein.

In the present invention, however, the vaporizing-chamber occupies the lower middle portion of the boiler-shell, and its bottom substantially coincides with the bottom of said shell, and, furthermore, the partitions separating this space from the preheating-spaces are preferably attached to the bottom of the

shell and converge upwardly. By such an arrangement I provide ample vaporizing and preheating surface without elevating the water-line. The two preheating-spaces may be connected across by a channel having no heating flues. The fire-box is carried laterally beyond the width of the track-gage to give a wide grate in accordance with approved practice and is furthermore adapted to the novel arrangement of spaces within the boiler-shell by having upwardly-converging sides conformable to the separating-partitions within said shell.

A further novel feature is the arrangement of the steam-pipe passing from the throttle to the cylinders.

In the accompanying drawings, Figure 1 represents a longitudinal section of a locomotive constructed according to my invention. Fig. 2 represents a section on the line 2 2 of Fig. 1. Fig. 3 represents a section on the line 3 3 of Fig. 1. Fig. 4 represents a section on the line 4 4 of Fig. 1. Fig. 5 represents a section on the line 5 5 of Fig. 1. Fig. 6 represents a section on the line 6 6 of Fig. 1. Fig. 7 represents a rear elevation. Fig. 8 represents a horizontal section of the steam-pipe and throttle. Fig. 9 represents a vertical section thereof. Fig. 10 represents a transverse section through the throttle-valve.

In the drawings, 20 21 22 are the track-wheels. 23 is a pressure-retaining outer shell of circular cross-section, at the end of which is a smoke-box 24, having a stack 25, while at the rear end is the cab 26 and fire-box 27, surrounded by water-legs 28. The lower or grate portion of said fire-box is wider than the track-gage; but the sides converge upwardly in conformity with a similar shape imparted to the vaporizing-chamber, as will later appear.

Within the circular shell are the vaporizing, preheating, and steam chambers. The vaporizing-chamber 29 occupies the lower middle portion of the shell and has its sides formed by a pair of longitudinal partition-plates 30, attached to the bottom of the shell 23 and converging in an upward direction at the same angle as the sides of the fire-box. These partitions are also attached to the forward and rear tube-sheets 31 32.

33 indicates the vaporizing-tubes traversing the vaporizing-spaces 29 in a longitudinal direction and connecting the interior of the fire-box 27 with a flue-chamber 34, located in front of the forward tube-sheet 31 and having sub-

stantially a mushroom outline, as indicated in Fig. 6. This chamber connects the vaporizing-tubes with the superheating-tubes.

On opposite sides of the vaporizing-chamber 29, between the partitions 30 and the shell 23, are located the two preheating-spaces 35, traversed longitudinally by feed-water-heating tubes 36, connecting the smoke-box 24 with a rear flue-chamber 37, located back of the rear tube-sheet 32 and straddling the fire-box 27, as best seen in Fig. 2. The two preheating-chambers are connected by a narrow channel 38, passing under the vaporizing-space 29 between it and the boiler-shell and free from heating-flues, its purpose being to equalize the water-level in the two preheating-spaces.

In the steam-space above the vaporizing and preheating chambers are located a series of longitudinal superheating-tubes connecting the forward flue-chamber 34 with the rear flue-chamber 37. In order to form a maximum amount of superheating-surface, these tubes are carried close up to the roof of the shell 23, and as this leaves insufficient room for the steam-pipe I carry the latter outside of the shell. 40 is a small steam-dome near the forward end of the shell comprising a single casting 41, riveted to the sides of an opening in the shell and formed with the seats for the throttle-valve 42 and with bearings for a bell-crank lever 43 for operating said valve. The casting has a removable cover 44. Integrally cast with this casting and projecting forwardly therefrom above the boiler-shell is the steam-pipe 45, proceeding from the valve-seats for a short distance forward outside of the shell to avoid the forward tube-sheet 31 and then entering the flue-chamber 34, wherein it has an extension 46, leading to the cylinders 47, the complete connection not being shown.

48 is a narrow sheet making a joint between the upper rear edges of the partitions 30 and the outer shell of the fire-box 27 for a cross connection between feed-water spaces.

In operation the flame and gases from the fire-box 27 pass forward through the vaporizing-tubes 33 and serve to vaporize water which has been previously brought to boiling temperature in the preheating-spaces 35. The gases then pass into the forward flue-chamber 34 and from thence pass backwardly through the superheating-tubes 39. Entering the rear flue-chamber 37 the gases again pass forwardly through the preheating-tubes 36 and from thence into the smoke-box 24 and out of the stack 25. Therefore the gases are at first caused to vaporize the water. The heating-surface of the tubes 33 may be considerably smaller relatively to the grate area than would be proper in an ordinary locomotive-boiler. After being somewhat cooled in these tubes the gases pass through the tubes 39 and superheat the steam within the upper portion of the

boiler-shell. They finally pass through the preheating-tubes 36 and yield up a further portion of their heat to raise the temperature of the feed-water to or toward the boiling-point. Feed-water is fed to one or both of the spaces 35 at their lower portions and rising to the upper edges of the partitions 30 overflows into the vaporizing-space 29, in which the level is preferably kept somewhat lower than in the side spaces 35. Since much of the steam is generated around the rear ends of the vaporizing-tubes 33, it must traverse the whole set of superheating-tubes 39 longitudinally in passing to the steam-dome 40, and the steam must further traverse these tubes transversely. A proper degree of superheat is thereby imparted to the steam. The amount of superheat is fairly stable, since at light loads when the travel of the gases is slowest they will yield up more of their heat to the vaporizing-tubes and will be sufficiently cooled on reaching the superheating-tubes to avoid overheating the steam. The hottest water is to a large extent inclosed by colder water in the preheating-spaces 35, and hence radiation losses are decreased.

The construction and arrangement of parts herein described enables me to obtain a relatively large amount of heating-surface below the water-line without decreasing the steam-space.

A locomotive-boiler with these improvements makes more steam and gives more power than the standard types of locomotives for the same amount of fuel and allows greater trainloads to be handled or a greater speed attained without increasing the usual facilities for stoking.

It will be noted that the whole fire-box 27, including its crown-sheet, is located some distance below the top of the main shell. This gives rise to several advantages. In the ordinary boiler the limited steam-separating space and the lack of drying-surface render necessary a large steam-space over the crown-sheet, and consequently a complex and costly stay construction for the crown-sheet. Moreover, since the crown-sheet is necessarily high in order to get in sufficient tubular heating-surface below the water-line, it is usual to carry only a thin depth of water over the crown-sheet. This imposes a limitation to the engine-power, especially while climbing grades, for at such time no feed-water is introduced and the water-line falls, so that as the locomotive passes the summit and pitches down by the head the water runs to the front end and the crown-sheet is in danger of becoming dry. In my boiler, by reason of the location and construction of the fire-box and the fact that much of the heating-surface is located above the crown-sheet, not only can the sides and top of the fire-box be made flat and easily stayed with ordinary stay-bolts, but I am enabled to carry the water deeper over the crown-sheet with-

out sacrificing steam-space, and thus carry a larger water capacity between maximum and minimum levels for grade-climbing. Furthermore, there is much more room in the cab than usual, and the fireman and engineer are able to see each other and communicate over the fire-box.

What I claim as new, and desire to secure by Letters Patent, is—

10 1. A locomotive comprising track-wheels, a fire-box having a grate portion wider than the gage of the wheels and upwardly-convergent sides, a pressure-retaining tubular shell, means forming a vaporizing-space within said shell
15 conforming in side outline to the fire-box and occupying the lower middle portion of the shell, vaporizing-tubes in said vaporizing-space, additional tubes within the shell outside of said vaporizing-space, and means
20 whereby the fire-box gases are caused to traverse said vaporizing and additional tubes successively.

2. A locomotive comprising track-wheels, a fire-box at the rear end widened at the grate
25 portion thereof laterally beyond the width between wheels and having water-legged sides converging upwardly, a tubular pressure-retaining boiler-shell, upwardly-converging partitions within said shell and attached to the
30 bottom thereof, said partitions including between them a vaporizing-space connected with the water-legs of the fire-box, vaporizing-tubes in said space, additional fire-tubes within the tubular shell, and means whereby
35 the fire-box gases are caused to traverse said vaporizing-tubes and said additional tubes successively.

3. A locomotive-boiler comprising a tubular pressure-retaining shell, partitions within
40 said shell attached to the bottom thereof and including between them a vaporizing-space extending substantially to the bottom of the shell, a series of vaporizing fire-tubes in said space, a series of preheating-tubes in the
45 spaces on both sides of said vaporizing-space, a fire-box at one end of the shell, and means whereby the gases therefrom are caused to traverse first the vaporizing-tubes and later the preheating-tubes.

50 4. A locomotive-boiler comprising a pressure-retaining outer shell, means within said shell forming a vaporizing-space extending substantially to the bottom of the shell and two preheating-spaces on opposite sides of
55 said vaporizing-space, an equalizing-channel connecting said preheating-spaces, vaporizing and preheating tubes in the vaporizing-space and the preheating-spaces respectively, super-

heating-tubes in the steam-space within said shell above the vaporizing and preheating spaces, a fire-box, and means whereby the gases therefrom are caused to traverse the vaporizing, superheating, and preheating tubes in successive order.

5. A locomotive-boiler comprising a pressure-retaining outer shell, means forming a vaporizing-space in the lower middle portion thereof and including upwardly-convergent longitudinal partitions occupying said lower portion and provided with free upper edges, vaporizing-tubes in said space, preheating-tubes in the side spaces between the outer shell and said partitions, and superheating-tubes in the upper part of the shell, above the vaporizing and preheating tubes.

6. A locomotive comprising track-wheels, a fire-box having a grate portion wider than the gage of said wheels and upwardly-convergent sides, a pressure-retaining shell, means forming a vaporizing-space within said shell conforming in side outline to the fire-box and occupying the lower middle portion of the shell, vaporizing-tubes in said space, preheating-tubes in the side spaces between the shell and said partitions, superheating-tubes in the upper part of the shell, and means whereby the gases from the fire-box are caused to traverse said vaporizing, superheating and preheating tubes in the order named.

7. A locomotive-boiler comprising a main shell of substantially circular section inclosing the water and steam spaces and having internal tubular structure close to its upper wall, a steam-dome having a body composed of a single casting secured to the edges of an opening in said shell and integrally formed with a throttle-valve seat and with a portion of the steam-pipe extending over said shell to connect with the cylinders, a throttle-valve mounted on said casting, and a cover removably secured to said casting.

8. A boiler of the locomotive type comprising a pressure-retaining shell, a vaporizing-chamber within the same, preheating-chambers within said shell on opposite sides of the vaporizing-chamber, and a cross connection or water-channel between the upper portions of said preheating-chambers.

In witness whereof I have hereunto set my hand, before two subscribing witnesses, this 28th day of December, 1904.

SIDNEY A. REEVE.

Witnesses:

C. M. ALLEN,
JOHN K. MARSHALL.