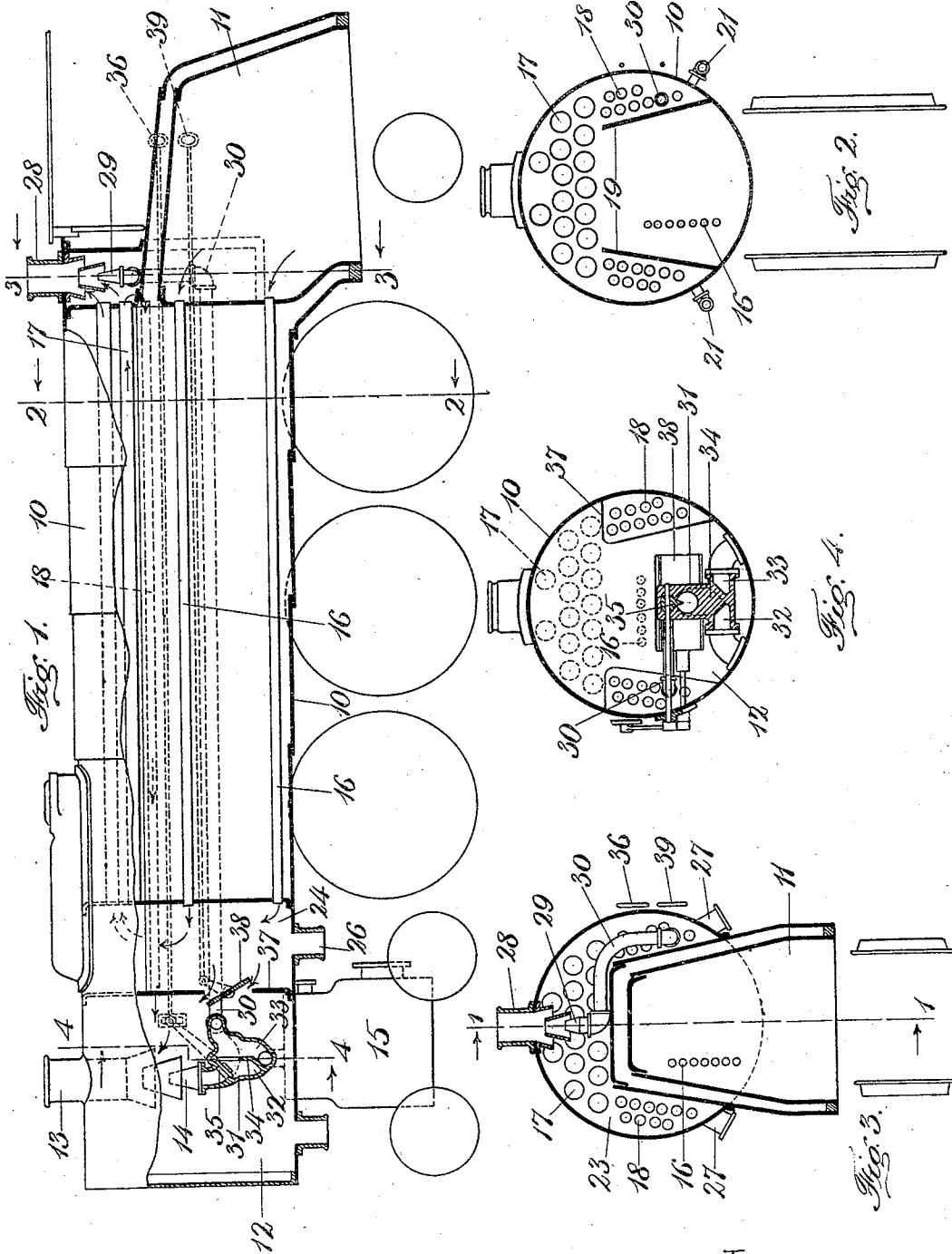


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LOCOMOTIVE BOILER.
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Patented Oct. 26, 1909.

938,171.



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LOCOMOTIVE-BOILER.

938,171.

Specification of Letters Patent.

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To all whom it may concern:

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

This invention relates to boilers of the locomotive type, in which the furnace gases pass two or more times or in opposite directions through the length of the boiler, such type being illustrated in my prior patents Nos. 799,265 and 803,788.

The objects of the present invention are to secure an improved draft and an improved control of the several functions of the boiler, such as vaporizing, feed-heating and superheating.

Of the accompanying drawings, Figure 1 represents a longitudinal section of a locomotive constructed in accordance with 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 transverse vertical section of the device 31 on the line 4—4 of Fig. 1.

The same reference characters represent the same parts in all the figures.

In the drawings 10 is the body of the boiler, 11 is the fire-box at the rear end, 12 is the smoke-box at the forward end, 13 is the usual smoke-stack leading therefrom, and 14 is the nozzle directed into the smoke-stack and receiving exhaust steam in the usual manner from the cylinders 15. This boiler contains three sets of tubes, viz: vaporizing tubes 16, superheating tubes 17, and feed-heating tubes 18, the arrangement being substantially the same as shown in my Patent No. 803,788 aforesaid. The vaporizing chamber is formed by the lower wall of the boiler and two upright longitudinal partitions 19, 19 extending from end to end, and the group of vaporizing-tubes occupies the lower middle portion of the boiler. The feed-heating tubes 18 are arranged in two groups alongside of the vaporizing space below the upper edges of the partitions 19. Feed-water is supplied to the two preheating spaces through pipes 21, 21 (Fig. 2), and, becoming heated in passing upwardly over the tubes

18, it overflows into the vaporizing space. The vaporizing chamber and the preheating chambers have a common steam space in the upper part of the boiler shell and in this are located the superheating tubes 17. All tubes terminate in the front and rear tube-sheets, but the rear ends of only the vaporizing-tubes 16 emanate from the fire-box 11. The rear ends of the feed-heating and superheating-tubes 18, 17 open into a rear gas chamber 23 which straddles the fire-box 11. In front of the forward tube-sheet is a gas chamber 24 adapted to connect the forward ends of the vaporizing-tubes 16 with the forward ends of the superheating-tubes 17, so that gases issuing from the former may return through the latter to the gas chamber 23. The forward ends of the feed-heating tubes 18 open directly into the smoke-box 12 alongside of the forward gas chamber 24 as in Patent No. 803,788 aforesaid. It will be apparent that if a complete circuit of the gases is allowed they will pass from the fire-box 11 forward through the vaporizing-tubes 16 into the gas chamber 24, then rearwardly through the superheating tubes 17 into the rear gas chamber 23 and then forwardly through the feed-heating tubes 18 into the smoke-box 12 and thence out of the stack 13. 25, 26, 27 are cinder pockets in the bottoms of the smoke-box 12 and gas chambers 24, 23.

For the purpose of increasing the draft, I have added a smoke-stack 28 which leads to the atmosphere from the rear gas chamber 23 and is provided with a blast nozzle 29 receiving exhaust steam from the cylinders through a branch pipe 30, which is carried back through one of the feed-heating spaces in order to assist in heating the feed water. This rear smoke-stack may also receive live steam from the ordinary "stack blast" and exhaust steam from the air-brake pump as in an ordinary locomotive. The nozzle 14 and pipe 30 lead from a fitting 31 in the smoke-box 12, which has compartments 32, 33 leading from the respective cylinders on opposite sides of the locomotive and separated by a partition 34 over the upper edge of which they communicate. A double-faced oscillating valve 35 operated by a handle 36 in the cab is adapted to shut off either nozzle 14 or 29 when in either of its extreme positions, or to stand in an intermediate position filling up the opening in

the partition 35. Thus any relative strength of blast may be obtained in the two stacks; and when the valve 35 stands in mid-position, one stack receives the full exhaust blast of one cylinder and the other stack that of the other cylinder. This gives alternate blasts in the two stacks and each blast is stronger than if both nozzles received the exhaust of both cylinders.

10 In the front wall 37 of the forward gas chamber 24 is an opening controlled by a pivoted damper 38 which is actuated by a handle 39 in the cab, whereby more or less of the gases issuing from the vaporizing-tubes 16 may pass directly out of the forward stack 13. Or, if the partition 37 be omitted altogether, all of the gases drawn rearward by the stack 28 will have both sets of tubes, 17 and 18, as their pathway.

20 In the operation of this apparatus, whenever the nozzle 29 of the rear stack is in operation some of the gases entering the forward gas chamber 24 will be drawn back through the superheating tubes 17 and discharged out of the stack 28, whether or not the damper 38 is open. When said damper is closed all of the gases take this path; and when both stacks are in operation, some of the gases will return forward through the preheating-tubes 18, thus making a third passage of the boiler as indicated by the forwardly-directed dotted arrows in Fig. 1. If only the forward stack 13 is in operation and the damper 38 closed, all of the gases will pass three times the length of the boiler. The draft is somewhat restricted in this case if the preheating surface 18 is relatively small in area, but such operation gives maximum efficiency. If only the forward stack 13 is in operation and the damper 38 is open, the gases will pass only through the vaporizing-tubes 16 direct to the forward stack, as in any locomotive. This manner of operation gives the maximum freedom of draft and may be employed when the boiler is forced, as in climbing grades.

If both stacks be in operation and the damper be sufficiently wide open, or if the partition 37 be entirely absent, the flow of gases will be rearward in both sets of tubes, 17 and 18, in parallel, giving a freer draft or permitting a smaller boiler-diameter for a given amount of superheating and feed-heating; but the efficiency of this plan is not so good as when the gases traverse the superheater-tubes before entering the feed-heating tubes. By using the superheating-tubes 17 the water-level may be carried very high without wet steam and thus the period of time during which steam may be made without feeding is increased. My improved arrangement of stacks and damper results in a better draft for this kind of boiler and a perfect control over the distribution of draft

and relative quantities of heat apportioned to the several sets of tubes.

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

1. A locomotive-type boiler having water-vaporizing, steam-superheating, and water-preheating surfaces, heating flues adapted to conduct the gases over said surfaces successively in the order named and in forward and return directions, a stack at the rear part of the boiler adapted to discharge a portion of said gases before they have completed the entire passage of said heating surfaces, and a second stack at the forward part of the boiler adapted to discharge gases which have completed the entire passage.

2. A locomotive boiler comprising a boiler barrel having a furnace at the rear end, vaporizing and preheating chambers within said barrel at the same level, flues traversing said chambers, means forming a gas-passage connecting the forward ends of said flues, and a stack at the rear end of the preheating flues for discharging gases which have traversed the two sets of flues.

3. A locomotive-type boiler comprising a boiler barrel containing vaporizing and preheating chambers alongside each other and having a furnace at the rear end, superheating surfaces for the steam, passages for conducting the gases first through the vaporizing-chamber and then across the superheating-surfaces and through the preheating-chamber, and a single stack at the rear part of the boiler adapted to discharge the gases after such transit.

4. A locomotive-type boiler having vaporizing, superheating, and preheating surfaces, flues for conducting the furnace gases over said surfaces in forward and return directions, a gas-chamber at the rear of the boiler connecting the superheating and preheating passages and having a gas-discharge stack, a second gas-chamber at the front of the boiler connecting the vaporizing and superheating passages, and a third gas-chamber at the front of the boiler having a stack for discharging the gases from the preheating-passage.

5. A locomotive-type boiler comprising a fire-box at the rear end, a smoke-box at the forward end, having a smoke-stack, longitudinal vaporizing, superheating and preheating tubes receiving the gases in the order named, a gas chamber at the forward end connecting the vaporizing and superheating-tubes and having an opening into the smoke-box, an adjustable damper controlling said opening, a gas chamber at the rear end connecting the vaporizing and feed-heating tubes, a stack leading from the last-said gas chamber, and steam nozzles directed into the said stacks and supplied with exhaust steam from the engine.

6. A locomotive-type boiler having flues

arranged for the passage of gases in opposite directions, a plurality of stacks for discharging said gases, a plurality of engine cylinders, exhaust pipes leading from said cylinders, exhaust nozzles directed into the said stacks, and an exhaust valve controllable from the cab and adapted to close either nozzle or connect the respective exhaust pipes with the respective nozzles.

- 10 7. A boiler containing vaporizing, superheating and feed-heating surfaces, a stack

drawing over the vaporizing surface, a second stack drawing over the superheating and feed-heating surfaces, and means for varying the relative draft of said stacks.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses, the 26th day of February 1906.

SIDNEY A. REEVE.

Witnesses:

HENRY L. PARKER,

HENRY L. PARKER, Jr.