No. 610,075. Patented Aug. 30, 1898.

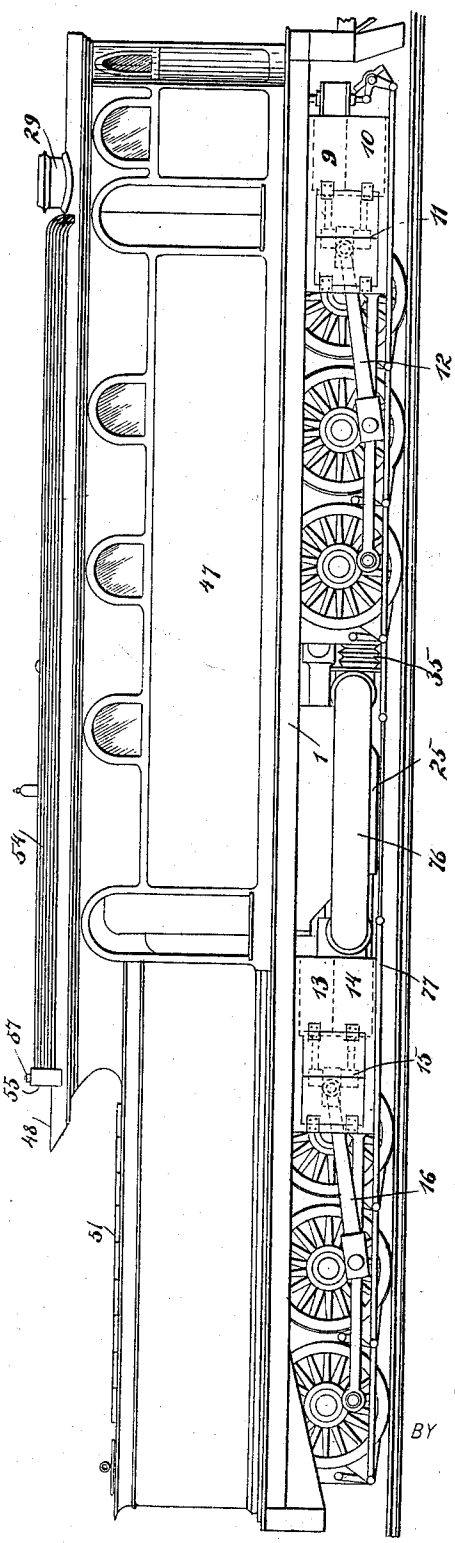
T. J. MURRAY.

LOCOMOTIVE ENGINE.

(Application filed Sept. 28, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

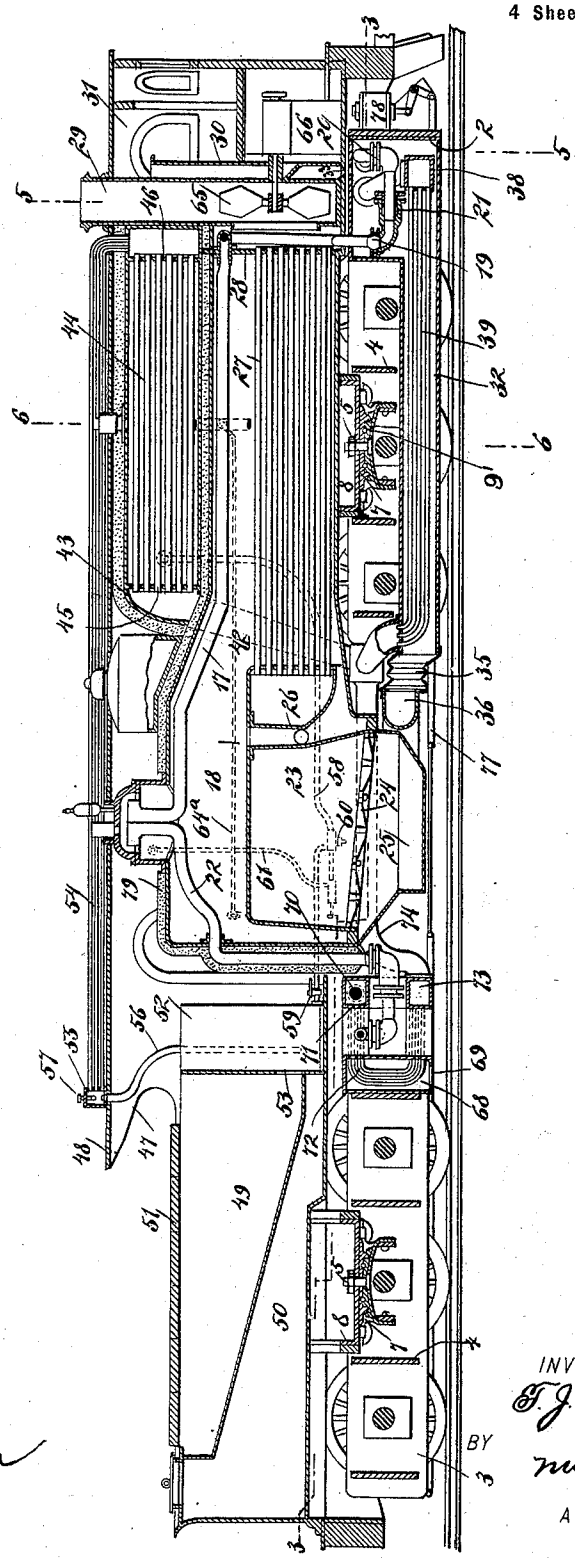


Fig. 2.

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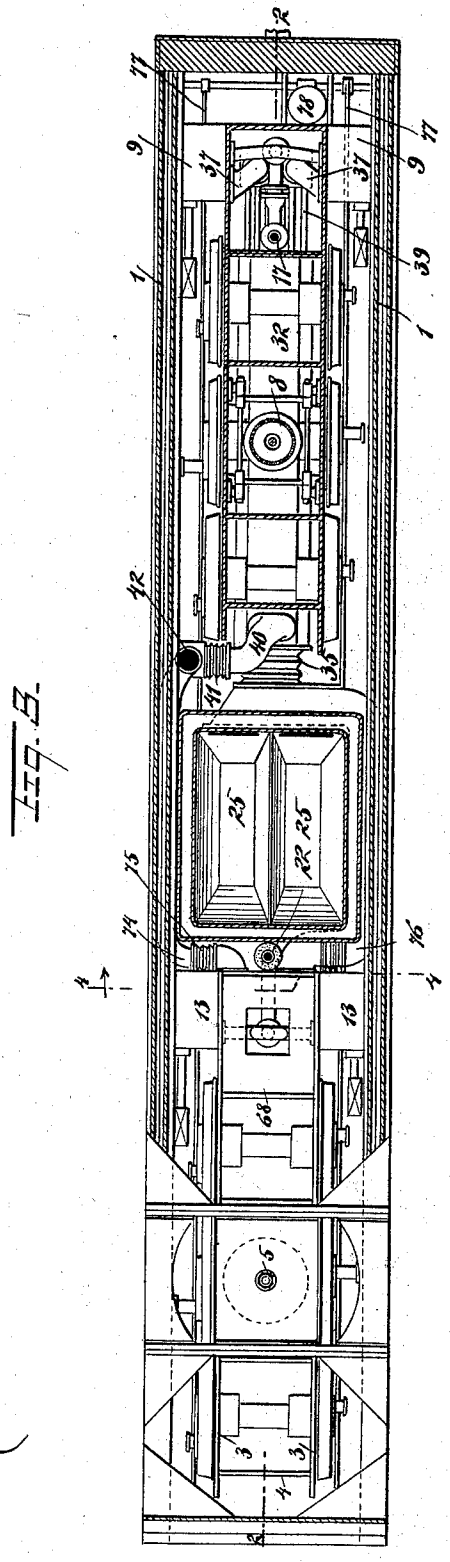


FIG. 3.

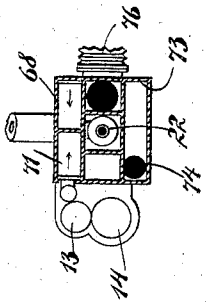


FIG. 4.

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LOCOMOTIVE ENGINE.

(Application filed Sept. 28, 1897.)

(No Model.)

4 Sheets—Sheet 4.

Fig. 5.

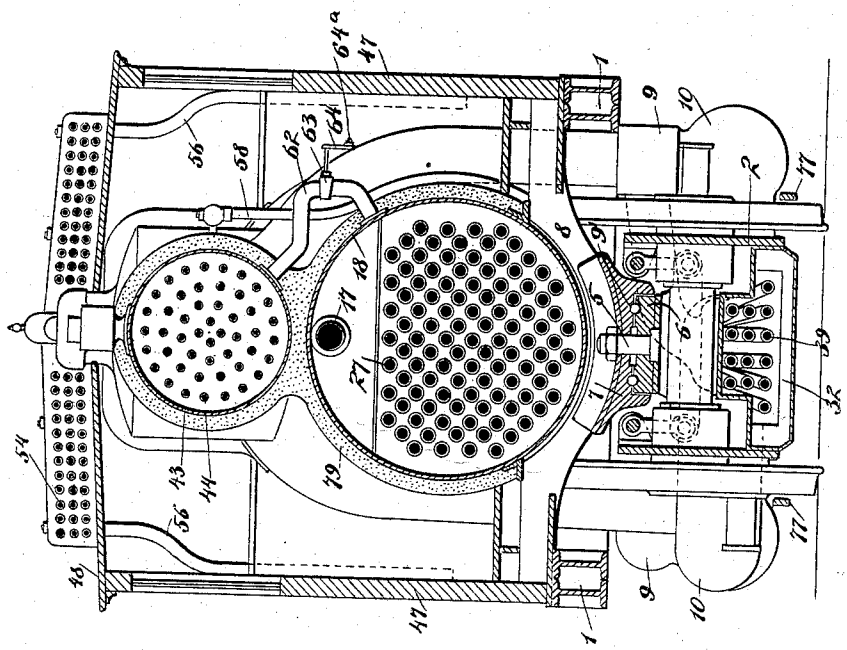
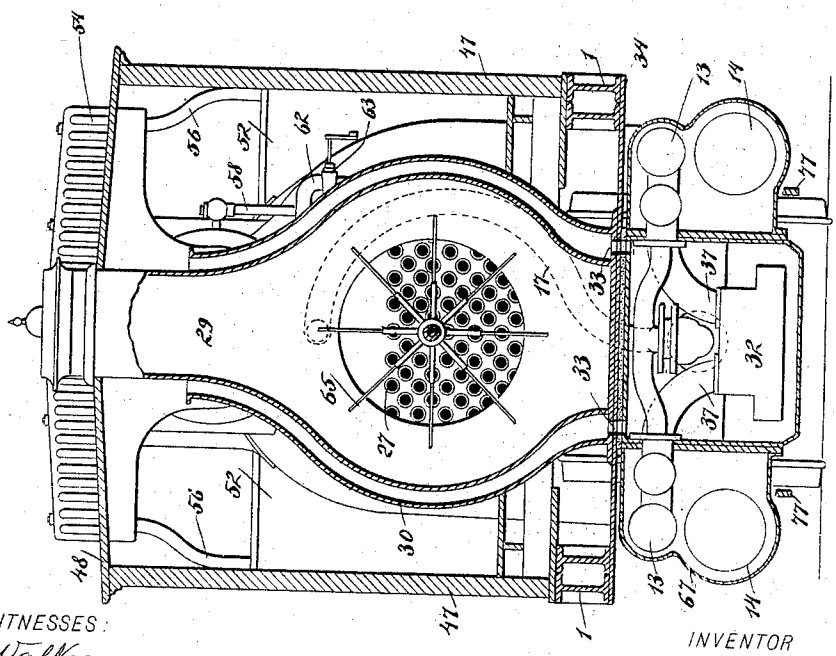


Fig. 5.



WITNESSES:

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UNITED STATES PATENT OFFICE.

THOMAS J. MURRAY, OF BUTTE, MONTANA.

LOCOMOTIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 610,075, dated August 30, 1898.

Application filed September 28, 1897. Serial No. 653,359. (No model.)

To all whom it may concern:

Be it known that I, THOMAS J. MURRAY, of Butte, in the county of Silver Bow and State of Montana, have invented new and useful Improvements in Locomotive-Engines, of which the following is a full, clear, and exact description.

This invention relates to locomotive-engines particularly adapted for use in cold climates; and the object is to provide a construction whereby all of the heating apparatus is suitably incased and protected from cold air or snow, thus permitting the parts to retain their heat and condense less steam on their surfaces than would be the case were the parts left exposed.

A further object is to provide an improved means for heating air to be drawn through the furnace, to provide means for heating the feed-water and admitting it to the boiler, and to provide a simple construction of surface condenser from which the condensation is returned to the water-tank.

I will describe a locomotive-engine embodying my invention, and then point out the novel features in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of a locomotive-engine embodying my invention. Fig. 2 is a section on the line 2 2 of Fig. 3. Fig. 3 is a section on the line 3 3 of Fig. 2. Fig. 4 is a section on the line 4 4 of Fig. 3. Fig. 5 is a section on the line 5 5 of Fig. 2, and Fig. 6 is a section on the line 6 6 of Fig. 2.

The locomotive will consist of three distinct parts or frames, each carrying a number of operating parts. The main frame comprises side girders 1, which extend the entire length of the locomotive and are trussed together at suitable intervals. This main frame carries the boiler, coal-bunkers, water-tanks, ash-pans, furnace, feed-heater, foot-plates, and a cab. The main frame is supported on the forward truck-frame 2 and a rear truck-frame 3. Each truck-frame will be supported on six wheels, and each truck-frame consists of side pieces connected together by cross-plates 4. These trucks may be considered the engines, as they carry the high and low pressure cylinders, as will be hereinafter described.

The trucks are connected to the main frame so as to swing relatively thereto in a horizontal plane, to allow the engine to round curves, by means of centering-pins 5, each extended through a bottom bearing-plate 6, mounted on a cross-bar of the frame, and through a top bearing-plate 7, secured to a cross-bar 8 of the main frame. Ball-bearings 9′ are arranged in raceways formed in the upper and lower bearing-plates, and one of the bearing-plates (here shown as the upper bearing-plate) has a peripheral flange, which engages around the periphery of the lower bearing-plate, so as to withstand the motive force imparted to the total machine, or, in other words, to withstand the shocks incident to the running of the locomotive. The ball-bearings will allow a free movement in all directions radial to the center.

The forward truck 2 carries at each side a high-pressure cylinder 9 and a low-pressure cylinder 10. The pistons operating in the cylinders of a side have their stems connected to a cross-head 11, which is connected to the crank-shaft 12, engaging with the drive-wheels of the forward truck. The rear truck 3 also carries at its opposite sides high-pressure cylinders 13 and low-pressure cylinders 14. The pistons in each cylinder of a pair have their stems connected to a cross-head 15, which has a crank-rod connection 16 with the rear driving-wheels.

Steam is admitted to the forward high-pressure cylinders through a pipe 17, leading from the steam-dome to the boiler 18, mounted on the main frame. This pipe 17 extends forward through the head of the boiler down through the smoke-box and thence horizontally to the steam-chests of the high-pressure cylinders. I provide ball-and-socket connections 19 and 20 between the vertical and lower horizontal portions of the steam-pipe, and I also provide a sliding connection 21 between these pipes. By this arrangement it is obvious that the portion of the steam-pipe carried by the boiler and the main frame may turn relatively to the other portion. Steam is led into the steam-chest on the rear high-pressure cylinder by means of a pipe 22, and

this pipe has similar ball-and-socket and sliding connections as above described and for the same purpose.

At the rear portion of the boiler 18 is a fire-box 23, having a grate 24 and an ash-pan 25. The ash-pan will be practically air-tight and will be provided with the ordinary doors operated in the usual manner for discharging ashes. The products of combustion pass from the fire-box between the water-legs 26 and thence through the flues 27 into the smoke-box 28, and from this smoke-box into the smoke-stack 29.

Surrounding the smoke-stack 29 and spaced therefrom is a jacket 30, open at its top within the cab 31, which is arranged at the front end of the engine, and the space formed by this jacket communicates with an air-heating chest 32, supported by the forward trucks and extended longitudinally thereof. This communication is provided through holes 33 formed in the foot-plate 34 and the top of the chest 32. The rear end of the air-heating chest 32 has a flexible connection 35 with a chamber 36, leading into the furnace or fire-box below the grate. The exhaust-steam from the forward cylinders flows through pipes 37, which extend through the sides of the heating-chest 32 and communicate with the interior of a boxing 38, and from the interior of this boxing 38 a number of steam-tubes 39 extend longitudinally through the chest 32 and pass outward through the upper wall of said chest just forward of the flexible connection 35. These several tubes discharge into a pipe 40, which has a flexible connection 41 with a pipe 42, which leads into the rear end or rear chamber of a feed-water heater arranged on the top of the boiler.

The feed-water heater comprises a shell 43 and steam exhaust-pipes 44. These steam exhaust-pipes at their rear ends extend through a header 45 and at their forward ends through a header 46. The pipe 42 will of course lead into the rear chamber rearward of the header, so that the steam therefrom may pass through the tubes 44 into the chamber at the forward end of the header. It may be here stated that the locomotive will be entirely inclosed within a housing comprising side walls 47 and a roof 48.

Supported on the main frame over the rear trucks is a tender comprising coal-bunkers 49 and a water-tank 50. The coal-bunkers will be provided with suitable covers 51, which prevent the entrance of snow, rain, or the like, thus keeping the coal or fuel in a dry condition, which will add materially to the combustion. The water-tank 50 communicates with feed-water tanks 52, and there is a space between these feed-water tanks 52 through which coal may be received from the coal-bunkers 49, the coal discharging through an opening 53. The fireman of course will be located in the space between the furnace and the tender.

Arranged upon the roof 48 of the housing is a surface condenser, here shown as consisting of a number of pipes 54, each one being extended downward at its forward end through the roof of the housing and into the chamber forward of the forward header of the feed-water heater. The rear ends of these pipes communicate with the interior of a chest 55, and from this chest 55 pipes 56 lead into the tanks 52. There will be as many of these pipes 54 as will give the required surface for the condensation of the exhaust or waste steam from the cylinders of the engine. Their diameters will be of the most suitable for a surface condenser having air as the cooling medium. These tubes will be arranged in two, four, or more tiers high and will have a slight downward slope to the rear, so that the water will run into the box or chest 55. The chest or box 55 will be provided with suitable safety-valves 57 to prevent the bursting of the condensing-pipe by any overpressure of steam and also to prevent the water rushing up the other pipes 56 and thus flooding the condenser when the steam is shut off, thus forming a vacuum in the condenser. Water is fed into the feed-water heater from the tank through a pipe 58, comprising a valve 59 and an ejector 60, receiving steam through the steam-pipe 61, and water is discharged by gravity from the feed-water heater through a pipe 62 into the boiler 18. This pipe 62 has a valve 63, the stem of which is provided with a crank 64, from which a rod 64^a extends to a suitable place to come under the control of the fireman.

Arranged in the smoke-stack 29, forward of the smoke-box, is an induction-fan 65, the shaft of which extends through the smoke-stack and jacket 30 and connects with a suitable motor in a casing 66 within the cab 31. The several steam-cylinders and the piston-stems will be inclosed in suitable casings 67, so as to protect them from cold air, snow, and the like. These casings will be provided with doors, which may be opened when it is desired to oil the bearings.

Between the rear sets of cylinders is an air-heating box 68, which may receive atmospheric air through an opening 69 in the bottom wall of said boxing. The exhaust from the rear cylinders flows through pipes 70 into a steam-box 71, with which one end of a series of steam-pipes 72 communicates, the other end of said pipes connecting with a steam-box 73 in the lower part of the air-heating box. From this steam-box 73 a pipe 74 leads to a connection with the pipe 42, leading to the feed-water heater. The laterally-extended portion of this pipe 74 will be provided with a flexible connection 75 to receive the side thrusts of the engine. From the air-heating box 68 a pipe 76 leads outward around the fire box or furnace and communicates with the chamber 36, which leads into the furnace. Therefore it will be seen that the exhaust-steam from the rear set of cylinders will be utilized for heating the feed-water and also utilized for heating air to be discharged

through the fuel. The usual brake-shoes will be employed and connected to a brake-rod 77, which is operated by a piston operating in a cylinder 78 and controlled from the cab 31.

In operation the air passing downward through the jacket 30 will enter the air-heating chest 32, where it will become heated by the exhaust-steam passing through the tubes 39. This air, as also the air from the box 68, will be drawn through the burning fuel on the grate 24 by means of the fan 65. The products of combustion will of course be drawn through the flues 27 by means of said fan 65 and forced outward through the smoke-stack 29. The feed-water is heated by being raised by the injector to the cylinder 43. This water will become heated by means of the exhaust-steam flowing through the tubes 44. The exhaust-steam will then of course pass up through the condenser-pipes and in a condensed condition flow into the water-tanks.

The great difficulty of forcing hot water into the boiler with a pump or an injector is obviated by my construction—that is, by placing the heater over the water-level of the boiler and having a communicating valve-controlled pipe between said heater and the boiler. The operation is as follows: The heater being injected full from the tank is allowed to heat up to any temperature that can be attained by the length of time between feeding the boiler at certain intervals, after which the injector is shut off and the valve in the pipe communicating between the heater and boiler is opened. The steam from the boiler will rush into the heater and thus equalize the pressure. Thereupon the water falls by its own weight into the boiler and can be regulated by the opening and closing of the valve. When the desired amount of water is put into the boiler, the valve of the pipe 62 is to be closed and the heater again filled from the tanks for subsequent use.

As an additional protection to the boiler and feed-water heater I may provide these elements with an asbestos covering 79, as indicated in the drawings.

It is obvious that a locomotive embodying my invention may be run for great distances without stopping for coal or water, and, further, that by means of the housing the engine will be effectually protected from cold weather or snow, which would absorb the heat, and therefore a great economy in running expenses is gained, and, further, as the fuel is contained in bunkers directly over the water-tanks which are kept heated the said fuel will be warm and dry and therefore beneficial for economic steam-raising.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a locomotive-engine, the combination with the boiler, fire-box, and smoke-stack, of an air-chest in a plane below the boiler and having one end communicating with the outer air and its other end connected with the fire-box, exhaust-steam pipes in the air-chest, a feed-water heater above the boiler and with which the exhaust-steam pipes are connected after leaving the air-chest, and a fan in the smoke-stack, substantially as described.

2. In a locomotive-engine, the combination with the boiler, fire-box, and smoke-stack having a jacket around it, of an air-chest directly below the boiler and having its rear end connected with the fire-box and its front end with the space between the jacket and smoke-stack, exhaust-steam pipes in the air-chest, a feed-water heater above the boiler and with which the exhaust-steam pipes are connected after passing through the air-chest, and a fan in the smoke-stack, substantially as described.

3. In a locomotive-engine, the combination with the boiler, and fire-box, of an air-chest below the boiler and communicating with the fire-box, exhaust-steam pipes in the air-chest, a feed-water heater above the boiler and with which the exhaust-steam pipes are connected after passing through the air-chest, and a condenser above the feed-water heater and having one end connected with the feed-water heater and its other end with a water-receptacle, substantially as described.

4. In a locomotive-engine, the combination with the boiler, fire-box, and smoke-stack having a jacket around it, of an air-chest below the boiler and having its rear end connected with the fire-box and its front end with the space between the jacket and smoke-stack, a feed-water heater above the boiler, exhaust-steam pipes in the air-chest and connected with the feed-water heater after passing through the air-chest, a condenser above the feed-water heater and having its front end connected with the feed-water heater and its rear end with a water-receptacle, and a fan in the smoke-stack, substantially as described.

5. In a locomotive-engine, the combination with the boiler, fire-box, and cylinders, of an air-chest below the boiler, and having its rear end communicating with the fire-box, a boxing in the front end of the air-chest and into which the exhaust-pipes from the cylinders lead, steam-pipes leading from the boxing through the air-chest, a feed-water heater above the boiler, and a pipe leading from the feed-water heater and into which the pipes in the air-chest discharge, substantially as described.

6. In a locomotive-engine, the combination with the boiler, and fire-box, of an air-chest below the boiler and having its front end communicating with the outer air, a flexible connection between the rear end of the air-chest and the fire-box, exhaust-steam pipes in the air-chest, a feed-water heater above the boiler, a pipe at the rear end of the air-chest and into which exhaust-steam pipes discharge, and a pipe leading from the feed-water heater and having a flexible connection with the pipe into which the exhaust-

steam pipes discharge, substantially as described.

7. In a locomotive-engine, the combination with the boiler, fire-box, cylinders, and smoke-stack having a jacket around it, of an air-chest below the boiler and having its front end communicating with the space between the jacket and smoke-stack and its rear end communicating with the fire-box, exhaust-steam pipes leading from the cylinders into and through the air-chest, a feed-water heater above the boiler and with which the exhaust-steam pipes are connected after passing through the air-chest, a casing inclosing the several parts, a condenser on the top of the casing and having its front end connected with the feed-water heater and its rear end with a water-receptacle, and a fan in the smoke-stack, substantially as described.

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