2 Sheets—Sheet 1.

W. B. CRAW.

Feed-Water Heater.

No. 218,859. Patented Aug. 26, 1879.

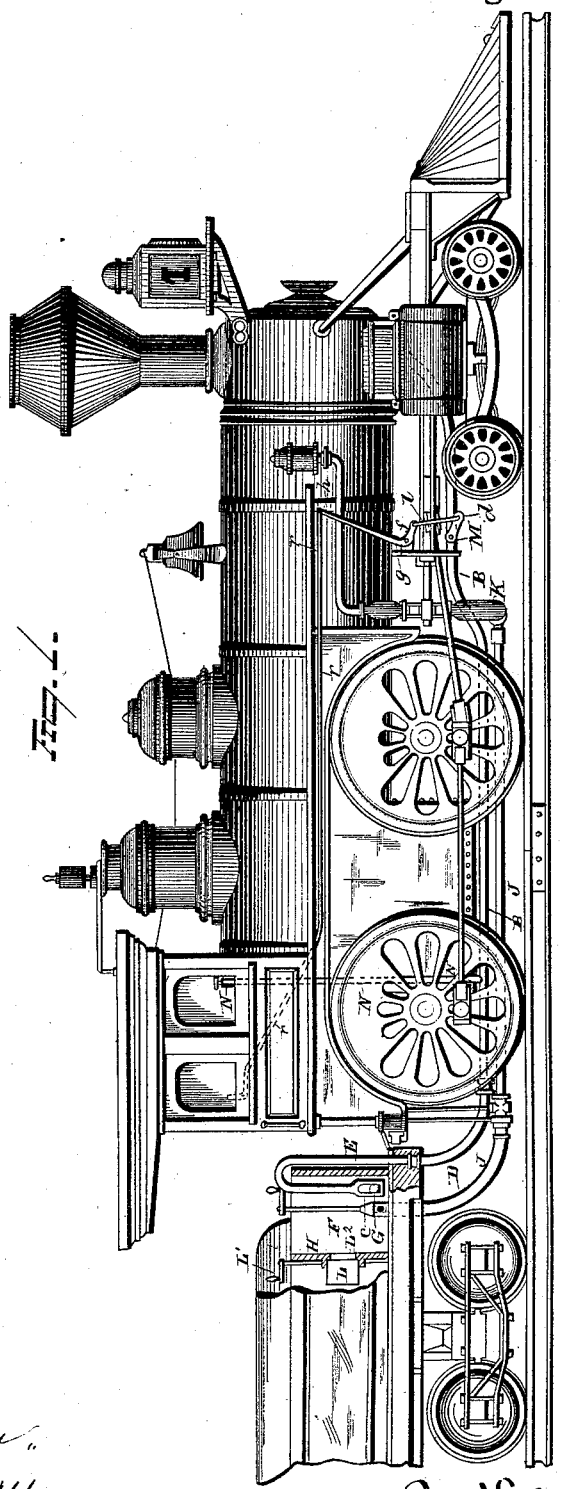

Fig. 1.

WITNESSES

E. L. Nottingham.

F. O. McCleary.

INVENTOR

W. B. Craw.

By H. A. Seymour.

ATTORNEY

2 Sheets—Sheet 2.

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Fig. 2.

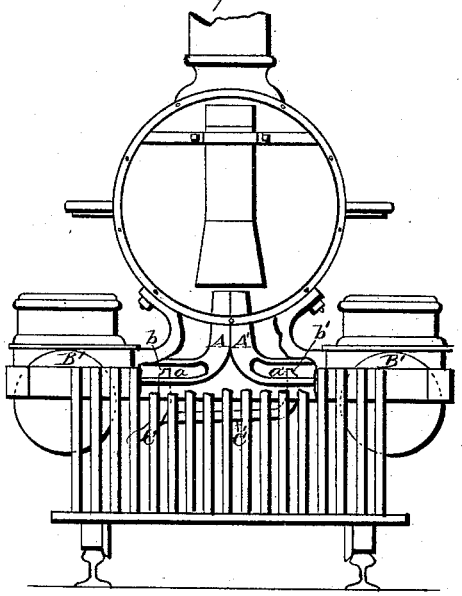


Fig. 3.

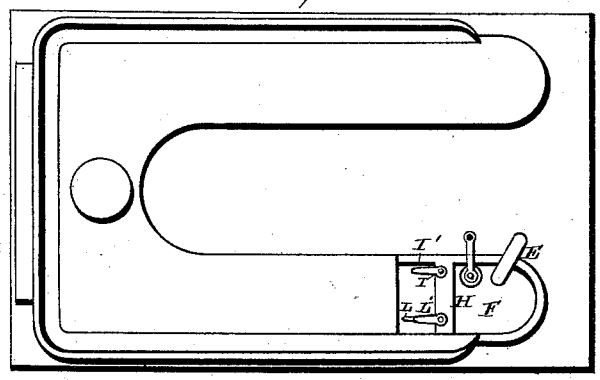
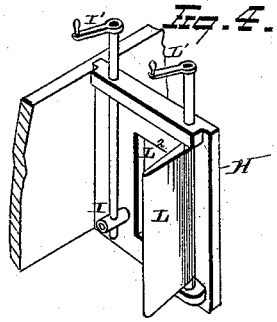


Fig. 4.



WITNESSES

E. F. Nottingham

F. O. M. Cleary

INVENTOR

W. B. Craw.

By H. A. Seymour.

ATTORNEY

UNITED STATES PATENT OFFICE.

WILLIAM B. CRAW, OF BURLINGTON, IOWA.

IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **218,859**, dated August 26, 1879; application filed July 12, 1879.

To all whom it may concern:

Be it known that I, WILLIAM B. CRAW, of Burlington, in the county of Des Moines and State of Iowa, have invented certain new and useful Improvements in Feed-Water Heaters for Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in feed-water heaters for locomotive-engines; the object being to provide a simple and durable feed-water heater, which may be applied to locomotive-engines at small initial cost, and of such construction and arrangement of parts that the heat of the exhaust-steam may be utilized in raising the temperature of the feed-water before it is fed into the boiler.

My invention consists, first, in the combination, with a pipe connecting at one end with the exhaust-steam pipes or passages of a locomotive, of a compartment formed in the tank of the tender, and connected with the main chamber thereof by gates or valves, or both, one end of said pipe entering said compartment, whereby exhaust-steam may be conveyed to a portion of the water in the tank, and the supply of water therein kept constant in quantity and equalized in temperature.

My invention further consists in the combination, with a pipe leading from the locomotive exhaust-steam pipes to a compartment formed in the water-tank of the tender, of a cork or other float valve connected with the end of the pipe submerged in the water of the compartment, whereby water is prevented from entering the exhaust-steam-supply pipe, and also the exhaust-steam is not subjected to undue back-pressure.

My invention further consists in the combination, with a pipe leading from the locomotive exhaust-steam pipes or passages to a compartment formed in the water-tank of the tender, of a water cock or valve located in the lower portion of the partition forming the compartment, said valve provided with a handle, whereby a constant flow of water may be secured from the main chamber of the tank to the heating-compartment thereof.

My invention further consists in the combination, with a pipe leading from the locomotive exhaust-steam pipes or passages to a compartment in the water-tank, of a gate located in said compartment, said gate being provided with a handle, whereby any desired quantity of cold water may be instantly supplied to the heating-compartment to regulate the temperature of the water therein.

In the accompanying drawings, Figure 1 is a side elevation of a locomotive-engine furnished with my improved feed-water heater. Fig. 2 is a front-end elevation, with a portion of the parts cut away to more clearly show the construction and arrangement of parts. Fig. 3 is an enlarged view of the heating-compartment in the tank, and Fig. 4 is a plan view of the tank.

A A′ represent the exhaust pipes or passages, through which exhaust-steam is conveyed from the steam-cylinders B′ B′ to the smoke-stack. B is a pipe for conveying exhaust-steam to the water-tank.

The forward portion of pipe B is subdivided into two branch pipes, C C′, which lead to and open into the exhaust-passages A A′.

In order that the exhaust-steam may readily enter the branch pipes C C′ in sufficient quantity to effect the desired result, the ends *a a′* of the branch pipes C C′, which connect with the exhaust-passages A A′, project upwardly into said passages, and are cut away at *b b′*, adjacent to the steam-cylinders, whereby said projecting ends operate as deflectors to convey the exhaust-steam into the branch pipes and rearward into the water-tank.

When it is not desired to convey the exhaust-steam to the water-tank, and the valve governing the flow of steam is closed, the upwardly-projecting ends *a a′* will not restrict the passage of exhaust-steam to the smoke-stack to any harmful degree or extent. Pipe B is preferably carried beneath the fire-box, or on the lower side thereof, and suitably supported at its rear end, though it may be located immediately underneath the seat of the cab, and its rear end carried down to be in line with the under surface of the foot-board of the tender. To the rear end of pipe B is detachably secured a flexible tubular connection, D, either of rubber or woven hose, or metallic conductor, provided with a universal joint and with suitable steam-tight couplings.

The opposite end of the connecting-tube D is attached to a pipe, E, which extends upwardly, and is carried over and downwardly into the compartment F of the water-tank.

The lower end of pipe E is provided with a valve-cage, *c*, within which is placed a float-valve, G, which latter may be made of cork or rubber, or other equivalent material.

When exhaust-steam is allowed to enter the pipe and flow into the compartment F of the tank it is not subjected to any appreciable back-pressure from the valve G, as the latter is light and readily forced downwardly away from its seat on the lower end of the pipe E.

The valve G serves to prevent water from entering the steam-pipe, and thus obviates any danger of water freezing and bursting the steam-supply pipes when the engine is not running.

H is a partition extending across the end of the water-tank, and connected at its ends to the opposite walls thereof. I is a cock or valve located in the lower portion of said partition, and to said cock is connected a handle, I′, for opening and closing the same.

J is a pipe leading from the lower portion of heating-compartment F to the steam-pump K, the latter operating to force the heated water into the boiler of the locomotive.

By means of the valve I a small and regular supply of water from the main tank to the heating-compartment can be insured.

L is a gate hinged or pivoted to partition H, and provided with a handle, L^1. Gate L opens or closes the opening L^2 in said partition, its purpose being to enable a large supply of water to be instantly supplied to the heating-compartment whenever desired, in order to regulate the temperature of the water therein.

Pipe B is provided with a valve or cock, M, the valve-stem of which is provided with an arm, *d*, which is connected by a link, *e*, with one arm, *f*, of a bell-crank lever, *g*, to the other arm, *h*, of which is secured a rod, *h*, which extends back into the cab, that the supply of exhaust-steam allowed to flow into the tank may be easily regulated by the fireman from within the engine-cab.

To prevent the water from freezing in the heating-compartment of the tank when the engine is not running, I connect a steam-pipe, N, with the pipe B, the other end of pipe N opening directly into the steam-space of the boiler.

Pipe N is furnished with a valve to cut off steam when not needed for use.

Instead of having the exhaust-steam pipe project downwardly into the water, it may terminate above the level of the water, and a finely-perforated diaphragm be interposed between the surface of the water and end of the pipe, that the steam may be distributed and subdivided into fine jets, thus causing the heating-compartment to act as a surface-condenser, at the same time reducing the back-pressure on the exhaust-pipe, and yet utilize the heat of the steam in raising the temperature of the feed-water.

By means of my improved feed-water heater the water in the heating-compartment may be raised in temperature of from 120° to 150° Fahrenheit, and thereby effect a considerable saving in the cost of fuel, cause the engine to generate steam more quickly and freely, serve to reduce the amount of water used, owing to the fact that the steam conveyed to the tank is condensed and again used, serve to purify the water before entering the boiler, and thereby lessen the formation of scales or mineral deposits on the inside of the boiler and flues, and thus operate to prolong the life of the fire-box, boiler, and flues.

In some build of engines the steam-conducting pipes may be inserted in the exhaust-pipes near the nozzle or end of exhaust-pipes, and in such case the pipes would go into the upright portion of the exhaust-pipes at right angles thereto, and the projecting ends of the steam-pipes cut away on their lower sides to allow the steam to enter same.

Again, the steam-conducting pipes may be placed beneath the jacket or boiler-casing, to prevent the condensation of the steam within the pipes.

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

1. The combination, with the exhaust-steam pipes or passages of a locomotive, of a pipe connecting therewith at one end, and its opposite end opening into a compartment formed in the water-tank of the tender, said compartment being connected with the main chamber of the tank by gates or valves, or both, substantially as set forth.

2. The combination, with a pipe leading from the locomotive exhaust-steam pipes or passages to a compartment formed in the water-tank of the tender, of a cork or equivalent float-valve connected with the end of the submerged pipe in the water of said compartment, substantially as set forth.

3. The combination, with a pipe leading from the locomotive exhaust-steam pipes or passages to a compartment formed in the water-tank of the tender, of a water cock or valve located in the lower portion of the partition forming the division-wall of said compartment, substantially as set forth.

4. The combination, with a pipe leading from the locomotive exhaust-steam pipes or passages to a compartment in the water-tank, of a gate located in said compartment, said gate being provided with a handle, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 7th day of July, 1879.

WILLIAM B. CRAW.

Witnesses:

CHAS. W. GARDINER,

F. L. MISNER.