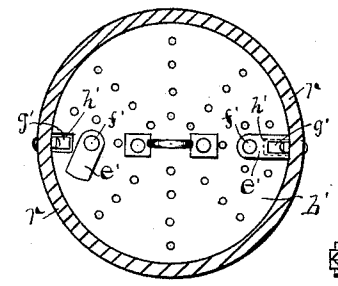
(No Model.)

A. & R. WILDMAN.

FEED WATER HEATER FOR STEAM BOILERS.

No. 451,546. Patented May 5, 1891.

Fig. 3.



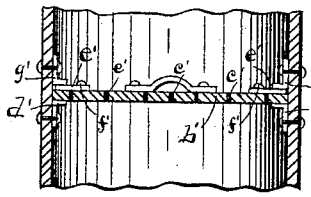


Fig. 2.

Fig. 1.

Fig. 4.

Attest.

J. F. Mount.

G. P. Thomas.

Inventors.

Andrew Wildman.

Robert Wildman.

By Jas E. Thomas

Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ANDREW WILDMAN AND ROBERT WILDMAN, OF SAGINAW, MICHIGAN.

FEED-WATER HEATER FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 451,546, dated May 5, 1891.

Application filed October 11, 1890. Serial No. 367,819. (No model.)

To all whom it may concern:

Be it known that we, ANDREW WILDMAN and ROBERT WILDMAN, citizens of the United States, residing at Saginaw, in the county of Saginaw and State of Michigan, have invented certain new and useful Improvements in Feed-Water Heaters for Steam-Boilers; and we do 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 appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in that class of feed-water heaters in which the exhaust-steam of an engine is utilized to raise the temperature of the water which is being fed to the boiler; and the object of the invention is to provide a device for heating the feed-water of a steam-boiler, which will utilize a large portion of or the entire heat contained in the steam exhausted from an engine.

Another object of the invention is to so arrange and construct a heater for utilizing the exhaust-steam of the engine that a large area of pipe-surface will be exposed to the influence of the exhaust-steam within the heater, and to so construct the pipes for conveying the feed-water through the heater as to entirely avoid or reduce the liability of corrosion or filling up of the pipes with sediment.

Another object of the invention is to provide a cheap and reliable device for heating the feed-water of boilers, which can be easily made and repaired, and also be easily cleaned, and which will render the water passed through its pipes entirely free from sediment and foreign matter.

The invention consists in the combination, arrangement, and construction of the device, as we shall hereinafter more fully explain, and which will be specifically pointed out in the claims of this specification.

Our improvement will be found illustrated in the accompanying drawings, in which similar letters of reference indicate like parts throughout the several illustrations.

Figure 1 is a vertical central section of my improved heater and of the sediment-separators attached thereto. Fig. 2 is a horizontal section of one of the sediment-separators taken at $x\,x$ in Fig. 1. Fig. 3 is a vertical section of Fig. 2. Fig. 4 is a longitudinal section of a portion of the heater-pipe detached.

a represents a casing or shell of a cylindrical form inclosing a steam-chamber *b*, and the lower end of the cylinder is closed by a bottom *c*, which is supported upon suitable legs or other supports, and is provided with an opening *d*, through which is passed the inlet-end portion *e* of the pipe *f*, which conducts steam to the chamber from the exhaust of the engine. The upper end of the cylinder is closed by a head *g*, which is attached to the cylindrical shell by bolts or in any suitable manner and so that it may be removed and leave the end of the shell or casing entirely open and free for cleaning, &c., and through this head *g* is passed the end of a pipe *h* for conveying the steam from the chamber, and *i* is a valve in the exhaust-pipe *h* for controlling the area of the exhaust, as desired.

Within the chamber *b* is placed a series of horizontal coils *j* of a pipe *k* for conveying feed-water to the boiler through the chamber, the pipe being led from the upper portion of a filter *q* through a shell *a* into the lower portion of the chamber, where it is provided with a continuous series *j* of horizontal coils of conical form, each coil being above a short distance from and of a less diameter than the coil below, while the end of the upper coil is attached to or formed into a connecting-pipe *l*, which, leading downwardly outside of the coil *j*, is connected to the lower end of a second series of coils *j''* similar in form and construction to the series *j*, the base or larger coils of the series *j''* being arranged to overlap the upper and smaller coils of the series *j* and to lie outside of the pipe *l*, a space being provided between the coils for the pipe *l*, and the upper end *m* of the series *j''* is led outward through a shell *a* and into the lower end of a separating apparatus *n*. The coils *j* and *j''* are suitably supported upon brackets *o*, fixed upon the shell *a*, and upon the upper head *g* is secured by its center an inverted-funnel-shaped deflector *p*, having an opening in its middle surrounding the opening in the pipe *h*.

The filter or sediment-separator q before mentioned is arranged with a cylinder r, having a bottom s and a removable top or cover t secured in position by bolts or otherwise, and through the bottom s is passed the end of a section u of the feed-water pipe leading from the pump.

The chamber v within the cylinder r is provided with a disk w, having a series of perforations or openings y, and is located across the chamber at a short distance from its bottom, and is suitably supported in position by brackets z, projecting from the side of the chamber below the disk, and a handle a' is secured to the upper side of the disk, with which to easily remove the disk from the cylinder.

b' is a second disk provided with perforations c', and is located above the disk w and near the upper portion of the chamber, and is supported by brackets d', projecting from the sides of the chamber, and held in position from above by the bars e', which have one end pivoted to the disk at f', while their opposite free ends swing beneath the brackets g', which project inwardly from the walls of the chamber above the disk, and slots h' are formed in the disk, which allows the brackets g' to pass when the disk is lifted out, but which are closed by the bars e' when they are in position for holding the disk in place. The chamber v is thus divided by the disks into an upper compartment i', a lower compartment j', and a middle compartment k' between the disks, which is filled with hay or other filtering substance.

The separating apparatus or filter n before mentioned is similarly constructed with the three compartments to the filter q and with the feed-water-pipe section l' leading from the upper portion of the filter to the boiler. The end e of the exhaust-pipe is enlarged or spread out into a funnel end m', and the steam from the engine is passed through this nozzle directly in contact with the coils of pipe j and j'', and, passing between the coils to the upper portion of the chamber, takes its exit therefrom through the opening in the deflector p and the pipe h. The feed-water is forced by the pump through the pipe u to the lower compartment j' of the filter q, where the velocity of the water is reduced by the enlarged area, and it then slowly passes upward through the openings in the disks and the filtering material between the disks, whereby it is relieved of its sediment, which drops below in the compartment j' or remains with the filtering material, and the water then passes through the pipe k and the coils j and j'' in the steam-chamber, where, being subjected to the heat of the exhaust-steam, its temperature is raised nearly or quite to a boiling-point, and it then passes through the pipe m into the second filtering device n, where its current is again expanded, and it is again slowly forced through the filtering material between the plates, and thereby relieved of any sediment that may have been precipitated by the rise in temperature taking place in the coils j and j'', the sediment dropping into the lower chamber j' and the water moving through the pipe-section l' to the boiler.

The sediment collected in the separators q and n may be removed by opening the valves n', the operation of the pump having first been shut off, and this allows boiler-pressure to force the water backward through the pipes and separators, and these valves n' being opened singly or separately operates to completely wash the pipes and separators and filtering material therein from all accumulation of sediment and foreign matter.

In Fig. 4 is shown an enlarged longitudinal section of the feed-water pipe through the conduit n', in which is passed a twisted metal strip o', which can extend nearly across the area of the pipe, if desired, and operates, as the water is forced through the pipe, to change the direct course of the water and cause the water to take a spiral course through the conduit, and the flow of water through the conduit, in contact with the strip, causes the strip to move and vibrate so that its edges in contact with the surfaces of the conduit operate to assist in cleaning the pipe or preventing any sediment to accumulate therein. This strip is intended to extend the entire length of the feed-water pipe and the coils within the heater-chamber, but may be, however, used, if desired, only in the portion of the pipe which contains the water having the temperature raised.

It will be seen that by the arrangement of the coils j and j'' the exhaust-steam is brought into direct contact with the sides of the pipe and a great area of surface for heating the water is exposed to the steam, whereby the excess of heat is quickly absorbed by the cooler water in the pipes, so that whatever steam leaves the chamber is of a low temperature and almost entirely deprived of its heat.

Any desired number of the coils can be placed in position in the chamber, the construction and attachment of additional coils being the same as with the coils already described, the chamber being formed of a proper height to admit the required number, and either or both of the sediment-separators can be omitted, if desired, as in some localities the water is pure and free from any foreign matter.

It will be seen that by the use of my improved heater a large percentage of fuel can be saved, as the water being passed under pressure through the heater will quickly absorb the heat from the exhaust-steam, and the temperature of the water will be raised to a boiling-point as it enters the boiler.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination, in a feed-water heater, of a vertical cylindrical casing inclosing a steam-chamber and having a pipe for leading the exhaust-steam to the lower portion of the

chamber and from the upper portion thereof, the feed-water pipe entering the lower portion of the said chamber and leading from the upper portion of the chamber to the boiler and provided within the chamber with an upper and a lower series of coils of a conical form and having the lower and larger coils of the said upper series surrounding the upper and smaller coils of the said lower series, and with a pipe for connecting the upper coil of the said lower series with the lower coil of the said upper series, with the brackets *o* secured to the walls of the chamber for carrying the coils and retaining the series in position, substantially as set forth.

2. The combination, in a feed-water heater, of a vertical cylindrical casing inclosing a chamber and having a feed-water pipe entering the lower portion of the chamber and leading from the upper portion of the chamber to the boiler and provided within the chamber with one or more series of horizontal coils of a conical form, a pipe passed in the lower portion of the chamber for conducting the exhaust-steam from the engine thereto, and a pipe passed into the upper head of the casing for leading the exhaust-steam from the chamber, with a conical deflecting-plate within the upper portion of the chamber and with its lower edges reaching over the upper and smaller coils of the said series and provided with a central opening at its apex for the passage of steam, substantially as set forth.

3. In a feed-water heater, the combination of the shell *a*, having a bottom *c* and a cover or head *g*, inclosing a chamber, the exhaust-pipe *f*, with its end passed through the head *c*, the exhaust-pipe *h*, leading through the head *g*, the feed-water pipe *k*, passing into the lower portion of the chamber and provided with the series of horizontal coils *j*, arranged in a conical form, the upper series of coils *j''*, of a conical form, and with the lower coils of the series *j''* overlapping the upper and smaller coils of the lower series *j*, a pipe *l*, connecting the lower end of the upper series with the upper end of the lower series, the pipe *m*, leading from the upper end of the upper series through the shell *a*, the vertical cylinder *r*, connected to the pipe *m*, the perforated disk *w* within the lower portion of the cylinder, the perforated disk *b'*, resting upon brackets *d'* in the upper portion of the cylinder and provided with the slots *h'*, the bars *e'*, pivoted to the upper side of the plate by their outer ends and with their inner ends beneath the brackets *g'* and covering the said slots, and the pipe *l'*, leading from the upper portion of the said cylinder to the boiler, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

ANDREW WILDMAN.
ROBERT WILDMAN.

Witnesses:
G. P. THOMAS,
JOSEPH ASLIN.