C. H. KOYL.

FEED WATER HEATER.

APPLICATION FILED FEB. 9, 1911.

1,001,761.

Patented Aug. 29, 1911.

Fig. 1.

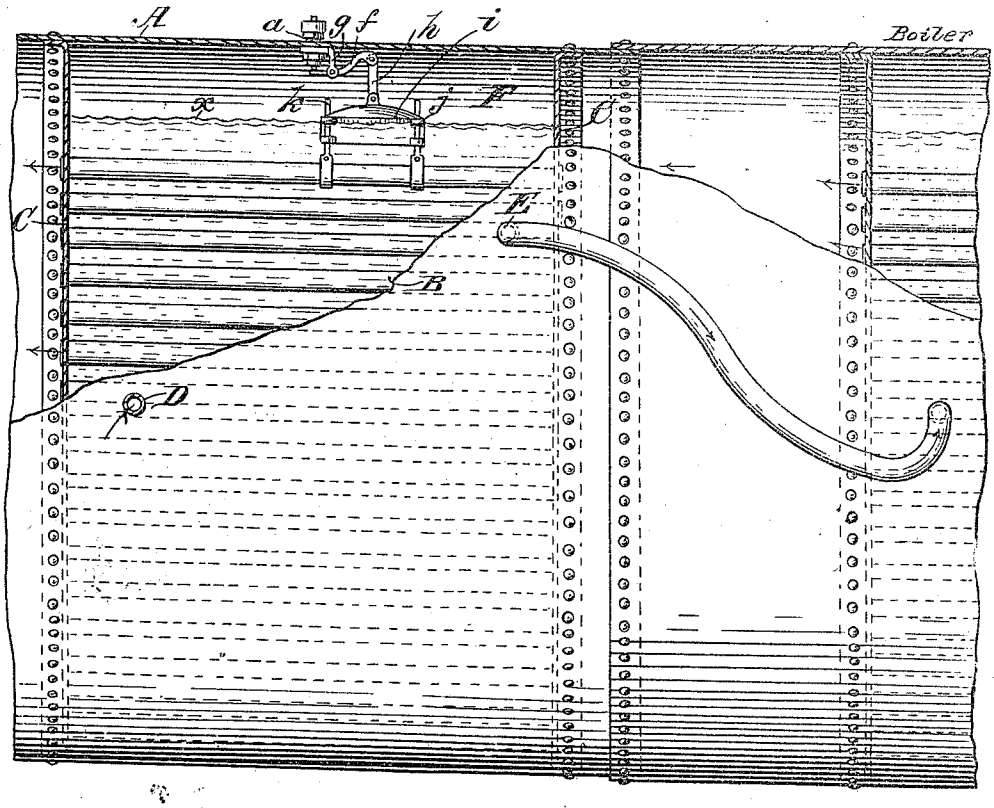



Fig. 2.

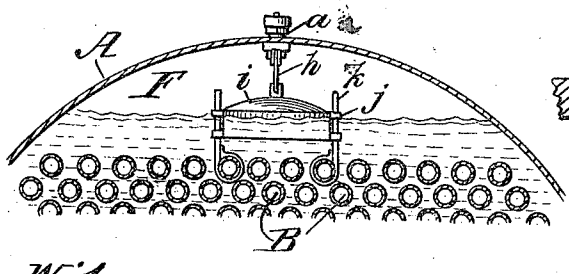
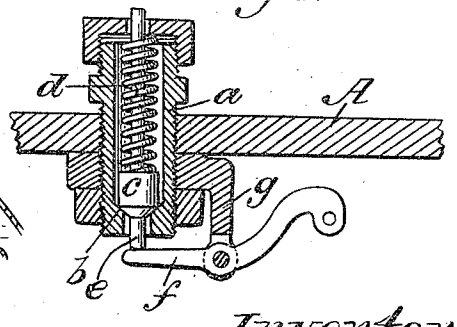



Fig. 3.




Witnesses.

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# UNITED STATES PATENT OFFICE.

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## FEED-WATER HEATER.

1,001,761. Specification of Letters Patent. **Patented Aug. 29, 1911.**

Application filed February 9, 1911. Serial No. 607,616.

*To all whom it may concern:*

Be it known that I, CHARLES HERSCHEL KOYL, a citizen of the United States, and resident of New York city, in the county of New York and State of New York, have invented a new and useful Improvement in Feed-Water Heaters, of which the following is a specification.

My invention, which relates to feed water heaters of the closed or pressure type, is designed to obviate the corrosive action of certain waters upon the feed water heaters through which they pass on their way to the steam boilers supplied by said heaters.

There are many natural waters used in various sections of this country, for industrial purposes, and particularly in steam boilers, both stationary and locomotive, whose impurities, as I have found, consist mainly, and indeed almost solely, of dissolved gases—oxygen, nitrogen and carbonic acid—of which gases the combination of oxygen and carbonic acid is corrosive of iron, and particularly so when warm. In steam boilers, these gases are driven out from the water by the first heating, and do little damage, inasmuch as they escape to the steam space at the top. But in closed feed water heaters, such as are in use today in connection with both locomotive and stationary boilers, there is no steam space, the water outlet being at the top, and in consequence the liberated gases cling in bubbles to the heater flues and shell, which they corrode so rapidly that the useful life of these heaters is limited to a few months. I find that this trouble can be obviated by constructing the closed feed water heater so as to provide therein above the level of the feed water outlet, a space wherein the liberated gases, as they bubble up, may displace the water and gather, and by combining therewith a valve-controlled discharge aperture—preferably automatically controlled—whereby said gases as they accumulate, may be vented so as to maintain said space at practically constant volume; and it is in the combination of the thus-acting instrumentalities that my invention essentially resides.

In the case of locomotives, the heater is usually an extension of the front of the boiler, the flues are horizontal, and heat is derived from the fire gases; in the case of stationary boilers, the heater is usually an independent structure, generally vertical, and almost always heated by exhaust steam.

In the accompanying drawing to which I shall now refer for a better understanding of my invention, the feed water heater is a locomotive feed water heater, with horizontal flues.

Figure 1 is a longitudinal vertical axial section of so much of a horizontal flue feed water heater as required to illustrate my invention. Fig. 2 is a cross section through the upper portion of the same. Fig. 3 is a sectional view of the vent device on an enlarged scale.

A is the cylindrical shell of the heater.

B are the heating flues, passing through heads C, which close the ends of the shell in the usual way.

D is the water inlet, through which water is supplied to the water space of the heater.

E is the water outlet through which the heated water passes off to the boiler which it is designed to supply. This outlet is below the top of the heater, to provide in said top, above the outlet, a space F, into which the gases liberated from the feed water may escape and gather. In practice there will always be some gas in space F, because, in pumping water into the cold heater in the first instance, some air will be trapped in the space in the top of the heater above the outlet, and the volume of the gas will of course be increased as soon as heat is turned on and air and gas begin to be liberated from the water, these gases bubbling up through the feed water, and gathering in the space F, which will be gradually enlarged to accommodate the increased volume of gases by the pressure of the same operating to lower the level of the water in the heater. The normal level of the feed water is indicated by the water line $x$, which indicates the level at which the float will open the vent valve, as will now be described, the purpose of such venting being to maintain at practically constant volume the gases accumulating in this space. For this purpose, a suitable valve controlled vent should be provided. The structural details of such a vent can be varied widely. The device which I have shown in illustration of my invention, is automatic in its action. It comprises a cylindrical valve case $a$ secured in an opening in the top of the heater shell, with its lower end extending down into the space F. In this lower end is a seat $b$, closed by a valve $c$,

balanced, like a safety valve or an old fashioned whistle valve, against interior pressure by a spring *d*. The stem of the valve, below its head, is prolonged as at *e* to project down below the valve case *a* in a position to be operated on by a lever *f*, pivoted to a bracket *g*, fixed to case *a*, one of the ends of said lever lying under and in contact with the valve prolongation *e*, and its other end being jointed to the upper end of a link *h*, whose lower end is jointed to a float *i*. This float, which should be strong enough to withstand boiler pressure, rests on and is supported by the feed water, and is provided on its sides with guide eyes *j*, which engage vertical guide rods *k*, attached to the heater flues, whereby the float, while secured against horizontal motion, is free to rise and fall vertically, the connections between the valve and the float being, as shown, such that the valve will open when the float sinks, and will close when the float rises.

When the feed water heater is in action, the liberated gases will gradually accumulate in the space F and force downward the water on which the float rests. The float sinks with the action of the water and by its weight, acting through the link *h* and lever *f*, will lift the valve, thus opening the vent and permitting the accumulation of gases to escape, and then, the pressure being thus relieved, the water will at once rise to its normal level, the float rising with it and allowing the valve to close. In this way the space F is maintained automatically at practically constant volume. If for example the feed water outlet, E, is eighteen inches below the top of the heater, the normal water line or level *x*—that is to say, the level at which the float by its weight will operate to open the vent valve *c*—should be, say, six inches above the outlet. The venting action of the valve *c* is dependent wholly upon the volume of gases in the space F, by which the level of the feed water is determined. The valve *c*, as before said is a balanced valve, its spring *d* being tested to balance the highest pressure which the boiler with which the heater is used is to carry, and the weight of the float must be sufficient to overcome a certain amount of the spring force, so that even if the pressure should lower within predetermined limits, the float will still act to open the vent valve, whenever the accumulated volume of gases lower the water line *x* to what I have termed the normal level.

It is possible to maintain the air space F non-automatically within reasonable limits of variation, by connecting the air and water spaces of the heater to a gage glass, through which the rise and fall of the water line can be observed, and providing a hand operated valve by which the engineman or fireman can vent the gases at intervals, as observation may call for. But I prefer the automatic regulation as above described.

The shape and dimensions of the air space F can of course be varied, what is essential being that there should be in the heater above the feed water outlet, a space in which the liberated gases can freely accumulate.

Outlet E to boiler, as before said, should be about eighteen inches below top of heater and at least six inches below the normal water line *x*. The system being a connected one, the pressure will be the same in both boiler and feed water heater; the location of the water line *x* in the heater will however be dependent upon the volume of liberated gases in the space F above the water; and that space will be vented whenever the water line falls below what I have termed the normal level. Under this arrangement, and because of the gas-filled space F in the top of the heater above the feed water outlet E, there will be the same kind, if not degree, of surging of the water in the heater as in the boiler, which will aid in freeing the heater tubes from gas bubbles, just as it does in the case of the boiler tubes.

Having described my improvement, and the best way now known to me of carrying the same into effect, I state in conclusion that I do not wish to be restricted to the particular details hereinbefore shown and specified in illustration of my invention, since manifestly the same can be varied without departure from the principle of the invention. But

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

1. The combination with a steam boiler of a closed feed water heater and a feed water outlet leading therefrom to the boiler, said heater being provided with a space above its feed water outlet for the accumulation of liberated gases, a valve controlled vent through which the thus accumulated gases can escape, and means for operating said valve, substantially as and for the purpose hereinbefore set forth.

2. The combination with a steam boiler of a closed feed water heater and a feed water outlet leading therefrom to the boiler, said heater being provided above its feed water outlet with a space for the reception and accumulation of liberated gases, and means whereby said space is automatically vented to maintain the gases therein at practically constant volume, substantially as and for the purposes hereinbefore set forth.

3. The combination with a steam boiler of a closed feed water heater and a feed water outlet leading therefrom to the boiler, said heater being provided above its feed water outlet with a space for the reception and accumulation of liberated gases, a vent valve

balanced to the pressure for which the heater is calculated, a float whose position is determined by the water level in the heater, and connections whereby when the water in the heater falls to a predetermined level, the float will be caused to open the valve, substantially as hereinbefore set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES HERSCHEL KOYL.

Witnesses:

JAMES M. ELDER,

MAE BELLE GREUCOX.