

WILLIAM C. SELDEN.

Improvement in Feed-Water Apparatus for Steam Boilers.

No. 119,185.

Fig. 1.

Patented Sep. 19, 1871.

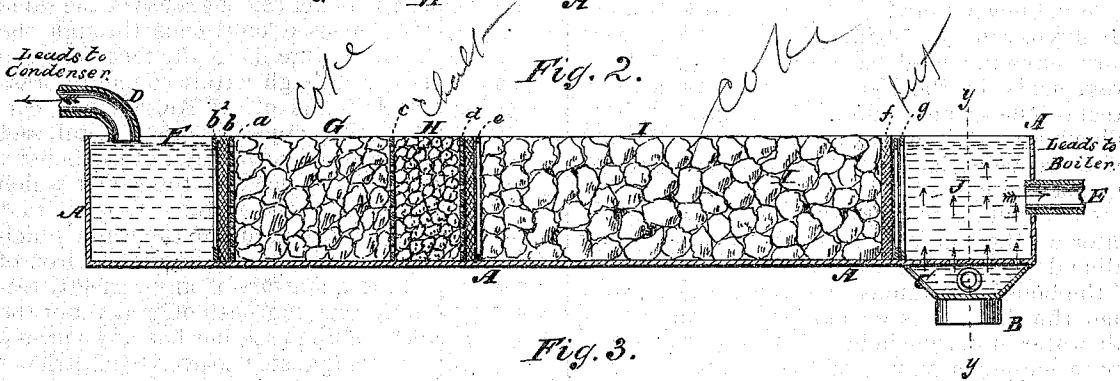
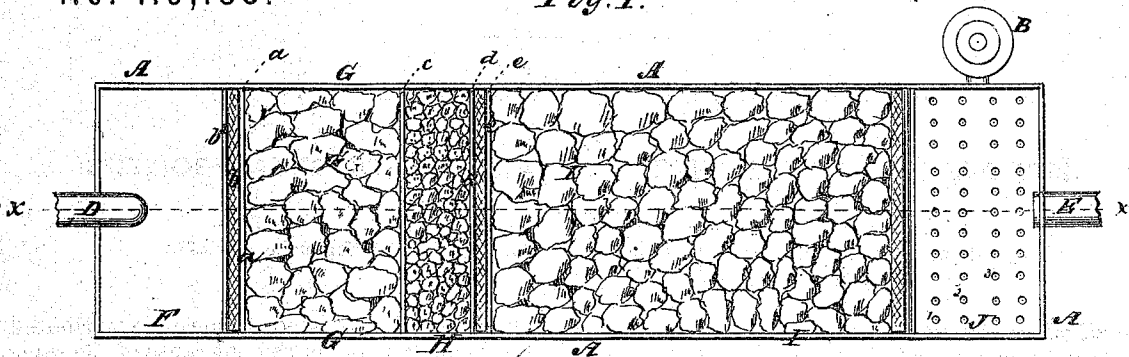


Fig. 3.

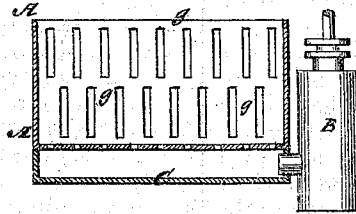


Fig. 4.

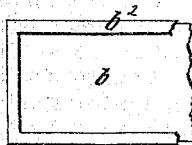


Fig. 5.

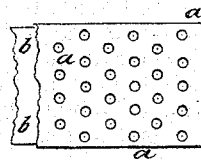
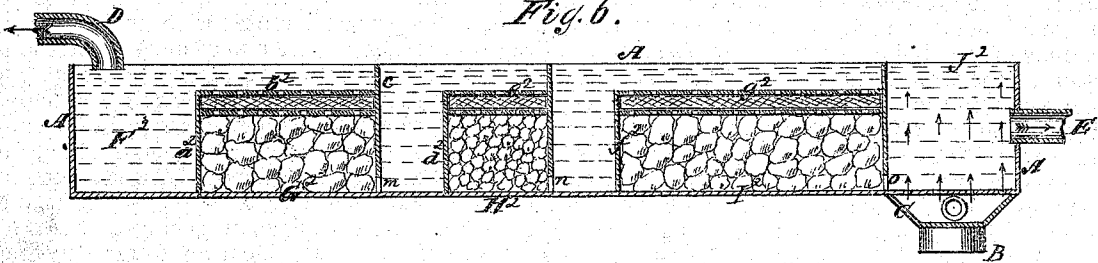


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM C. SELDEN, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN FEED-WATER APPARATUS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 119,185, dated September 19, 1871.

To all whom it may concern:

Be it known that I, WILLIAM C. SELDEN, of Brooklyn, county of Kings, in the State of New York, have invented certain new and useful Improvements in the Feed-Water Apparatus of Steam-Boilers; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawing making part of this application.

It is a well-known fact that in the use of salt water for the purposes of steam generation the saline deposits and incrustation on the surfaces of the boiler are serious objections and to overcome the difficulties encountered in the use of salt water in marine boilers it has been customary to employ a supply of fresh water, (or distilled salt water.) Since, however, it is not practicable to carry a sufficient supply of water to permit a constant fresh supply to the boiler, (and an escape of the exhaust steam,) it has been customary to reconvert the steam, (after it has passed through the engine,) into water in a surface condenser, and use the same water over and over again. This process has also been applied to stationary boilers in cities, and wherever the consumption of the fresh water used to run the boiler is an item of sufficient expense to induce the economic system of using the water over and over by the condensation of the exhaust steam back to water, as I have mentioned. Experiment and practice have, however, demonstrated beyond dispute the fact that, although no material injury is inflicted on the metal of the boiler by the use in it of pure fresh water in the reuse, or in using over and over again the same (distilled) water, (by the process of condensation and reuse I have alluded to,) serious injury occurs to those portions of the boiler which are exposed to the action of the water. It has been demonstrated by experiment that the same kind of water which, when supplied in fresh quantities to or passed once through the boiler, has no injurious effect on the latter, will, when used over and over again in the same boiler, soon injure and destroy the metal. What chemical or other change occurs in the condition of the water by the process of successively expanding it into steam and reconvert it into water, or what is the cause of this known effect, is a mooted question with engineers and scientists, and various theories have been advanced on the subject and some reme-

dies for the evil suggested. Some have attributed this effect on the boiler (by the reuse of the same water, which if passed only once through the boiler would not injure it) to the fact that the water in passing through certain copper or brass tubes or vessels wears off by friction and carries in solution the copper or other metal, and that by the deposit of such metal in the boiler a galvanic action is induced in the boiler which destroys the iron of the latter. Others, that some chemical change occurs in the water which induces to this injurious influence on the iron of the boiler. I am not aware of any perfectly satisfactory solution having been offered yet of the cause or causes of the evil, nor has any successful remedy been suggested to overcome it that I know of.

I have learned by experience and experiment that in the use of the system employed for using over and over again the same water a large quantity of foreign matter, such, for instance, as the tallow or other lubricating material used in the engine, and the metallic wearings of the engine and other parts, must necessarily be taken up by the water, and that this accumulation of foreign matters must be continually augmented by other accumulations as the water travels over and over again through the boiler, engine, and condenser. I am also aware that by the process of heating and generating into steam the water is deprived of the air which it contains when in a natural state, so that it will require, after condensation, a greater degree of heat for a regeneration into steam than was necessary when it was in its natural condition. And also, that in the heating of the water the oxygen of the expelled air probably unites with the iron, leaving free nitrogen, which may unite with the hydrogen set free by the decomposition of oxygen in heating the water, thus forming ammonia, which is known to be very destructible to iron.

From these facts and experiences I have concluded that, for the purpose, of reducing the evil effect of the water on the boiler, saving the engine from the ill effects of grinding through it continually a mass of floating foreign matters, and economising in the generation of the steam, it is important to provide some means by which the water, after it shall have passed through the boiler, engine, and condenser, shall be deprived, as far as possible, of all extraneous and dele-

terious substances, and shall be acted upon both mechanically and chemically in such a manner as to put it in a natural and purified condition before it is resupplied to the boiler. And to accomplish these ends I propose to employ, somewhere between the condenser and the boiler, some suitable apparatus, through which the water shall pass and in which it shall be thoroughly filtered to extract all foreign substances; shall be resupplied with the proper proportion of air or oxygen, and shall be supplied with, or deprived of, such chemical qualities as may be necessary to render it incapable of causing the difficulty which I propose to effectually overcome, viz., the injurious effect on the iron of the boiler. What sort of chemical treatment precisely the water is to receive will depend upon the nature of the water, the character of the metals with which it is brought into contact, and other conditions.

My invention consists in subjecting the water to such mechanical and chemical treatment after it has been generated into steam and reconverted into water, or has been once used, and before its reuse in the boiler, as shall purify it and restore it to its natural or former condition as nearly as possible.

To enable those skilled to fully understand my invention, I will describe the mode in which I have successfully practiced it in one or more instances, leaving it to the judgment of the engineer and chemist to vary the details of the apparatus and process of treatment as circumstances may require.

In the accompanying drawing is illustrated an apparatus which I have used in successfully carrying out my invention, and with which very beneficial results have been attained.

Figure 1 is a top view; Fig. 2, a vertical section at *x x*, Fig. 1; Fig. 3, a cross-section at *y y*, Fig. 2; and Figs. 4 and 5, detail views of the apparatus.

A represents a tank or box suitably constructed, and which, when used in connection with marine boilers and engines, should be provided with a removable cover properly fitted on to prevent the contents of said tank being displaced or thrown out by the motion of the ship. This tank A is divided by partitions into a series of compartments, some of which are filled with filtering and purifying materials, as will be presently explained. B is an air pump, adapted to force air into a receiver, C, near one end of the tank A, from which it escapes through numerous apertures in the bottom of one of the compartments of said tank. D is a pipe leading from the condenser to one end of the tank A, and E is a pipe leading from the opposite end of said tank to the boiler, (or to a reservoir from which the boiler is supplied.) The compartment at F receives the water from the condenser, while the one G next to it is filled with coke. The partition *a*, between these two compartments, is perforated, as seen, so as to permit the passage of water contained in F through it; and on the side adjacent to the compartment F is arranged

(close to said partition) a filter, *b*, made of felt. The compartment H is filled with broken chalk or lime, while compartment I is filled (like G) with coke. *c* and *d* are perforated partitions, similar to *a*, and *e* is another (slotted) partition. Between *d* and *e* is left a space, which is filled in with wool to form another filter. At *f* is another felt filter arranged, as shown, next to the slotted or perforated partition *g*, and through this filter the water has to pass to supply the compartment J, in which the filtered water is subjected to the action of air blasts, as will be presently described, and from which it is taken off by the tube or pipe E, to be supplied to the boiler for reuse.

The general operation of this machine or apparatus is about as I will now explain. The water from the condenser passes (continually) through the pipe D and discharges into the compartment F, (which is generally kept nearly full,) and from here passes through the felt filter *b* and perforated partition *a* into the compartment G, where it percolates through the mass of coke with which this compartment is filled, and by this means of filtration most or all of the solid extraneous substances are extracted. From here it passes on through the mass of chalk or lime in compartment H, where a chemical action will occur to deprive the water of any metals which may be held in solution (and have passed through the felt and coke filters) by rendering such metals solid; and should such solid particles be carried on by the water they will be extracted by the wool filter, (located between *d* and *e*,) and by the coke filter at compartment I, where the water is again subjected to the action of a larger quantity of coke. After passing through another felt filter, *f*, the water enters and fills the compartment J, from whence it is drawn off at pleasure through a tube, E, to supply the boiler. The air-pump B being kept in operation in the mean time, atmospheric air is constantly forced into the receiver C, and escaping from thence upward through the perforations 1, 2, 3, &c., in the bottom of compartment J, passes in jets through the body of water contained in said compartment. By this continuous blast of air through the water in J said water is supplied with its necessary or proper proportion of air. The quantity of air supplied to (or forced through) the water may, of course, be regulated. If expedient, and if desired to have the action of the air-blast periodical, or intermittent, or its force should be so slight as to require it, the apertures in the bottom of J may be provided with some suitable valve device, to prevent the water from passing down into the receiver C. Not only is the requisite quantity of air mechanically combined with the water by this injection from the air-pump, but a chemical action may occur by the introduction into the mass of water of additional oxygen, by which it will be deprived of any contained ammonia, (by the chemical union of oxygen with the nitrogen of the ammonia;) and thus the injurious effects of this substance, if it exists, in the water will be prevented. In Figs. 4 and 5 is shown in detail the construction of one of the

felt filters made as I have used them in a working machine. The filter here shown is composed of a thick sheet of felt, b , which is attached around its contour or edges to a metallic frame, b^2 , and in the use of the filter this frame b^2 , with its attached sheet of felt, is placed and held (by suitable lugs) so as to be embraced between said frame b^2 on one side and the perforated partition-plate a on the other side, as illustrated. When a removal or changing of the felt is necessary, the frame b^2 may be extricated and another with a fresh felt substituted for it. At Fig. 6 is shown a modification of the apparatus, in which, in lieu of permitting the water to flow through the filters and compartments in about a horizontal direction, (as in the apparatus just described,) it is caused to filter downward or flow through the filters and mineral masses in about a vertical direction. In this modified apparatus the compartments and filters are so arranged that the water which is fed in from the condenser through pipe D fills the compartment F^2 , and, flowing over the top of the solid partition a^2 , passes down through the felt filter at b^2 into and through the mass of coke in compartment G^2 . From here it escapes (at the bottom) through an opening or openings at m , and filling up the space between c^2 and d^2 , flows over the top of the latter and thence down through the wool filter at e^2 into and through the chalk at H^2 . From the bottom of the chalk compartment it escapes through the opening at n , and filling up and flowing over the top of f^2 , passes through the felt filter g^2 , thence through the coke compartment I^2 , and out at o into the air-charging compartment J^2 .

The process and operation it will be seen are substantially the same in this modified form of apparatus, the only difference being in the direction of filtration, which it may be advisable sometimes to have downward, as just described.

It will be understood that the size, proportion, and even the construction of the apparatus may be varied, and that, in lieu of subjecting the water

to the necessary processes of filtration, oxygenation, &c., in one apparatus and at the same time the necessary mechanical and chemical actions may be made on the water in separate apparatus and at different times, without departing from the spirit of my invention, the gist of which lies in the idea of subjecting the water to the necessary processes to purify it and fit it for use in the boiler after it has been reconverted from steam and before it is again used for the purpose of generation of steam in the boiler.

It may be found expedient to place in the apparatus through which the water is passed some metallic substance, on which any destructive effect the water has a tendency to inflict on metals, may be produced, and the water be thus deprived of its destructive influence before it goes to the boiler again.

I do not wish to be understood as limiting my claim of invention to the use of the apparatus shown, or to that of any particular apparatus; nor to the nature of or material used for the filters; nor to the chemical ingredients and actions to which I have alluded, as each and all of these features in carrying out my invention may be varied; but, having explained the method by which I propose to prevent the injury to the boiler which arises from the reuse of the water, and described the mode in which I have successfully practiced my invention with very beneficial results—

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

The method of purifying the water and rendering it fit for reuse previous to its return to the boiler, substantially as herein set forth.

In testimony whereof I have hereunto set my hand and seal this 22d day of July, 1871.

WILLIAM C. SELDEN. [L. S.]

Witnesses:

J. FELBEL,
ALFRED F. CONKLIN.

(72.)