ADDRESS TO THE GOVERNMENT OF THE UNITED STATES UPON THE MERITS OF PIRSSON'S PATENT STEAM CONDENSER

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649314201

Address to the Government of the United States Upon the Merits of Pirsson's Patent Steam Condenser by Joseph P. Pirsson

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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JOSEPH P. PIRSSON

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Trieste

To Senator Felch
with the Respects
of W. Potter.

ADDRESS

TO THE

GOVERNMENT OF THE UNITED STATES

UPON THE MERITS OF

PIRSSON'S PATENT STEAM CONDENSER.

WASHINGTON:
GIDEON AND CO., PRINTERS.
1850.

AN ADDRESS

TO THE

GOVERNMENT OF THE UNITED STATES.

THE ATTENTION OF THE CONGRESS OF THE UNITED STATES IS RESPECTFULLY INVITED TO

PIRSSON'S PATENT CONDENSER,

For Supplying the Boilers of Marine Engines with Fresh Water; which will be found of the utmost importance to their Steam Naval Marine.

☞ *This great invention can also be so arranged as to furnish an adequate supply of perfectly pure fresh water for the* *USE OF THE SHIP'S CREW*, FOR WASHING CLOTHES, &c., &c.

Patented in the United States, and the Kingdoms of Great Britain, Holland, Belgium, Republic of France, &c., &c., &c.

The importance of possessing an ample supply of fresh water, for the generation of steam as a motive power, is, to Engineers, and all others interested in the subject, well known. In the last few years, and at present, the use of steam as an agent for Marine purposes, has, and still continues to receive, considerable attention from those engaged in commercial enterprises, as well as our own and foreign Governments; to many the subject, as far at least as detail is concerned, is entirely new, and the few remarks I am about to make are more particularly addressed to such persons. Although the subject under consideration relates to the *construction* of the steam engine, such parties may suppose *that* to be a matter with which they have little or nothing to do. Inasmuch, however, as great loss may follow from this supposition, I propose to give so much information as will be necessary to stimulate further investigation.

In all sea-going steamers the salt water of the ocean has hitherto necessarily been employed in the generation of steam for their engines. Numerous are the evils consequent upon this. One arises from its density, another from its *chemical* action, and both these are increased in their effects by the continuance of the process, for the steam generated from salt water will be perfectly *fresh*. As fast as water leaves a boiler in the form of steam, more must be sent in to supply its place; and this, in the old mode of working, has necessarily been from the ocean, and therefore *salt*: it is evident, then, that in a short time the water must become *saturated;* that is, when it can hold no more salt in solution; and the moment that point is passed the *excess* is immediately precipitated, in the solid state, on the flues and bottoms of boilers. There is a means, however, by which the precipitation of salt can be *partially*, though never wholly, prevented; and that is, by performing the operation known as "blowing off." This consists in discharging from the boiler, at certain regular intervals, a portion of the super-salted water, before it becomes fully saturated;* and introducing in its place a new supply of sea-water. But it will at once appear to the uninitiated as a very strange proceeding to throw away hot water, which represents a certain amount of *power* and *fuel*, to replace it with cold water, which has to be

*Sea-water becomes a saturated solution when the density of the brine is 12-33ds of its weight. The most favorable point at which to keep the water, is 2-33ds, to accomplish which an amount equal to one-half of the quantity required for making steam must be fed in and *blown out!*

heated, and again blown overboard! As engines have hitherto been constructed, however, there has been no possible alternative. As before remarked, the evil has been only palliated, not cured. The water in the boiler still remains more dense than it is in the sea; and of course in an increased degree, more dense than fresh water.

I propose now to state the several effects consequent upon this result. First, water holding impurities in solution does not attain the aeriform state with the same facility as if pure; neither does it possess the same elastic force or power of propelling the engine with the same temperature, i. e., the same consumption of fuel; hence the amount of difference is the direct amount of loss; and the following statement will give some idea of what that amount is.

The elastic force of steam, generated from fresh water, as shown by the rise in a column of mercury, (the usual way of measuring the pressure of steam,) and that from salt water, is as follows:

The steam of fresh water,	at 212° F.,	has an elastic force sufficient to raise a column of mercury				30 inches.	
The steam from sea-water,	" 212° F.,	"	"	"	"	29.05 "	Loss, 0.95 in.
" fresh water,	" 216° F.,	"	"	"	"	32.5 "	
" sea-water,	" 216° F.,	"	"	"	"	24.6 "	Loss, 7.90 "
" fresh water,	" 220° F.,	"	"	"	"	35.1 "	
" sea-water,	" 220° F.,	"	"	"	"	26.5 "	Loss, 8.51 "

This is at the ordinary density of ocean water, and shows a considerable difference, the last example exhibiting a loss of four and a quarter pounds pressure on each square inch of the piston. Taking, then, a common sized cylinder for marine engines, say seventy inches diameter, we should have, if fresh water were employed, and with the consumption of the same amount of fuel, a pressure of 16,354 pounds on the piston more than if in the case of salt water. This, however, is *below* the true calculation, for the density of the water taken is that of the sea, and is far less than of that contained in the boilers. Thus is shown the disadvantage in the use of salt water as regards *power*.

I shall now exhibit its action, in comparison with fresh water, upon the boilers and engines. On land in situations where pure water can be had, numbers of boilers can be found which have been in constant use, under *high pressure steam*, for periods ranging from fifteen to twenty years, and are yet safe. In sea steamers it would be difficult to find any iron boilers seven years old; and if found, they would exhibit a spectacle of *craziness and patches*, wasteful in the extreme as to the use of fuel, and dangerous besides. A great majority reach this condition in less than five years; and *many* are worn out and become hazardous in two or three years use! The steamship Princeton's boilers, made of iron, were renewed after 3 years service. There are even instances where boilers have imperatively required extensive repairs at the end of the first voyage, by reason of the destroying character of sea-water. The rationale of this will now be briefly examined.

Sea-water in 1000 parts contains 25 of *chloride of sodium; 5.3 sulphate of magnesia; 3.5 chloride of magnesium*; 0.2 *carbonate of lime and magnesia;* 0.1 *sulphate of lime*, besides, in minute quantities, *sulphate and muriate of potash*, *iodide of sodium*, *and bromide of magnesium*. Iron appears to have a strong chemical affinity for some of these matters; and it is found, that the moment the water in the boiler has obtained a greater specific gravity than that of the sea, *deposit commences*, increasing in quantity as the density becomes greater. This deposit immediately adheres to the iron and coats it with a white crust, called *scale*. The *first* effect resulting will be the rapid oxidation or corrosion of the iron; and so firm is the union of the two, that nothing will remove the compound but a chisel or like instrument. This process is of itself very injurious, as it cuts away and weakens the iron; but there are many places in boilers where even this expedient cannot be resorted to, as under the flues, in the water legs and other intricate parts; and hence these parts are the first to yield, as clearly seen in the *numerous patches* applied to repair them. The next feature resulting from this, is the inability to generate the requisite supply of steam, arising from the fact, that the coating or scale is a *non-conductor of heat*, and the extent of the evil will be in proportion to the *thickness of this coating*, which varies in the same boiler, from that of a sheet of paper, to three-quarters of an inch, or even more. If the only result of this were the increased consumption of fuel, it might appear unnecessary to allude to it so emphatically, but it is the forerunner of consequences far more momentous, viz., *liability to explosion*, and *that too without warning, or the possibility of calculating the time*. That occurs in this wise: When scale has formed, the water no longer comes in contact with the iron; the crust is a bad conductor of heat, and the iron attains a dangerously high temperature. If the scale is thick, the intense heat in the furnace (urged it may be, by a powerful artificial blast) will make such parts red-hot, sometimes, in a single minute. In this state, having no longer strength, it immediately yields to the internal pressure, and an explosion is the result. Where the scale, however, is not so thick as to produce this precise result, it yet causes the destruction of the iron, by what is called burning. In such cases the boilers are in an extremely dangerous condition, and repairs must always follow. The direct expense of making these is by no means the only cost, for there follows, what is to the *owners* far worse, *loss of time*. And startling as it may seem, *the time lost in making repairs, from damage by salt water alone, may be safely estimated at one-eighth of the whole existence of the ship*.

Repairing damages involves the necessity of suitable shops; and as these are found in comparatively but few places, and distant from each other, sea steamers are often under the necessity of going thousands of miles for what oftentimes will be mended in a week, as witness the case of the steam frigate Mississippi, Capt. Adams, which was compelled to leave the Gulf of Mexico, at a time when most wanted, to go to Norfolk for the purpose of having her boilers repaired, &c. All salt water is not alike in producing the before-mentioned bad effects, some being much worse than others. Such are the tropical seas: a steamer there can, with difficulty, keep down the deposit of salt, and numerous instances have occurred in which they have had to lie-to, have their boilers cooled down, opened, *and the salt shovelled out* as if from a factory, before she