

Lind J (1761). The Substance of a Paper read before the Royal Society, being a Letter from Dr Lind to Mr Robinson Master of the Royal Academy at Portsmouth, and FRS. In Lind J (1762) An essay on the most effectual means of preserving the health of seamen, in the Royal Navy. Containing directions proper for all those who undertake long voyages at sea, or reside in unhealthy situations. With cautions necessary for the preservation of such persons as attend the sick in fevers. 2nd, improved and enlarged. London: printed for D. Wilson, pp 85-93.

Lind's discovery that steam of salt water was fresh

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* The Substance of a Paper read before the Royal Society, being a Letter from Dr. Lind to Mr. Robinson, Master of the Royal Academy at *Portsmouth*, and F.R. S.

“ In revising my Essay on preserving Seamen, there occurred to me a Distress usual to Mariners, which is the Want of good and wholesome Water in many Parts of the World at which they are obliged to remain.— A Calamity not indeed peculiar to Seamen, but to many of our Colonies and Factories abroad, who are destitute of all other but the Rain Water. Whilst in other Places, especially on the *Guinea Coast*, the bad Waters of the Soil are justly suspected to occasion Fluxes, the *Guinea Worm*, and various Maladies which infest those Countries.

“ In order to supply such Places with a pure wholesome Water, and with the least Trouble, I have long meditated an Application of the Solar Fire for distilling Sea-Water, upon the Principle, that though it was made greatly to exceed that of any Culinary or Furnace Heat, yet it would not melt any Metal so long as Water uncompress'd was kept applied to its Side; and that various Contrivances might be made for retaining and diffusing it beyond the *Focus* of the *Speculum*.—As both the Glass and Still should rest upon Stands, no farther Trouble would perhaps be requisite, than a Person to attend to bring back the burning *Focus* to its proper Line, when altered by the Sun's Motion.—And even to save this Trouble a proper Apparatus might be thought of.

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“ But previous to making any Trials by the Sun's Heat, I began with distilling Sea-Water, and various Ingredients, in order to fix upon such as would be least expensive, the most easy to be procured, and which would produce the purest elementary Water.

“ I imagined that Sea Water distilled in Mr. *Appleby's* Way, had a soft Taste unnatural to Water. And I found upon distilling the Sea-Water from Soap-leys, Chalk, Lime, Ashes, &c. that each Ingredient communicated somewhat of its peculiar Taste and Flavour; but in no Distillation did the Sea Salt ascend in a greater Quantity than I found by a diluted Solution of Silver in Aqua Fortis to be contained in the Rain that usually falls here, near the Sea, when the Wind comes from thence.

“ Being able to draw no certain Conclusions from the Distillations I had hitherto made to what Ingredients the Preference was due for distilling Salt Water fresh, and not having the Convenience of using Glass Retorts, I ordered a small Tin Still to be made, which should contain about two Quarts of Water, to be worked without a Worm-Tube in my Study.

“ After properly cleansing this Still, I drew off some of the purest Rain Water, which I reserved as the standard Taste of a new distilled Water; or of any Flavour that might be imparted by the distilling Vessels. I then put some Sea-Water by itself into the Still, which, to my great Surprize, pass'd into the Receiver, without having any Mixture of *Bitumen* or Sea Salt, and, as I judged, equal in Purity to Rain Water.

“ I tried it with a Solution of Salt of Lead, but found
 “ that neither it, nor indeed any distilled Water, discovers
 “ Impurities with this Solution, which is only proper to
 “ search for a *Selenites*.

“ I observed that when the Still run flow, the Sea-
 “ Water then boiling gently, the Water came over freer
 “ from Sea Salt than the rain Water aforementioned.

“ I hope this Discovery will prove useful, and I am,

“ S I R,

*Hoflar Hospital,
 26 April, 1762.*

“ Your most humble Servant,

“ *James Lind.*”

Having found that when Sea-Water boils, nothing ascends but a pure Vapour, which when condensed by any simple Means, is converted into an excellent pure and elementary Water; no Persons at Sea, or even when cast away upon a desert Island where there is Fuel, will now ever perish for want of fresh Water, if either they carry a Still to Sea, or can on Shore make a Contrivance for distilling simply the Sea-Water.

The common Ship-boilers, by being fitted with a Pewter Still Head, will answer all the Purposes of a Still at Sea. The Worm instead of being placed in a Tub standing upon the Deck, may be contained in a close Cavity, surrounding this Head with a Receiver, hung or slung to the Extremity of its Pipe, that it may not be affected by the Ship's Motion. The cold Sea-Water should be poured

into this Cavity by a Funnel fixed at the Top, with a Valve to prevent the Effect of the Ship's rolling; and when it becomes hot, may either be conveyed by a Pipe into the Still, or allowed to run off by another Pipe filled with a Stop-cock. In Case of a Scarcity of Water at Sea, what Satisfaction it must afford to be possessed of the certain Means of Exemption from insufferable Thirst, Misery, and a cruel Death?

One would indeed think that the shocking Situation and Distress to which many Seamen and Passengers have been reduced for want of that invaluable Blessing, good Water, would induce all Commanders of Ships to be at the trifling Expence of so simple a Machine as this Head for their Pot or Coppers, and which would enable them at all Times to procure wholesome Water both for themselves, their Officers, Passengers, or Sick, in Place of their usual corrupt and stinking Water at Sea. A daily Supply of Water may be also procured without any additional Waste of Fuel.

Thus, if instead of Bricks, the Fire-places of Ships had Iron Pots fixed in such a Manner, that when the Fire was at any Time lighted to dress the Victuals, the Heat would be applied to the Side of the Iron Pots constituting the Side of the Grates, and consequently the Sea-Water contained in them being put into a boiling Heat, the Vapour might be condensed by such a simple Head to the Pots as has been described. By this means, in the worst Weather at Sea when it is possible to dress Victuals, a constant Supply of fresh Water for common Drink may be obtained.

Further, having recollected that Salt Pork in Ships, is always boiled in Sea-Water; as also Salt Beef in long Cruises or Voyages; and imagining, that if the Head of the Pots, in which those Provisions are dressed, were close and tight, those salted hard Meats might macerate and soften better, and there would be a considerable Saving of Fuel (as I found that Sea-Water boils with a less degree of Heat than fresh, and Water closely confined requires less Heat and Fuel to keep it boiling) I determined to make some Experiments on this Subject.

For this Purpose I took a Piece of Ship-salt Beef, another of salt Pork, and boiled each of them separately with Salt-Water, in a Pot with such a Still-head as hath been recommended at Sea. I was much pleased to find, that when salt Beef is boiled in Sea-Water, the condensed Vapour from the Pot (for none of it was allowed to escape) affords an excellent sweet Water, slightly tinged with the Beef Flavour,

The Water got from Pork boiled in Sea-Water, had a stronger, though not disagreeable Flavour of Pork.

When the Beef and Pork were sufficiently boiled and very fresh, the Pot was emptied, and some Ship-Peas put into it with that Water only, which had been procured from the Sea in boiling the former flesh Meats. This Water was remarkably soft, and quickly softened, broke, and boiled the Peas. In like manner I boiled some Oatmeal with the same Water which made excellent Water-gruel,

Now as both the Pease and Gruel were dressed in the same Pot as the Beef, with the condensing Cover, there was a Surplus of fresh Water, which originally came from the Sea, and upon standing twenty-four Hours, had neither Taste or Smell, but might serve either for a fresh boiling of Peas, or for the Use of the Hogs, Fowls, &c. in the Ship.

The whole usual Ship-provisions were thus dressed without the Use of any other but the Salt-Water, and an Overplus remained of wholesome fresh Water.

I am apt to think, that salt Beef will freshen equally well when boiled in Salt-Water as in the Fresh, provided the Water is renewed by letting the Brine occasionally run off by the Cock at the Bottom of the Copper, and supplying its Place with warm Sea-Water from the Refrigeratory.

When the Ship's Provisions are to be boiled, for saving Water in this Manner, the Pewter Head before recommended is to be used; and the Cook must be careful in keeping his Utensils very clean, and especially his Coppers free from Verdigrase.—Distilled Waters become much more palatable by keeping, and that got from the Sea will keep for many Months sweet in clean Vessels or Casks.

As to the Application of the solar Heat, it must be done to Sea-Water raised to a certain and known Level, in a close Iron or Tin Tube, and to a Part of that Tube in the Form of a truncated Cone, containing a

Quart or two, or just as much Water as it is found, upon Tryal, that the burning Glass will set and keep boiling.—But further Experiments are requisite to evince the Utility of this last Method, and to put it in Practice.

I have only to add on this Subject, that it appears by some thermometrical Observations published in the Appendix, that Sea-Water when at Rest, freezes at ten Degrees below the freezing Point of fresh Water on Farenheit's Thermometer. Whoever then discovers a Method of producing an artificial and constant Cold to that Degree, will be able to freeze Sea-Water, and consequently render it fresh and potable in the Cakes of Ice when thawed.