such caption, allowing time for their attendance, after notified, not less than at the rate of one day, Sundays exclusive, for every twenty miles travel. And every person deposing shall be carefully examined and cautioned, and sworn or affirmed to testify the whole truth, and shall subscribe the testimony by him or her given, after the same shall be reduced to writing, which shall be done only by the magistrate taking the deposition, or by the deponent in his presence. And the depositions so taken, together with a certificate of the notice, if any, given to the adverse party, or his attorney, shall be sealed up by the said magistrate, and directed to the Speaker: *Provided, nevertheless,* That no ex-parte deposition shall be used on the trial of the said petition, which shall have been taken at any time before the twenty-sixth day of December next: *Provided, also,* That evidence taken in any other manner than is herein before directed, and not objected to by the parties, may, with the approbation of the House, be produced on the trial."

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2d CONGRESS.] No. 24. [1st SESSION.

## PLAN FOR CONVERTING SALT WATER INTO FRESH.

COMMUNICATED TO THE HOUSE OF REPRESENTATIVES, NOVEMBER 22, 1791.

The SECRETARY OF STATE, to whom was referred, by the House of Representatives of the United States, the petition of Jacob Isaacks, of Newport, in Rhode Island, has examined into the truth and importance of the allegations therein set forth, and makes thereon the following report:

The petitioner sets forth that, by various experiments, with considerable labor and expense, he has discovered a method of converting salt water into fresh, in the proportion of eight pints out of ten, by a process so simple that it may be performed on board of vessels at sea by the common iron cabouse, with small alterations, by the same fire, and in the same time, which is used for cooking the ship's provisions; and offers to convey to the Government of the United States a faithful account of his art or secret, to be used by or within the United States, on their giving to him a reward suitable to the importance of the discovery, and, in the opinion of Government, adequate to his expenses and the time he has devoted to the bringing it into effect.

In order to ascertain the merit of the petitioner's discovery, it becomes necessary to examine the advances already made in the art of converting salt water into fresh.

Lord Bacon, to whom the world is indebted for the first germs of so many branches of science, had observed that, with a heat sufficient for distillation, salt will not rise in vapor, and that salt water distilled is fresh. And it would seem that all mankind might have observed that the earth is supplied with fresh water chiefly by exhalation from the sea, which is, in fact, an insensible distillation effected by the heat of the sun. Yet this, though the most obvious was not the first idea in the essays for converting salt water into fresh. Filtration was tried in vain; and congelation could be resorted to only in the coldest regions and seasons. In all the earlier trials by distillation, some mixture was thought necessary to aid the operation by a partial precipitation of the salt and other foreign matters contained in sea water. Of this kind were the methods of Sir Richard Hawkins, in the sixteenth century; of Glauber, Hauton, and Lister, in the seventeenth; and of Hales, Appleby, Butler, Chapman, Hoffman, and Dove, in the eighteenth; nor was there any thing in these methods worthy noting on the present occasion except the very simple still contrived extempore by Captain Chapman, and made from such materials as are to be found on board every ship, great or small. This was a common pot, with a wooden lid of the usual form, in the centre of which a hole was bored to receive perpendicularly a short wooden tube, made with an inch and a half auger; which perpendicular tube received at its top, and at an acute angle, another tube of wood also, which descended till it joined a third of pewter, made by rolling up a dish, and passing it obliquely through a cask of cold water. With this simple machine he obtained two quarts of fresh water an hour; and observed, that the expense of fuel would be very trifling if the still was contrived to stand on the fire along with the ship's boiler.

In 1762, Dr. Lind, proposing to make experiments of several different mixtures, first distilled rain water, which he supposed would be the purest, and then sea water without any mixture, which he expected would be the least pure, in order to arrange between these two supposed extremes the degree of merit of the several ingredients he meant to try. "To his great surprise," as he confesses, "the sea water distilled, without any mixture, was as pure as the rain water." He pursued the discovery, and established the fact, that a pure and potable fresh water may be obtained from salt water by simple distillation, without the aid of any mixture for fining or precipitating its foreign contents. In 1767, he proposed an extempore still, which, in fact, was Chapman's, only substituting a gun barrel instead of Chapman's pewter tube, and the hand pump of the ship to be cut in two, obliquely, and joined again at an acute angle, instead of Chapman's wooden tubes bored express; or, instead of the wooden lid and upright tube, he proposed a tea kettle (without its lid or handle) to be turned bottom upwards over the mouth of the pot, by way of still-head, and a wooden tube leading from the spout to a gun barrel passing through a cask of water; the whole luted with equal parts of chalk and meal, moistened with salt water.

With this apparatus of a pot, tea kettle, and gun barrel, the Dolphin, a 20 gun ship, in her voyage round the world in 1768, from 56 gallons of sea water, and with 9 pounds of wood, and 69 pounds of pit coal, made 42 gallons of good fresh water, at the rate of 8 gallons an hour. The Dorsetshire, in her passage from Gibraltar to Mahon, in 1769, made 19 quarts of pure water in four hours with 10 pounds of wood. And the Slambal, in 1773, between Bombay and Bengal, with a hand pump, gun barrel, and a pot, of 6 gallons of sea water made 10 quarts of fresh water in three hours.

In 1771, Dr. Irvin, putting together Lind's idea of distilling without a mixture, Chapman's still, and Dr. Franklin's method of cooling by evaporation, obtained a premium of £5000 from the British Parliament. He wetted his tube constantly with a mop instead of passing it through a cask of water; he enlarged its bore, also, in order to give a freer passage to the vapor, and thereby increased its quantity, by lessening the resistance or pressure on the evaporating surface. This last improvement was his own; it doubtless contributed to the success of its models; and we may suppose the enlargement of the tube to be useful to that point at which the central parts of the vapor passing through it would begin to escape condensation. Lord Mulgrave used his method in his voyage towards the

north pole in 1773, making from 34 to 40 gallons of fresh water a day, without any great addition of fuel, as he says.

M. de Bougainville, in his voyage round the world, used very successfully a still which had been contrived in 1763, by Poyssonier, so as to guard against the water being thrown over from the boiler into the pipe by the agitation of the ship. In this one singularity was, that the furnace or fire-box was in the middle of the boiler, so that the water surrounded it in contact. This still, however, was expensive, and occupied much room.

Such were the advances already made in the art of obtaining fresh from salt water, when Mr. Isaacks, the petitioner, suggested his discovery.

As the merit of this could be ascertained by experiment only, the Secretary of State asked the favor of Mr. Rittenhouse, President of the American Philosophical Society; of Dr. Wistar, professor of chemistry in the college of Philadelphia; and Dr. Hutchinson, professor of chemistry in the university of Pennsylvania, to be present at the experiments. Mr. Isaacks fixed the pot of a small caboose, with a tin cap and straight tube of tin passing obliquely through a cask of cold water; he made use of a mixture, the composition of which he did not explain, and from twenty-four pints of sea water, taken up about three miles out of the capes of Delaware, at flood-tide, he distilled twenty-two pints of fresh water in four hours, with twenty pounds of seasoned pine, which was a little wetted by having lain in the rain.

In a second experiment of the twenty-first of March, performed in a furnace and five gallon still, at the college, from thirty-two pints of sea water he drew thirty-one pints of fresh water in seven hours and twenty-four minutes, with fifty-one pounds of hickory, which had been cut about six months. In order to decide whether Mr. Isaacks's mixture contributed in any and what degree to the success of the operation, it was thought proper to repeat his experiment under the same circumstances exactly, except the omission of the mixture. Accordingly, on the next day the same quantity of sea water was put into the same still, the same furnace was used, and fuel from the same parcel. It yielded, as his had done, thirty-one pints of fresh water in eleven minutes more of time, and with ten pounds less of wood.

On the twenty-fourth of March, Mr. Isaacks performed a third experiment. For this a common iron pot of three and a half gallons was fixed in brick work, and the flue from the hearth wound once around the pot spirally, and then passed off up a chimney. The cap was of tin, and a straight tin tube of about two inches diameter, passing obliquely through a barrel of water, served instead of a worm. From sixteen pints of sea water he drew off fifteen pints of fresh water in two hours fifty-five minutes, with three pounds of dry hickory and eight pounds of seasoned pine. This experiment was also repeated the next day, with the same apparatus and fuel from the same parcel, but without the mixture. Sixteen pints of sea water yielded in like manner fifteen pints of fresh, in one minute more of time and with half a pound less of wood. On the whole, it was evident Mr. Isaacks's mixture produced no advantage, either in the process or result of the distillation.

The distilled water in all these instances was found, on experiment, to be as pure as the best pump water of the city. Its taste, indeed, was not as agreeable, but it was not such as to produce any disgust. In fact, we drink in common life, in many places, and under many circumstances, and almost always at sea, a worse tasted, and probably a less wholesome water.

The obtaining fresh from salt water was for ages considered as an important desideratum for the use of navigators. The process for doing this by simple distillation is so efficacious, the erecting an extempore still with such utensils as are found on board of every ship is so practicable, as to authorize the assertion that this desideratum is satisfied to a very useful degree. But though this has been done for upwards of thirty years, though its reality has been established by the actual experience of several vessels which have had recourse to it, yet neither the fact nor the process is known to the mass of seamen, to whom it would be the most useful, and for whom it was principally wanted. The Secretary of State is therefore of opinion, that since the subject has now been brought under observation, it should be made the occasion of disseminating its knowledge generally and effectually among the seafaring citizens of the United States. The following is one of the many methods which might be proposed for doing this: Let the clearance for every vessel sailing from the ports of the United States be printed on a paper, on the back whereof shall be a printed account of the assays which have been made for obtaining fresh from salt water, mentioning shortly those which have been unsuccessful, and more fully those which have succeeded, describing the methods which have been found to answer for constructing extempore stills of such implements as are generally on board of every vessel, with a recommendation, in all cases where they shall have occasion to resort to this expedient for obtaining water, to publish the result of their trial in some gazette on their return to the United States, or to communicate it for publication to the office of the Secretary of State, in order that others may, by their success, be encouraged to make similar trials, and be benefited by any improvements or new ideas which may occur to them in practice.

TH: JEFFERSON.

PHILADELPHIA, *November* 21, 1791.

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2d CONGRESS.] No. 25. [1st SESSION.

## ATTORNEY GENERAL AND DISTRICT ATTORNEYS.

COMMUNICATED TO CONGRESS, DECEMBER 28, 1791.

UNITED STATES, *December* 28, 1791.

*Gentlemen of the Senate and of the House of Representatives:*

I lay before you, for your consideration, the copy of a letter which I have received from the Attorney General of the United States.

GEO. WASHINGTON.