

LIV. *An Account of the great Benefit of blowing Showers of fresh Air up through distilling Liquors.* By Stephen Hales, D.D.
F. R. S.

Read Dec. 18,

1755.

THE great importance of having a sufficient supply of fresh water in ships has been the occasion of many laudable attempts to make sea-water fresh and wholesome : but all the attempts and discoveries hitherto made have laboured under this great and material objection, *viz.* the great quantity of fuel, that was necessary to distil, with a slow progress, a small quantity of water, by any methods of distillation hitherto known. But I have lately happily, most unexpectedly, discovered an easy and effectual method to distil great quantities of water with little fuel ; which I was led to by the following incidents ; *viz.* Mr. Shipley, secretary of our Society *for the encouragement of arts, manufactures and commerce*, brought me acquainted with Mr. William Baily of Salisbury-court, the author of many ingenious contrivances ; who shewed me, in a small model of a tin vessel, a method, by which he has happily increased the force of the engine to raise water by fire, *viz.* by lifting up some of the boiling water, at every stroke, by means of a conical vessel, with small holes in it, full of tow ; whereby the quantity of the ascending steam or wreek was considerably increased. This led me to think, that a greater quantity of liquor might also by this means be distilled ; but on trial I found the
increase

increase to be only one twelfth part, though considerable in the expanded form of a steam. Hence I was led to try what would be the effect of causing an incessant shower of air to ascend through the boiling liquor in a still; and this, to my surprize, I found on trial to be very considerable. There was another circumstance also, which probably conduced to lead my mind to this thought, *viz.* About six months before, Mr. Littlewood, a shipwright at Chatham, came thence purposely to communicate to me an ingenious contrivance of his, soon to sweeten stinking water, by blowing a shower of fresh air through a tin pipe full of small holes, laid at the bottom of the water. By this means, he told me, he had sweetened the stinking bilge water in the well of some ships; and also a butt of stinking water in an hour, in the same manner as I blew up air thro' corn and gunpowder, as mentioned in the book on *Ventilators*.

2. The method, which I used to blow showers of air up through the distilling water, was by means of a flat round tin box, six inches diameter, and an inch and half deep; which is placed at the bottom of the still, on four knobs or feet half inch high, to make room for the liquor to spread over the whole bottom of the still, that the heat of the fire may come at it. In larger stills this box must be proportionably larger, and have higher feet. And whereas the mouth of the still is too narrow for the tin box to enter, which box ought to be within two inches as wide as the bottom of the still; therefore the box may be divided into two parts, with a hinge at one edge or side, and a clasp at the other, to fix it toge-

ther, when in the still. This box must be of copper for distilling sea-water ; mine was made of tin, for other liquors also. The air-pipe, which passes through the head of the still, will help to keep the air-box from moving to and fro by the motion of the ship ; or, if that should not be found sufficient, three or four small struts may be fixed to the sides of the air-box. They must reach to the sides of the still. The cover and sides of the air-box were punched full of very small holes, one-fourth inch distant from each other, and about the twentieth part of an inch in diameter. On the middle of the cover or lid of this air-box, was fixed a nosil more than half inch wide, which was fitted to receive, to put on, and take off the lower end of a tin pipe, which was twenty inches long, and passed through a hole in the head of the still : four inches of the upper end of this pipe were bent to a crook, almost at a right angle to the upright stem, in order thereby to unite the crook to the widened nose of a pair of kitchen double bellows, by means of a short leathern pipe of calves-skin. See PLATE X. *Fig. 1.* This tin air-box, and many more of them for other persons, were made by Mr. Tedway, tinman, over-against the Meuse-gate, Charing-crofs.

3. The double bellows were bound fast to a frame, at the upper part of the iron nose, and at the lower handle, in order the more commodiously to work them. And that the upper half of the double bellows may duly rise and fall, in order to cause a constant stream of air (besides the usual contracting spiral springs withinside), several flat weights of lead must be laid on the upper part of the bellows,

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near the handle, with a hole in their middle, to fix them on an upright iron pin fastened on the bellows; that by this means the weights may the more commodiously be put on or taken off. For, according to the different depths of the liquor in the still, so will the force of the included air, against the upper board of the bellows, be more or less. Thus, supposing the depth of the water in the still to be twelve inches, from the surface of the depressed water in the air-box, then the pressure of the included air against the upper part of the bellows, will be equal to that of a body of water a foot deep, and as broad as the inner surface of that board. It will, therefore, be requisite to add or take off weights, according to the different depths of the water in the still, at different periods of the same distillation. The bellows must be proportionable to the size of the still, but need not be very large. Where-ever the stills are fixed in ships, the air may be conveyed to them from the bellows, either through a small leathern pipe, distended with spiral coiles of wire, or through Bamboo canes, or broad small wooden pipes, like hollow fishing rods.

4. When I first distilled in this ventilating way, in order to estimate, what the difference might be in the quantity distilled, by that or the common method, I tried both ways, by receiving the distilled liquor into a quarter of a pint glass, estimating the times by a pendulum beating seconds. Where I found, to my surprize, that sometimes three times more was distilled by ventilation than by the usual way: But finding inequalities in the small quantities thus distilled, in order the more fully and assuredly

to ascertain the true proportion there was in the two methods of distilling, I put three gallons of water into the still; and, when it boiled, put on the still-head, and fixed its nose to the worm-tub pipe; which tub was full of cold water. When it had distilled for an hour, the receiver was instantly taken away. And on measuring the distilled water, found it to be two quarts and 45 cubic inches by a glass divided into cubic inches. And a gallon containing 282 cubic or solid inches, this quantity of distilled water, which was 186 cubic inches, is $\frac{2}{3}$ th part of a gallon.

5. Then, filling the still as full of water as before, and when it began to boil, fixing the head to the still and worm-tub, which was full of cold water; there was distilled in an hour, with constantly blowing showers of fresh air up through the stilling liquors, five quarts, less by seven cubic inches, which is 345.5ths cubic inches; that is, little less than the double of the quantity, that is distilled in the usual way. In several other distillations of a quart at a time, I found the quantity distilled by ventilation to be more than the double of that in the usual way. So that the quantity by ventilation may, at a medium, be estimated the double of the usual distillation. It is the well known property of moving air, to carry along with it a considerable quantity of adjoining vapour, as also of falling water to carry much air down along with it.

6. It is to be hoped therefore, that so considerable an increase in the quantity distilled will be of great benefit to navigation, as it may be done in less time, and with less fire.

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7. In the account of Mr. Appleby's process, for making sea-water fresh, which is published by order of the lords of the admiralty, in the Gazette of Jan. 22, 1754, it is said, that a still, which contains 20 gallons of water, will distil 60 gallons in ten hours, with little more than one bushel of coals; and therefore 120 gallons in 20 hours, with little more than two bushels of coals. And by ventilation 240 gallons, or a tun; and 24 gallons may be distilled in twenty hours, making an allowance for the times of heating those stills full of cold water; and a still something larger and wider will distil a tun in 24 hours; which will more than suffice for a sixty gun ship, with 400 men, whose provision of water for four months is about 110 Tuns. And larger ships may either have proportionably larger stills, or else two of them. As for merchant-ships with few men, a small still will be sufficient.

8. The second-sized stills contain 10 gallons, and will produce 60 gallons in 20 hours, with half the above-mentioned fuel; and by ventilation 120 gallons.

9. The least stills contain five gallons, and will produce 32 gallons in 20 hours; and by ventilation 64 gallons in 20 hours.

10. I have seen some of these stills at Messrs. Steel and Stephens's, over-against Mercers-chapel, in Cheap-side, which have been made for this purpose. There are holes in the feet of the iron frame or stove, to screw them down to the deck. They were fixed at the fore-castle before the mast, in King Charles the second's time, when they thought they had discovered the way to distil sea-water, free from the noxi-

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ous spirit of salt, and from the nauseous bitter taste. Or, if it be thought proper, one part of the ship's boiler may be made use of, by adapting a still-head to it.

11. Now supposing a still to contain 25 gallons, and that four parts in five of it, *viz.* 20 gallons are distilled off: then, in order to distil a tun, or 210 gallons, the still must be emptied, cleansed, and re-filled eleven times; and if the whole be done in 24 hours, full 16 of those hours will be taken up in distilling at the rate of a gallon in about four minutes and an half; and the remaining eight hours of the 24, being divided into 11 equal parts, they will be each near 44 minutes to empty and cleanse the still, to refill it, and give the sea-water a proper boiling distilling heat: whether this can be done in so short a time, must be known by experience, and ought therefore first to be tried at land.

12. Doctor Butler, in his lately published method of *procuring fresh water at sea*, proposes the pouring in more sea-water into the still, thro' a funnel fixed in a small hole in the head or upper part of the still, when more than half the former water is distilled off; by which means the water in the still will soon acquire a distilling heat; and this to be repeated several times; but then it will be requisite to add each time more chalk, in such proportion as shall be found requisite. It will be well to try this method in hopes thereby to increase the quantity of water that is distilled. The hole in the head, or upper part of the still, is to be stopped with a small plate of copper, so fixed as to turn to and from over the hole.

{ 13. Doctor

13. Doctor Butler used capital soap-lees, in the proportion of a wine quart to 15 gallons of sea-water, which sufficed for four or five times repeated pourings-in of more sea-water into the still. But as I have found, that a small quantity of chalk has the same good effect, and is cheaper, and more easily to be had, it is therefore preferable to soap-lees.

14. When there is a fire in the cook-room, the sea-water might be ready heated to put into the still, without any additional expence of fuel, in the following manner, which I shall here describe; tho' I think it probable that it will not be put in practice; yet, as farther improvements may possibly hereafter be made in it, and as it may be of use in some cases, at land at least, I shall here give an account of it, *viz.*

15. About the year 1718, Mr. Schmetou, a German gentleman, got a patent here for heating great quantities of water, with little expence of fuel, which he then shewed me. Having fixed a spiral iron worm-pipe, in such a brick stove or chimney as women heat their irons in, thereby causing the water to run from a vessel, through the worm-pipe, several feet length round, in the fire. About thirty years after I acquainted Mr. Cramond of Twickenham with this; as hoping it might be of benefit in distilling sea-water. Upon which he procured such a spiral iron worm-pipe, which was about twenty feet long, and six-tenths inch diameter; the diameter of the spiral coile was about fourteen inches.

16. This I fixed in a brick stove in my garden, with its upper end fixed to a vessel, which contained 45 gallons of water. I found the event of this first trial

trial to be as follows, *viz.* When the water run full bore, at the rate of a gallon in 17 seconds, the heat of the water was found, by a mercurial thermometer held in the stream, at the lower end of the pipe, to be 80 degrees above the freezing point, 180 degrees being the heat of boiling water. When, by means of a turn-cock, a gallon of water was two minutes in running, then the heat was 140. At which rate the 45 gallons would be an hour and half in running through the iron pipe; at which rate 25 gallons will run through in 50 minutes, with so considerable a degree of heat; and if it was an hour running, the heat would approach still nearer to a boiling heat, when first put into the still, which would forward the distillation, if wanted.

17. I pumped the heated water up again into the upper vessel; and thus continued to circulate the heating water, till its heat was 160 degrees in the upper vessel, *viz.* within 20 degrees, or one-ninth of boiling, the heat requisite for plentiful distillation. I was in hopes that if the water in the upper vessel could have been brought to a due degree of heat, and a still-head were fixed on it, with its cooling worm-tub, then water might have been distilled in ships, by having the iron worm-pipe fixed in the chimney of the cook-room: But I found, that when the heat of the water in the upper vessel was 160 degrees, *viz.* within one-ninth of boiling; then, in running through the iron worm-pipe again, it was so over-heated as to expand in the pipe, into an explosive vapour, which hindered the running of the water. However I thought it not improper to give an account of this attempt, notwithstanding it failed.

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not knowing whether this method of heating water may not in some cases, at land at least, be of use, thereby to save, in some degree, both fuel and time : Perhaps an iron worm-pipe of a larger bore might do better.

18. The waste of fuel will be less in proportion to the quantity distilled in large, than in small stills ; and the wider the still-head is, so much the more liquor will be distilled, and more with a worm-tub than without it. The worm-tub may be so covered as to prevent the flowing over of the water by the motion of the ship.

19. It is of great importance to take care to keep all parts of the still clean, that there may be no rust or verdigrease in the copper, which will occasion vomiting.

20. If it be necessary, the better to close the joining of the still head, it may be done with a lute or paste, made of a mixture of powdered chalk and meal, wetted with salt-water.

21. Now that several effectual means are discovered, to make distilled sea-water wholesome, and also to distil it in much greater quantity in the same still, in the same time, and with nearly the same quantity of fuel ; it is reasonable to believe, that it will be of great benefit to navigation, not only in saving much stowage room, for other important purposes ; but also in procuring fresh sweet wholesome water, instead of stinking putrid water, hitherto used ; which must needs have a tendency to promote that putrid distemper, the scurvy. And if withal due care be taken to exchange for fresh air the putrid close confined air of ships, which has occasioned the

death of millions of mankind; then navigation will become remarkably more healthy, and with little more danger to health and life than at land, except from storms.

22. Now supposing, that, in a sixty gun ship, the 110 tuns of water, for four months use, were distilled at the expence of three bushels of coals to a tun, this would consume nine chaldrons of coals: And as a chaldron of coals weighs about a tun and half; hence it appears, that coals will distil about eight times their quantity of water. And the 110 tuns of water weighing (at the rate of 2240 pounds to the tun) 138 tuns; and the nine chaldrons of coals weighing thirteen tuns and half, that is 94 tuns and half less than the 110 tuns of store water; and allowing twenty-four tuns and half for the still, water-casks, and coals, there will be 70 tuns weight of stowage saved thereby, for other uses. Or if some tuns of store-water are carried by way of precaution, which it will be adviseable to do, especially at first, till they can be assured, by repeated experience, what quantity can be depended upon by distillation; even then about half the tunnage will be saved, which will be a very material advantage.

23. Though when the distilling liquor runs from the bottom of the worm-pipe, through a long pipe fixed to it, the waste by the ventilating rushing air is not great, when the water in the worm-tub is not hot; yet the following precaution, if needful, may be used, in distilling by ventilation, *viz.* to fix at the lower end of the worm-pipe, by means of a wooden faucet, a small cask for a receiver; the faucet to enter the upper side of the head of the cask, and

and in order to give a free passage for the great quantity of ventilating air to pass off, and withal, at the same time to prevent the escaping of much moist vapour with it, it will be proper to fix at the bung-hole a long upright pipe of wood, or of any metal. I used a gun-barrel four feet and a half long; thro' which some small degree of moist vapour escaped; as appeared by the dampness of a piece of paper, fixed at a little distance above the mouth of the gun-barrel. This vapour became visible, and much increased, when the water in the worm-tub was very hot; at which time, less is distilled into the cask-receiver; then also there is more danger of the spirit of salt arising. And it was observable, that the water in the worm-pipe vessel heated much sooner by ventilation than in the common way of distilling. For which reason that water ought to be changed so much the oftener, which can easily be done at sea. The cocks also at the side of the worm-tub ought to be large, in order to let the hot water off the faster.

24. But though the water in the worm-tub was sooner heated by ventilation, because a double quantity of hot steam passed through it more than passed through it in equal times in the common way of distilling; yet in the usual way of distillation the liquor in the still is hotter, with equal fire, as is evident by its aptness to boil over through the worm-pipe; whereas in the ventilating way it did not boil over, notwithstanding a very hot fire was purposely made for a trial. The continual streams of ascending fresh air, not only in some degree abating the heat of the water, but also incessantly carrying off the more rarefied particles of the water, which, when expanded into a repelling state,

do thereby cause the overflowing ebullition of the water. On which account it is probable, that less spirit of salt is formed and raised by ventilation than without it. As also on account of the fresh air ascending, not from the bottom of the still, where is the greatest plenty of salt, especially towards the latter end of each distillation; but about three inches from the bottom, *viz.* principally from the many holes at the surface of the air-box.

25. And whereas the quantity raised from the still, and distilled into the cask-receiver, cannot be seen; the proper quantity to be distilled in each distillation may with great accuracy be known, by having a well-closed pewter bottle, of the size of about half a pint, with a brass wire as big as a goose quill, fixed to it, the wire to pass through the receiver-cask, near the bung-hole, which the floating pewter bottle will raise up, till the marks on the wire appear just above the cask. I made use of a glass phial for this purpose. This wire will rise and fall freely, notwithstanding the motion of the ship, if it passes not only through the wood of the cask, but also through a metalline pipe two or three inches long, fixed in that hole. And it will be known by the simmering or boiling noise of the water in the still, whether it is hot enough to distil; for the running of the water into the receiver-cask cannot be seen.

26. As it might be suspected, that more spirit of salt would be raised, and distilled over in the ventilating way, than without it; having procured 18 gallons of sea-water by the Margate hoy, which was taken up at some distance from the shore, I put three
gallons

gallons of this sea-water, as soon as I had received it, into the still ; and when it began to distil, air was blown up through it. For some time, as is usual, in the distillation of sea-water, no spirit of salt arose ; but after distilling some time longer, there were very weak whitish clouds, with drops of solution of silver in aqua-fortis, as in the common way of distilling. Hence we see, that ventilation does not increase the quantity of salt, but rather probably somewhat decreases it, for the reasons given, N^o 24.

27. I distilled three gallons of sea-water, which had stunk, and became sweet again ; when about ten quarts of it had been distilled off, then there began to be very weak whitish clouds with solution of silver, but none with solution of mercury ; which shews the water to be hitherto good, agreeably to what I formerly had found to be the good effect of distilling sea-water, which had putrified, and become sweet again ; of which I published an account in the year 1739. But when I continued the distillation on, a quarter of an hour longer, *viz.* till there was but a pint of water remaining in the still, and the salts were incruited on its sides, up near three inches from the bottom, and lay in heaps at the bottom of the still, then the distilled liquor had whitish clouds in it, with the solution of mercury in aqua-fortis. From this distillation we see, that putrefaction, by dissolving the bittern salt and bitumen, into very minute parts, qualified them to combine with the more fixed common salt, so as to detain them from rising in distillation.

28. I distilled three gallons of sea-water, with the proportion of six ounces of Mr. Appleby's lapis infernalis,

fernalis, and fix ounces of calcined bones to twenty gallons of sea-water, as he directs. This water lathered well with soap, and boiled peas well.

29. I distilled also some sea-water with half an ounce of stone-lime to a gallon, from the Clee hills in Herefordshire, which having been preserved ten months in a firkin, had flacked to dry powder. This distilled water did also lather well with soap, and boiled peas well; which proves that the lime, which is a fixed body, does not distil over with the water. Since I made this distillation, General Oglethorpe informed me, that his father, Sir Theophilus, told him, that lime was one of the ingredients, which he and the rest of the patentees, in Charles the second's time, called the cement, with which they made distilled sea-water wholesome.

30. I distilled also some sea-water with the like proportion of powdered chalk, which boiled peas well, and was better tasted than the waters distilled with lapis infernalis, or lime. I distilled also some sea-water with an ounce of chalk to a gallon, but found no difference in the taste of this, and that which had but half an ounce of chalk to a gallon: So that half an ounce of chalk to a gallon of water will be sufficient; but where the sea-water is saltier, or more bituminous, more chalk may be added if needful.

31. Dr. Alston, of Edinburgh, in the preface to the second edition of his *Dissertation on Quick-lime and Lime-water*, says, That “ the like effect was
“ found in distilling sea-water with lime, that it
“ neither precipitated a solution of silver in aqua-
“ fortis, nor a solution of corrosive sublimate in wa-
“ ter,

“ter, nor did it form a pellicle of various colours
 “on its surface, as did the water distilled by Mr.
 “Appleby’s process”. And I find, page 35, of my
 book on this subject, that lime of oyster-shells had
 the same good effect, but required two distillations;
 I might then use too small a quantity of that lime.
 Hence it is probable, that the chalk, the lime, the
 lime in the lapis infernalis, and the lime in Dr. But-
 ler’s soap-lees, seize on and fix not only the bittern
 salt, but also the bitumen of the sea-water, as we
 learn from the like effect in the purification of the
 salt of hartshorn. That the saline spirit arises chiefly
 from the bittern salt, and not from the more perfect
 sea-salt, is probable from hence, *viz.* When I di-
 stilled three gallons of common water, made as salt
 as sea-water with common salt; no spirit of salt
 arose, even though the distillation was carried so far
 as to leave the salt, though very damp, to lie in
 heaps, and it was incruited on the sides of the still,
 for about three inches from the bottom.

32. It is a considerable further advantage, that
 water thus distilled by ventilation, being thereby re-
 plete and freshened with air, has for present use a
 more agreeable taste than water distilled without ven-
 tilation, which requires the standing a longer time
 to have its more disagreeable adust taste go off. And
 as the volatile oil of pepper-mint does arise on the
 wings of the ventilating air during the distillation;
 so also may that part of the bitumen, which is vola-
 tilized by heat; as also the volatile urinous salts of
 the sea-water, which arise from animal substances,
 be sublimed in the same manner.

33. It was observable, that the water distilled fast, even though the water in the still was below the surface of the tin air-box, through which the greatest part of the ascending shower of air rushed. Hence the ventilating air, in ascending among the vapours, carries them off fast. Hence it is to be suspected, that this method of ventilation will not do well for simple waters, or fermented vinous spirits; because they being very volatile, much of them may be carried off in waste.

34. It was observable, that in these distillations of sea-water, no whitish clouds appeared on dropping in solution of corrosive mercury, not even when considerably more than four parts in five of the water had been distilled over. And it was the same with the mixture of lapis infernalis, lime, and chalk; whence it is probable, that the lime and chalk seize on and fix the more volatile bitter salt, as does also the lime in the lapis infernalis. And it is well known, that sugar, that sweet salt, cannot be made without lime, on which, as its centre of union, it fixes and granulates.

35. And whereas with a solution of silver in aqua-fortis, which was much weakened and diluted with water, there appeared a faint degree of whitish cloud, in all the above-mentioned distillations, though not with the stronger solution of mercury, till the distillation was carried on, much beyond four parts in five of the water in the still; when both solutions caused remarkably white clouds, especially the solution of mercury; which indicates the quantity of the spirit of salt which was raised during the former part of the distillation to be exceeding small, since it could

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not seize on, nor disengage the aqua-fortis from the stronger solution of mercury, though it did in a very small degree in the weak solution of silver, so as to let loose a very little of the silver, which thereby caused the faint clouds. When a drop of the solution of mercury was dropped into the distilled water, after a drop of the solution of silver, it resorbed the silver cloud, and made the water clear, by means of the great proportion of acid aqua-fortis that was in it.

36. Now in order to make some estimate of the very small quantity of spirit of salt in these several distilled waters, I dropped a drop of the solution of silver into an ounce, or 480 grains of pure rain water, which gave no clouds; but on dropping in a drop of sea-water, which weighed a grain, the white clouds were strong. And since sea-water can dissolve nine times more salt than it has in it; therefore, supposing the drop to be so fully impregnated with salt, then the salt would be the 480th part of the ounce of water. But as there is nine times less salt, therefore the proportion of the quantity of spirit of salt will be but the 4320th part. And how much less must be the proportion of salt in these distilled waters, which is not sufficient to make a sensible impression on solution of mercury, and but a faint one on much diluted solution of silver? Such distilled sea-water will not therefore probably be unwholesome; almost all spring-waters have some degree of salt in them: But if there were more of the spirit of salt, a very small quantity of pot-ash, or pearl-ashes, or salt of tartar, combined with it, will turn it into common salt, the quantity of which would be extremely little.

37. It may be well to be provided in ships with some silver dissolved in aqua-fortis, mixed with pure rain-water, or distilled fresh water, in the proportion of sixty drops to an ounce of the water: though it is probable it may seldom be wanted, unless in some doubtful cases, when the taste may not be accurate enough to perceive, whether there be any spirit of salt in the distilled water.

38. Since double the usual quantity of vapour may by way of ventilation be carried off, common salt may thus be made much sooner, cheaper, and better; because, as there is much less fire used, so proportionably, less of the fine acid spirit of the salt, in which its virtue consists, will be evaporated away: For it is well known, that the salt is best, which has undergone the least action of fire in making.

39. This more speedy method of evaporating will also be useful, in making many other evaporations; as in making pot-ash, &c.

40. But some are apprehensive, that this great improvement in distilling may be of ill consequence in making those destructive spirits cheaper, which are already but too cheap. Had not the improvement been of great benefit to mankind in many other respects, I should have been far, very far, from endeavouring after it, or discovering it. But should the event be to make those spirits cheaper, and consequently, by spreading farther, more destructive, the consequence of that will be, that the increased raging devastation will the sooner necessarily rouse the nations to put a stop to what must be done hereafter: for if the ravages continue increasing, as they have done for sixty years past, the human
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man species must needs not only be greatly debased, but even in great measure diminished and destroyed. And yet none of the nations, whose very vitals are thereby consuming and destroying, endeavour to put any stop to it, except the heads of the native Indians in North-America, who have long repeatedly intreated the English to sell them no rum; which is as effectually extirpating of them, as the hornet did the unsubdued remainder of the Canaanites.

41. If mankind, instead of receiving and entertaining this pest with almost universal applause and approbation, could prevail with themselves to be in earnest, to use means to deliver themselves from it, then much might be done towards it, by lowering and weakening all kind of fermented distilled spirits with water, to a salutary degree, as is now practised in our plantations in America, in making punch so weak, as not to be hurtful; which, when it was much stronger, was well known to destroy multitudes. And where the like humane, wise, and laudable practice has been used in ships, it has had the same happy salutary effect.

42. What necessity or even temptation can there be to be averse to the making them wholesome, instead of being venomous and destructive? and that not only of the lives, but even of the morals of mankind. How much therefore does it behove all, who have any concern for the honour and dignity of their own kindred species, any indignation at its being thus debased and disgraced, any bowels of pity for the vast multitudes, not less than a million, that are yearly destroyed all over the world, by this moral as well as natural, and therefore worst of all evils

that ever befel unhappy man, to use their utmost endeavours to deliver mankind from this pest? But notwithstanding this astonishing ravage and destruction of the human species, yet the unhappy unrelenting nations of the world seem as unconcerned about it, as if only so many thousands, nay, millions of caterpillars or locusts were destroyed thereby. Was there ever a more important occasion to rouse the indignation of mankind? Can we be calm and undisturbed, when this mighty destroyer rears up its invenomed head every-where? The most zealous advocates for drams, even the unhappy besotted dramists themselves, the prolonging of whose lives, and whose real welfare both here and hereafter is hereby sincerely intended, cannot find fault with this well-meant remonstrance, in defence of them, and of all mankind, against this mighty destroyer, from one, who has long been labouring, and that not without success, in finding means to preserve multitudes of lives, by various ways.

LV. *An Account of the great Benefit of Ventilators in many Instances, in preserving the Health and Lives of People, in Slave and other Transport Ships.* By Stephen Hales, D. D. F. R. S.

Read Dec. 18, 43. ^{1755.} **I**T is to be hoped, that the several means here proposed for having fresh and sweet water at sea, will be of great benefit in preserving the health and lives of multitudes of that valuable