XII.—MEMORANDA OF METHODS EMPLOYED BY FISHERMEN FOR "BARKING" AND IN OTHER WAYS PRESERVING NETS AND SAILS.

By F. H. Storer.

Seafarers are familiar with the fact that upon several foggy coasts, notably those of Scotland and of the islands north of it, as well as the coasts of Cornwall, Nova Scotia, New Brunswick, and Newfoundland, the fishermen habitually tan or "bark," as the saying is, the sails of their boats, and their nets also, in order to protect them from rot and mildew. That is to say, they are accustomed to stain the sails a dingy reddish brown color by means of materials containing tannin, such as are employed in the ordinary process of tanning leather.

The process is manifestly an old one, and references to it may be found very early in the works relating to technology. But the methods employed seem to be to the last degree empirical in most localities, and the subject appears never to have received proper attention either from professional dyers or from scientific men. It is regrettable that the systematic works on dyeing, occupied as they have been with the practical and æsthetic side of the art, have hitherto paid little heed to the rough domestic processes which are of special historic interest. It is high time that these rough and often imperfect processes should be recorded and studied, both from the scientific and archæological points of view.

In seeking for what I might find printed concerning the tanning of sails I have come across several items which seem to be worthy of publication, as bearing upon the early history of the art of dyeing. I am the more especially impelled to print these notes, since no chemist, in so far as I am aware, has ever seriously considered the methods of coloring that are employed by the fishermen. Indeed, these processes have seldom been alluded to by chemists of late years. The common notion of deep-water sailors that the canvas to be stained is simply soaked in tan-pits, as hides are in the process of making leather, seems at first sight hardly probable in view of the depth of the color imparted to the sails in some localities, and of the well-known difficulty of dyeing strong, fast colors upon either linen or cotton except with the aid of mordants. Nevertheless, it appears that the sailors are very nearly right in their supposition, and that simple dipping of the sails in this sense, or, rather, boiling them in tan liquor, is a very general practice. Most of the references which I have found in books relate to it. Thus,

in William Lewis's "Philosophical Commerce of the Arts," London, 1763, **2**, 429, it is stated that fishing nets receive a pretty durable stain from soaking in astringents. Chomel's "Dictionnaire œconomique," Paris, 1767, **2**, 88, directs that nets may be colored by boiling them in tan liquor, or in a decoction of the bark of walnut roots; or the net may be rubbed with celandine or young wheat when a yellow or green color is wanted. So, too, in Chambers's Cyclopædia, Dublin, 1782, vol. 3, article Net (in Fowling). Similar directions will be found in several of the earlier dictionaries of rural affairs, and in many old books relating to country sports, such as hunting and fishing. In the "Dictionnaire de Marine," by Willaumez, Paris, 1825, p. 547, it is said that French fishermen soak their sails in a decoction of oak bark and red ochre to preserve them. James Anderson, in his "Account of the Hebrides and West Coast of Scotland," Edinburgh, 1785, pp. 336, 344, says that nets and sails are there tanned by simply soaking them in hot tan liquor from oak bark. The Encyclopædia Britannica, article Net, p. 105 of the edition of 1842, says the most usual color given to nets is the russet, which is obtained by plunging the net into a tanner's pit and letting it lie there till it be sufficiently tinged; this is of a double service to the net, since it preserves the thread as well as alters the color. Good, in Dingler's Polytechnisches Journal, 1820, **2**, 162, explains how he tans nets and sails by boiling them in tan liquor; and the same account is given in C. Mackenzie's "One Thousand Experiments in Chemistry," London, 1821, p. 508.. Millett, Polytechnisches Centrallblatt, 1847, p. 1285, cited in Elsner's Mittheilungen, **1**, 124, says fishermen merely soak their nets in hot tan liquor. He himself put some linen thus treated in a damp cellar and kept it for years. Wimmer, Dingler's Polytechnisches Journal, **121**, 372, repeated Millett's experiment with success. H. de la Blanchère, in his "Nouveau Dictionnaire général des Pèches," Paris, 1868, p. 763, says nets are tanned to hinder them from rotting. A quantity of ground oak bark is boiled for a couple of hours in rain water, and the still boiling liquor is poured upon the dry clean net, which has been placed in a tub. The net is well kneaded in the liquor and turned several times during the day. It is then left to soak during thirty-six or forty hours; finally it is withdrawn from the liquor and dried. The operation is repeated once a year. It has become more and more common to use catechu for tanning sea nets, and to-day most of them are preserved with this material. Being much richer in tannin than oak bark, it tans the nets more strongly and preserves them better. The operation is performed in the same way by means of hot water saturated with catechu, often admixed with oak bark to lower the price a little. The tanning of lines, also, especially for sea fishing, is an important operation, both because they last longer and because they are less visible. A dead-leaf color is obtained by chopping walnut bark or oak bark fine and boiling the fragments one hour in water. The lines are placed in the vessel among the bark and left to soak twenty-four

hours. They are then taken out, wrung, and dried. Catechu may be substituted for the bark; it acts quicker and gives a more solid color. A dirty orange color is obtained by collecting a quantity of the plant *Chelidonium Majus* in the fields and simply rubbing the lines with the green plant, so that they may be impregnated with the juice. The lines are then dried and the process is complete. A green color is obtained from young wheat plants chopped and pounded and boiled. The lines are soaked in the liquor twenty-four hours. In addition to the foregoing, Walton is credited by de la Blanchère with a method of dyeing lines with walnut leaves, beer, and alum.

I have myself made numerous inquiries of people likely to know something about the subject, and I am greatly obliged to many persons for the information they have given me and the pains they have taken to procure information. The well-known ichthyologist, Capt. Nath. E. Atwood, of Provincetown, in particular, put me in personal communication with fishermen from Nova Scotia, who in their own country had been accustomed from early youth to the barking of nets and sails. The accounts given by these men were explicit and concordant, to the effect that the bark of fir and spruce trees was collected in the woods and boiled thoroughly in water. The nets having been placed in tubs, the tan liquor was poured over them, the bark being thrown on top, and the nets were left to soak in the liquor during twenty-four hours. This operation was usually performed once a week, the common plan being to put the nets in soak Saturday night and leave them soaking over Sunday. These Nova Scotians were emphatic that nothing whatsoever was mixed with the tan liquor, or put upon the sails in conjunction with the tan. On the contrary, it was customary, they said, to use new sails in the boats for a short time before coloring them, in order that any grease or starch in or upon the sails might be washed out by rains and worked out by use. So too, the small amount of oily matter which is habitually put upon flax to make the fibers work more easily in the process of manufacturing it into cloth is always washed out with soap and water before the twine or canvas comes to be subjected to the tanning process. They state that when the nets are in use the color soon washes out of them, and that the process has to be frequently repeated on this account. In their eyes, the purpose of the tan liquor seemed to be rather to "kill the slime" which is left upon the nets when fish are captured than to permanently protect the twine from putrefactive influences. They said the same process was used for sails as for nets, only the sails were not soaked so often; they were dried after soaking. Immediately after dipping the sails were very dark, but the color gradually washed out of them. Nothing was ever added to fix the color, or, as one of my informants put it, "to set the tan." This same man stated that in the domestic economy of his locality the dyeing of linen articles was habitually practiced, and that his people were accustomed to use copperas and alum to set a variety of colors on household goods.

It may here be said that the use of copperas for dyeing fast blacks and browns of various shades as well as drabs and slate color, on cotton and linen by means of decoctions of different barks, husks, and leaves (such as those of the walnut, oak, maple, alder, beech, sumach, willow, pine, etc.), is common in American households, from Nova Scotia to Florida, as I am assured by several friends, and as has frequently been published (compare, for example, Dr. F. R. Porcher's "Resources of the Southern Fields and Forests," Charleston, 1869, pp. 215–217). The traditional "butternut" garments accredited to the Southern soldiers during the war are said to have been dyed in this way. Porcher (p. 215) says: "Those who cannot obtain copperas use the water from one of the mineral springs, which is strongly impregnated with iron." On pages 217 and 241 he urges that "vinegar and rusty iron will often fix colors without the aid of copperas"; and again, on page 302, he says, that "blacksmith's dust may be used in place of copperas." Others have suggested that in default of copperas, the mere act of boiling the cotton and the dye-stuff in an iron pot, preferably a clean one (*i. e.*, new and free from grease), may help to fix the color; and it is not impossible that the influence of iron dissolved from the pot by acids in the dye-stuff may have been felt to a certain extent in this sense, in some cases to be alluded to directly, where fast colors are said to have been obtained by means of barks without using any mordant; besides copperas, alum and blue vitriol are freely used in this country for various purposes in domestic dyeing.

Of late years catechu seems to have superseded bark in many localities. It is now freely used by fishermen both in Europe and America. I have myself known of boatmen occasionally soaking their mooring painters in a solution of it, to preserve them from decay, and I have seen simple catechu applied to the sails of boats also, to preserve them from mildew. It was thought to serve a good purpose, though, unless pains are taken to turn the sail frequently while it is drying, *i. e.*, while the catechu is undergoing oxidation, one side of the sail will be darker than the other.

J. G. Nall[1] says herring nets are usually made of a strong two-thread hempen twine, which undergoes a process of tanning in cutch, *i. e.*, catechu, a solution of which gives the twine a brown hue. In the autumn, the surface of the Yarmouth Denes, covered over with nets spread out to dry, has the appearance of a tan-pit. Oak and ash bark were formerly employed. Care has to be taken not to over-tan the nets, the meshes of which would become contracted and too much hardened. The nets are tanned in the beginning to preserve them from rotting, and the process is repeated at the close of the fishery in order to cleanse them thoroughly. A mackerel net will outlast several herring nets. They are neither exposed to the havoc created by the dogfish, nor to the grease

[1] "Great Yarmouth," &c., London, 1866, pp. 290, 291, 293.

with which the nets are saturated from the herrings, and which rots them rapidly unless they are continually cleaned.

On inquiry at one of the largest manufacturers of nets in Boston, I found, as was naturally to be expected, that the net makers use catechu in a very different way from the fishermen; that is to say, they fix it methodically with bichromate of potash as would be done at a dye-house in the case of any other cotton or linen goods. By the manufacturers, the nets are steeped in a hot aqueous solution of catechu, and then treated to a bath of the bichromate, whereby the color is oxidized, darkened, and "fastened" to the twine in the manner familiar to dyers. It is a process that has to be managed with care lest the netting should be weakened. Extract of hemlock bark, they told me, might be used instead of catechu, but it would cost more. It is only the lighter nets, such as herring nets, that are stained with catechu in Boston. The heavier nets are tarred; and, according to my informant, his firm tar many more nets than they tan. It did not appear that tar and catechu are used together by the Boston dealers, as they are in some places.

It is a fact well known to dyers that linen and cotton can be stained, after a fashion, by the use of tanning materials even when no mordant is present. Bancroft[1] says: "There is a species of coloring matter diffused in greater or lesser proportions through the barks and other parts of almost all trees and shrubs, and which, without any basis or mordant, permanently dyes or stains wool, silk, cotton, and linen, of that particular kind of color which the French call *fauve* (fawn color), and sometimes *couleur de racine ou de noisette* (root or hazel nut color). * * * It is found most abundantly in the peelings, rinds, or husks of walnuts, in the roots of walnut trees, in alder bark, etc.; and it seems to acquire both body and permanency by attracting and combining with pure air." Domestic processes of dyeing cotton, in this sense, by simply soaking in tan liquor and ageing, are sometimes mentioned in the agricultural newspapers.[2] But in spite of this familiar knowledge, it would still be remarkable if so dark and so durable a color as is actually seen on the sails in some regions had been imparted to them by merely soaking or boiling the canvas in tan liquor. As bearing upon this point, I may cite the following sufficiently explicit statement from a very old authority.[3] For the sake of enforcing the contrast between cotton and wool the author premises that "vegetable filaments, and thread and cloth prepared from them, differ remarkably from wool, hair, silk, and other animal productions, * * * in their disposition to imbibe coloring matters." And in illustration of the fact, a special instance is noted, as follows:

"Fishing nets are usually boiled with oak bark or other like astringents, which render them more lasting. Those made of flax receive from

[1] "Philosophy of Permanent Colors," 1, 227, of the Philadelphia edition of 1814.

[2] See, for example, The Rural New Yorker, January 31, 1880, p. 80, and May 14, 1881, p. 327; also, The Cultivator and Country Gentleman (Albany), 1880, **45**, 431.

[3] The chemical works of Casper Neumann, abridged by Wm. Lewis, London, 1759, p. 429 note.

this decoction a brownish color, which, by the repeated alternations of water and air, is in a little time discharged, whilst the fine glossy brown communicated by the same means to silken nets permanently resists both the air and the water, and stands as long as the animal filaments themselves."

Tannin of one kind or another is actually employed by dyers, not so much, perhaps, for the sake of the color it imparts by itself, as that it serves as a mordant to fix colors on cotton and flax, which could not otherwise be so well employed on these kinds of fibers. Crace Calvert,[1] for example, says of sumac that it is largely used in Yorkshire to mordant the cotton warps of mixed goods. By means of it the cotton takes the same colors as the woolen weft with vegetable dye-stuffs and with aniline colors. But it is particularly under the influence of weak alkalies that the tannins combine with vegetable fibers, and that they absorb oxygen, turn brown, and become fixed upon the cloth. As Calvert has said, on p. 311 of the work just cited, all the tannins are remarkable for the avidity with which they absorb oxygen in presence of alkalies, being converted into bodies of various colors, green, red, brown, and black.

I find, on investigation, that methods of dyeing depending on the action of alkalies upon tannin have long been in familiar domestic use in this country; the bark of the maple, alder, chestnut, walnut, and butternut, and doubtless of other trees, being used in different localities, as well as the husks of several kinds of nuts. For example, L. Stanley, of Maine,[2] directs: "To color brown, make a dye of common alder bark. First dip the articles in this, then wring them out and dip them into weak lye. This will make the color light or dark, according to the strength of the alder dye. It is a fast color." In the American Agriculturist for January, 1869, two or three receipts for dyeing tan-color are given. In general, the directions are to boil black-walnut hulls to a strong liquor, into which either cotton or woolen yarn may be put and boiled for ten minutes. The yarn is then taken out and dipped in a pail of strong lime-water, and the operation repeated until the color suits; or, instead of the hulls, chestnut or walnut bark may be used, or extract of hemlock bark.[3] According to Porcher,[4] "the inner bark of the short-leaved pine (*P. tæda*) will dye cotton goods a brown color without the aid of copperas. After boiling in the solution, dip in strong lye." I have heard of alder bark and soft soap being used in domestic dyeing in Nova Scotia for coloring linen tan-color; and it is plain that the soap would exert an alkaline action in this case, even if it served no other purpose. It appears from all this that while tan liquor alone is undoubtedly used in some localities for staining canvas and twine, there are

[1] "Dyeing and Calico Printing," Manchester, 1876, p. 326.

[2] American Agriculturist, February, 1867, **26**, 48.

[3] American Agriculturist, November, 1868, p. 401.

[4] "Resources of the Southern Fields and Forests," p. 585; cf. pp. 215 and 217.

other places where the people are familiar with a true process of dyeing, dependent upon the use of alkalies in conjunction with decoctions of astringent barks. As will be seen directly, I have discovered one locality where the last-named system is said to be applied to the coloring of sails and nets.

After having been for forty years accustomed to the sight of tanned sails, and familiar with the sailor's belief that they are simply tanned as leather is, but without ever having been thrown into intimate contact with people who use tanned sails, I had the curiosity in the summer of 1882 to ask a very intelligent fisherman on the New Brunswick coast how his comrades colored their sails, and was not a little surprised on being told of processes which, when chemically considered, mark a distinct advance on the traditional system of simple soaking in tan liquor. The New Brunswicker told me that his people boil the bark of spruce or fir trees in water for many hours, and finally decant the cooled liquor into a tub, where it is mixed with soft soap or with saleratus, and the sail (either hemp or cotton) is put to soak in the mixture for a couple of days. He maintained that sails thus tanned last two years longer than those not tanned, while for nets the process is deemed to be well-nigh indispensable. On my asking whether they didn't use oil with the saleratus, he answered that they did; and it was this reference to the use of oil and alkali which excited my interest in the subject, and led me to search for testimony which should corroborate his statement. It is evident from what has gone before, that in so far as relates to the use of alkalies with the tan liquor, the statements of the New Brunswick fisherman are fully supported. I have found evidence that both "lye" and soft soap are familiarly used as adjuncts to dyeing with barks, and it is well known that the conjoined use of tannin and alkali is an approved mode of operating which has long been habitual, in one form or another, in dye-houses. I have been assured, moreover, that soft soap is used in some Nova Scotian households in dyeing wool with cudbear, "to set the color and change its shade," which goes to show a practical familiarity with the use of this agent in coloring processes.

It should be explicitly said, perhaps, that I have not the least doubt that my informant was a thoroughly trustworthy person. I fully accept his statements as to the use of saleratus and soap; though of course he may have failed, and probably did fail, to correctly state certain details of the process as to ageing, dipping, and drying; but it will be noticed that in our conversation the word "oil" was first suggested by myself, and there is unquestionably a certain risk that we may have misunderstood one another in respect to this particular item. If oil is really used, as he said it was, in the process of coloring sails, the fact is one of no little interest in its archæological bearings; it would be an important contribution to the history of chemical technology, for, considered merely as a method of dyeing, the process would then be essentially

identical with the famous old East Indian method of fixing a fast red on cotton by means of madder (or its equivalent) and an oil mordant: I mean the color known to the English as Turkey-red, and to the French as *rouge d'Andrinople*. The East Indian process, as described by the earlier investigators, is as follows:

"For dyeing cotton, the Hindoos prepare an imperfect soap from oil, ashes, and animal matters. More precisely, they soak the skeins in a soapy liquor made with goat dung, oil (of stated kinds), and potash lye, obtained by leaching the ashes of certain plants; then they expose the cotton to sun and air for several days, and finally dye it with chay root (equivalent to madder), without applying previously to the cotton any alum or acid or saline matter."[1]

To my own mind, the verisimilitude, or, so to say, the chemical reasonableness, of the story as related to me by the New Brunswick fisherman lent strength to it, and I would have been glad to have found recorded evidence to support it, but as has been seen already, I have practically failed to do so. It is to be noticed, meanwhile, that the soft soap employed by the New Brunswickers would naturally be of home manufacture and incompletely finished. It would be likely to contain of itself much of the emulsion of oil and alkali so useful in Turkey-red dyeing. The probabilities are strong withal that the soap is made from a more or less rancid fish-oil such as Pallas[2] found in use among the Armenian dyers of Turkey-red at Astrachan, and such as in more recent times has been approved an efficient agent by the Turkey-red dyers of Manchester.

In case it should turn out to be true that sails and nets are anywhere colored by means of an oil mordant, it will be of special interest to ascertain how long the process has been in use in the locality, and whence it came thither. It seems highly improbable that the method should have been copied either in America or Great Britain from the Turkey-red dyers, for it is only in recent times, comparatively speaking, that the process of dyeing Turkey-red has been practised by the Western nations. It was not until the middle of the eighteenth century that it was successfully employed in France.[3] Mention is made of it as being employed in 1765 in Great Britain, and it is admitted that the art has been successfully practiced there since 1785.[4] The details of the Turkey-red process, as imported to civilized Europe, were so tedious and complicated, and the scientific explanation of them was so little understood, that there is hardly the least likelihood that any feature of the process could have been transmitted by professional dyers to European and American fishermen or housewives in recent times. The very crudeness of the domestic processes above-mentioned would of it-

[1] Mazeas, Memoires des Savans étrangèrs, 1763, **4**, 15–18.

[2] Cited by Berthollet, Elemens de l'Art de la Teinture, **2**, 161.

[3] Ure, Dict. Arts, **2**, 90.

[4] McPherson's Annals of Commerce, **3**, 433, and **4**, 95.

self indicate that they have not been derived from any modern dye-house. It seems far more probable that the tanning process might have originated in a primitive state of society, where the oil mordant may have been used familiarly, not only for red but for various other colors. It is in evidence that, though comparatively rarely used by the Western nations for fixing other colors than red, the oil mordant is perfectly competent to be used with a variety of other dyes besides madder and its congeners. Laugier[1] has dwelt upon the general applicability of the process for dyeing hemp, flax, and cotton. He finds it particularly applicable for yellows, for instance, as well as for reds. Beautiful shades of purple have been fixed upon cotton cloth by first mordanting with oil, as in the Turkey-red process, and then dyeing with aniline purple.[2] Indeed, the ordinary operation of "galling," employed incidentally in Turkey-red dyeing to strengthen and modify the red color, would be practically a dyeing of the cloth tan-color if it were pushed far enough. It is manifestly closely analogous to the dyeing of sails as described to me by the New Brunswick fisherman. It is known that under the influence of weak alkalies and dampness, galled cloth may absorb oxygen from the air and take on a brown color which is highly undesirable from the point of view of the Turkey-red dyers. Chaptal[3] stated the matter many years since: "The astringent principle of the nut-galls unites with the oil and forms a compound which darkens on drying and is but slightly soluble in water." "It is better to choose a dry time for the process of galling, because damp air blackens the astringent principle. After having been galled, the cotton cloth should be dried promptly, in order to avoid the blackening which would injure the brightness of the red the dyer wishes to obtain." Lewis[4] long ago tried experiments on fixing blacks by means of an oil mordant, using soft soap and following Mazeas's directions. He appears to have obtained a tolerably good fixation, though his colors were not handsome. The oil mordant was formerly sometimes used also for preparing a color known as "Swiss pink."

In some localities fishermen preserve their nets and sails by the combined use of bark (or catechu), tar, and oil (or grease), and the process has specially interested me as possibly having some bearing upon the question of an oil mordant just now discussed. Thus, in the Encyclopædia Britannica, article Fisheries, p. 248 (of the edition of 1879), it is stated that "barking" the sails is a regular practice with the trawlers, as it is with most other fishermen in England and Scotland. The process consists in mopping them over with a composition of a solution of

[1] Dingler's Polytechnisches Journal, **47**, 278.

[2] Watt's Dictionary of Chemistry, **2**, 357; Reports by the Juries: International Exhibition of 1862, Class XXIII, p. 3. It is to be hoped that the yachtsman who may set topsails of this superb color and strive to carry them to the forefront will gain a more worthy renown than did his prototype at Actium.

[3] Memoires de l'Institut (An. VII), **2**, 291, 292.

[4] In his "Philosophical Commerce of the Arts," London, 1763, **2**, 431.

oak bark, tar, grease, and ochre, which acts as a good preservative of the canvas. This is done once in six or eight weeks, and a suitable place is kept for the purpose at all the important fishing stations. Capt. J. W. Collins[1] states that to preserve their nets, the Newfoundland cod fishermen make a mixture of tan and tar, which is thought better than either used separately. The tan is made from spruce buds, fir bark, and birch bark (hemlock bark is not used), which are boiled together until it is sufficiently strong, when the bark is removed and tar added in the proportion of 5 gallons tar to 200 gallons tan, the whole being stirred well together. Some care is necessary in applying this, or else it will not be evenly distributed on the net. The custom of mixing tan and tar has doubtless been introduced from England, as it is known that the Cornish fishermen do this, pouring out their tanning liquor into large vats with coal tar, and this mixture is found to preserve the nets much longer than simple tanning. The Newfoundland nets, when prepared in this manner, generally last about four seasons.

Something similar is done by the Irish fishermen from Galway, a colony of whom have for a number of years been settled here at South Boston. I have received information from three different individuals with regard to the methods employed. The first witness assured a friend of mine that his people use "catechu, grease, and tar, to color their sails." He had, for his own part, forsaken the traditional practice, and "would not himself put such stuff on a white sail." Some time afterward I had an opportunity to talk with an intelligent Galway woman, a domestic in a friend's house. I quote her words: "First they take the clean cloth. Then it is all white. Then they get some kind of oil, I don't know what, and get it all over the cloth, and then they hang it up to dry for a long while—a week or two weeks—and then the cloth is yellow, and then they put the oil on it again, and hang it up to dry again—and I don't know what they do after that." I was careful not to ask any leading question, and made no effort to help on the story. She knew very well that the sails were almost black finally, but could not tell what made them black. Still later this same woman obtained the following account from the mouth of an old Galway fisherman. Take 3 gallons of tar and 20 pounds of fresh butter. Melt the butter in a vessel, and add to it a cup of salt. If salt butter were used there would be no need of the salt. Heat the tar almost to boiling in another vessel, and slowly add to it the butter, constantly stirring meanwhile. When the two are thoroughly combined the mixture is applied to the sailcloth by the hands of the fishermen; generally six fishermen on each side of the sail. The rubbing-in by hand is deemed to be all-important, and it is commonly done in the early morning of a fine day, and the sail exposed to the sun, in order that the mixture may be dried in. In good sunshiny weather the drying process is completed by sundown. At the end of a week another coating is given in the same manner, and after a couple of days

[1] Bulletin of the U. S. Fish Commission, 1881, p. 7.

the sail is fit for use. The quantity of tar and butter above given is sufficient for one of their fishing boats, which are some 6 or 8 tons burden. Great importance is attached both to the rubbing-in and the drying. In connection with these stories I could but recall the fact that the old French name of tarred cloth was *toile grasse.*

In this category may be mentioned the Dutch method of tanning cotton herring nets, as described by Captain Collins,[1] and stated by him to be "thought better than any other by these foreign fishermen." The tan is made by boiling catechu in water, in the proportion of 1 pound of the former to 2½ gallons of the latter. When it is sufficiently strong the nets are soaked in it twenty-four hours and then dried. They are tanned and dried three times, and then soaked in linseed oil. A pound of oil is provided for each pound of net, and the nets are allowed to remain in the oil as long as any of it will be absorbed. They are then well drained and spread on the ground to dry, after which the process is completed by tanning them once more. Nall[2] says a strong three-twist cotton cord procured from Musselburgh has lately been introduced as an experiment. It is prepared by steeping in a mixture of linseed oil and varnish, and is then squeezed through rollers. This renders it stiff and smooth as wire when dried. It is afterwards subjected to the tanning process. In addition to hempen twine, a coarse Persian silk was employed in the netting used in the Dutch fisheries of the seventeenth century, as more durable. It was slightly pitched or exposed to the smoke of burning ash to acquire a dark color and render it less perceptible by the fish.

There is a process of varnishing the silken lines used by pleasure fishermen for the purpose of keeping them dry and reelable that differs from the foregoing. As described by de la Blanchère, in his Dictionary, page 765, the lines may either be boiled in a drying oil, or, better, a small quantity of drying oil with which some white and green paint has been mixed may be carefully rubbed upon and into the stretched line. A second coating of the varnish is laid on when the first has become dry, and the operation is repeated at intervals until the wished-for stiffness and impermeability have been obtained. De la Blanchère remarks, also, that nets are sometimes treated with tars obtained from coal, and that the fishermen commend coal tar for this purpose in certain cases, in spite of the black color and the penetrating odor it imparts to the nets. John M. Mitchell[3] reports that Irish nets are most frequently tarred instead of being barked. Tarred nets, he says, are not so durable; in direct opposition to which statement I found a strong feeling at Provincetown in favor of tar, as being a much better preservative of nets than tan. Captain Atwood was decidedly of this opinion. Until the war of the rebellion his townspeople were accustomed to use pine

[1] Bulletin of U. S. Fish Commission, 1881, p. 8.

[2] In his "Great Yarmouth," &c., London, 1866, p. 291, and 290 note.

[3] In his book "The Herring," Edinburgh, 1864, p. 99.

tar from the South; it was only when their supply of the material was cut off that they began to use coal tar.[1] One of the Nova Scotian fishermen with whom I talked about tanning nets laid a good deal of stress on the large amount of "gum" there was in the fir bark employed. Both he and Captain Atwood seemed to believe that this resinous matter played an important part in preserving the nets. The Boston manufacturer of nets previously alluded to said that his firm formerly used Wilmington tar, but now they used coal tar altogether. He urged that tar makes the net stronger; that it makes the twine more like wire; that it hardens the fibers and keeps them together so that the twine does not fray. He had heard of tar and oil being used together, linseed oil he supposed, and thought the purpose of the oil might be to soften the tar. He remarked on having no facilities for drying (ageing) the tarred nets in his Boston warehouse, and dwelt upon the fact that freshly tarred nets are liable to "heat" and spoil. To prevent them from suffering injury in this way it is customary to soak them in brine. Moreover, when tarred nets are done up into bales salt is scattered upon each layer of netting to hinder the package from heating. It appears that it is now customary with the fishermen on the New England coast to regularly salt down their nets when they are stowed away at the end of the fishing season. In warm weather also the mackerel fishermen are at pains to strew salt upon their nets, layer by layer, when they stow them, even for brief periods, in the seine boats; the idea being, of course, in this case to check the putrefaction of the slime and gurry with which the nets are soiled.[2]

As to other methods of protecting sails from mildew, I learn that burnettizing (*i. e.*, the use of a dilute aqueous solution of chloride of zinc) is sometimes practiced in this vicinity. I was assured by the captain of a sea-going schooner that once when a suit of his vessel's sails seemed ruined with mildew he had them dipped, with the result that they came out white and clean, and wore well for three years. One practice is to spread out the sails of small vessels on a beach and wash them over with a mixture of whitewash and brine. Some people appear to use plain whitewash. An objection is urged, however, to the use of lime that it tends to rot the canvas, and there is probably some risk that in

[1] It is noticeable that our fishermen habitually put an extra allowance of tar on cordage that is to be kept under water. The cables of Bank fishermen, whether made of hemp or of manilla hemp, are commonly thoroughly tarred, and so are the buoy ropes of lobster pots and of sunken moorings.

[2] The modicum of the truth in the old conception that "putrescent bodies exert an action on complex organizations which by themselves are not putrescent," is well illustrated by a case like this. A parcel of microdemes having established a satisfactory residence upon the animal matter with which a net is soiled, soon find the cellulose of the twine a useful addition to their food. It serves in some sort as a diluent of the highly nitrogenized ration which the slime supplies. In other words, some of the constituents of the cellulose of the fiber are involved in the reactions which occur during the fermentation, and the integrity of the twine suffers accordingly.

seeking to destroy the mildew fungus with alkalies, the growth of forms favorable for putrefaction may be promoted. To quote from Duclaux:[1]

"Acid liquids are in general more favorable to molds, to yeasts, and to mycoderms; it is only very exceptionally and only *en passant* that mobile forms are found in them, *i. e.*, vibrios, bacteria, or monads. These kinds appear, on the contrary, by preference, in neutral or alkaline liquids, where the molds for their part have much trouble to live. The mold Aspergillus, for example, grows freely on bread moistened with vinegar, on the juice of lemon or slices of lemon, and on sour fruits and liquors."

I find a common impression that the sizing in new canvas attracts mildew, *i. e.*, that the mildew fungus finds a fit field for its support in the sizing which has been introduced into the interstices of the canvas at the factory. To avoid this difficulty some owners of vessels prefer to bend their new sails in the autumn in order that the sizing may be "worked out" of the canvas by the autumn and winter rains, at a time, that is to say, when the weather is too cold for mildew to prosper. Old sails are said to be comparatively exempt from mildew. The time-honored and universal custom of shaking out or hoisting sails in order that they may dry after rain is one familiar method of preservation. It is precisely because drying is frequently impracticable in some climates that the tanning process is practised.

It would be well to study practically whether the method of permanently dyeing sails, either with the aid of an alkali or by means of an oil mordant, is really an effective means of shielding the canvas from the mildew fungus; and it would be of interest to determine whether the altered and oxidized oil that constitutes the mordant in Turkey-red dyeing might not of itself help to preserve sails, even if no tanning or other coloring substance were combined with it. This last question could perhaps be answered at once, even now, by persons who have had experience with the use of Turkey-red cloths in damp situations. It is not unfair to suppose that the oil mordant might be useful of itself, since it would probably tend to keep the sails drier than they would be in its absence; and in this way it might be obnoxious to the fungi, which need moisture in order that they may thrive. So too with cordage; it might be questioned whether ropes made from hemp that has been impregnated with the oil mordant (and tannin), instead of with tar, would not be specially serviceable in some cases.

NOTE.—Since the foregoing article was written, several friends have described to me a method of coloring sails, practised in the vicinity of Venice, which differs essentially, both as to motive and procedure, from the processes of tanning and tarring above described. It appears that, far from dyeing or tanning their canvas, the fishermen at Chioggia merely mix earthy pigments, such as burnt sienna and yellow ochre,

[1] E. Duclaux, "Ferments et Maladies," Paris, 1882, pp. 43, 45, 50.

with salt water; rub the mixture upon their sails with a sponge, and let the coating dry in the sun. That is to say, they paint the sails with water colors, and as soon as the paint wears thin they smear on a new coating of it.

Apparently, the purpose of this application, nowadays, is purely decorative. At all events, the practise calls to mind certain historical instances, such as the purple sail of Cleopatra's galley, already alluded to; the fact that Alexander had sails of various colors, to distinguish the several divisions of his fleet; and that the English King Henry, in 1416, had a sail of purple silk on his particular ship. But as regards the Italians, it seems not improbable that there may have been some use formerly in making the sails dark-colored, in order the more readily to escape the observation of the pirates which infested the Mediterranean until a comparatively recent date. It is hardly probable that earthy pigments applied in the manner above stated can be of much, if any, use for preserving the sails. On the contrary, the question naturally arises, may not the earths sometimes actually injure the canvas in the same way that iron-rust is known to corrode sails, as well as other vegetable matters, by continually giving up oxygen to them while it takes up new oxygen from the air. I remember to have myself met, many years ago, with American fishermen who were very averse to having any kind of "dirt" get on their sails "because it rotted them."

It has been suggested to me that the Italian fishermen may possibly use the pigments in order to close the pores of the canvas so that the sails may hold the wind better. But if this be so why do they employ a process of application that requires to be frequently repeated? why do they not put on the pigments in such manner that they may stay?—F. H. STORER.

BUSSEY INSTITUTION (OF HARVARD UNIVERSITY),
August, 1883.