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PRESERVATION OF BISCUIT AND OTHER FARINACEOUS
ARTICLES OF DIET FROM WEEVIL, MAGGOTS, AND
OTHER INSECTS IN H.M. NAVY.

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I NEED scarcely say that for a very long period it has been found that the biscuit on board H.M. ships, when in a hot and tropical climate, has been rapidly attacked and destroyed by weevils and maggots, often to such an extent as to render it very repulsive, and quite unfit for human food, sometimes causing large quantities of it to be thrown overboard, or otherwise returned to the victualling yards when the vessel arrives in England.

This damaged and worm-eaten biscuit has usually been sold by auction from time to time, as it has accumulated, for feeding cattle, &c.

After the commencement of the annual sales, about four or five years since, the large *quantity* of biscuit which came to the hammer, as well as the worm-eaten condition in which some of it was found, attracted the special attention of the officials at the Admiralty, and it was considered desirable that some arrangement should be made to prevent so great a sacrifice of the very first-class biscuit, which is regularly manufactured at each of the victualling yards.

Having had the honour of being deputed by the authorities at the Admiralty to attend at these sales, I thought it was possible to stow the biscuit in iron tanks, hermetically closed, in such a manner as to make each tank in the bread-room easy of access; and at the same time to be so closely stowed in the vessel as to carry the full complement of bread for the ship's company as if it had been filled in bags in the usual way.

Having been requested to state the proposed mode of fitting the tanks, a rough sketch showing the form of scuttles for filling and emptying, &c., was forwarded, which obtained the approval of the proper authorities, and it was determined that three *trial*-tanks should be prepared at Deptford Yard (similar to sketch B), which should be filled with biscuit at Deptford, Plymouth, and Gosport Victualling Yards, respectively, and hermetically closed for twelve months, in

order to test the condition of the biscuit after being kept closely confined for the time named.

It may be observed that biscuit had been on several previous occasions put into iron tanks on board ships and in the storerooms at different stations; but, as a rule, it had mildewed and got spoiled, or had become infested with insects, which made some of the persons, who had considerable experience in these matters, somewhat fearful of the satisfactory results of the experiments about to be made; but the tanks formerly used were simply the old water-tanks with the manhole at the top, which necessitated the sending some one into the tank from time to time to get out the bread, which operation is, in itself, very disagreeable to persons eating the bread, while the constant opening and shutting the manhole (see sketch C), which is on the top of the tank, allowed any water falling on the tank to get into it, and the cover not being hermetically closed (and perhaps sometimes left off altogether) allowed the weevil to penetrate, and thus spoil the whole of the bread.

The arrangements of the fittings in the proposed experimental tanks were as follows:—Sketch A shows the upper scuttle for filling, and the

lower one for emptying, closed up and screwed tightly. The upper scuttle turns down to an angle of 45° with side flaps turning up (as shown in sketch B), the biscuit falling naturally out of the mouth of the bag into the tank. The lower scuttle, as will be seen, falls down level, and the biscuit is drawn out with a small rake into bags as required, the whole contents of the tank falling down naturally until most

of the upper part of the tank is emptied, when that at the bottom is drawn out by the rake as before. When about to fill the tank, the bottom scuttle is first screwed home tightly and joint puttied up, like the mode of securing an ordinary pane of glass, and after all the bread is put in, the upper scuttle is closed and hermetically sealed in like manner; and, in taking out the bread, it is only necessary to clean out the putty, turn down the lower lid, and take out what is required, when the lid must be again turned up, screwed home, and re-puttied.

The inside of the tanks is coated over with hot lime-wash, fixed with about three-quarters of a pound of coarse sugar to each gallon of wash, which keeps the lime from coming off and forms a good wholesome coating.

As before stated, the three experimental tanks, when completed, were examined, and approved by the Constructors' Department and Superintendent of Victualling. One of the tanks was retained at Deptford, and the others sent to Devonport and Gosport Victualling Yards, where they were filled with the newest bread that could be obtained, and hermetically closed up (as before described), in the presence of the Officers of the yard, the bread being carefully weighed before being put in, and a record kept of the weight.

The tank at Deptford, as well as the one at Devonport, was filled with biscuit only about two or three days old, but at Gosport the *newest* biscuit in store was several weeks old, which was accordingly put into that tank.

The tanks were filled in the summer of 1871, when the moth and weevil were very plentiful, and the experimental tanks were put into the condemned bread store, where large quantities of infected biscuit were stowed in bags, the weevil, moths, and maggots abounding at that season all over the loft, and crawling in and out of the open pores of the biscuit bags, which were kept stowed there, as it arrived from the ships, in order to await the annual sale.

If therefore (as some parties stated) the weevils, maggots, &c., bred naturally in the biscuit when stowed in closed iron cases at a high temperature, there was every opportunity for their so doing in the tanks during the summer weather, but if (as seems most reasonable) the moths and weevils fly about from place to place, and deposit their numerous eggs in the bags of new bread, they have ample opportunity for so doing, as in the store lofts, where the bags of *new* bread are stowed, the windows are usually open for ventilation, and these insects can fly in or out at pleasure, as they undoubtedly do, and thus corrupt, in a short time, the good bread. This was clearly to be seen in opening the Gosport tank, after the twelve months had expired, for, while the tanks at Deptford and Devonport, when opened, had not the slightest sign of insect life (the biscuit with which they were filled being all fresh baked), that at Gosport, where the bread had been lying in bags for some weeks before being put into the tank, showed very clear indications of maggots having crawled over the biscuit, and several live maggots were found, although they seemed in a weak condition, and had in no instance bored into the biscuit. It was, however, very manifest that, for lack of air, the maggots had

not in any case changed into the chrysalis state, nor were there any moths visible, which shows that there is no danger of further propagation, even if the young maggots are formed, after the tanks are hermetically sealed.

I would also observe that at the time of filling the tanks at the Royal William Victualling Yard, Devonport, I took an opportunity of putting, into large tin cases, some of the weevilly biscuit in which were hundreds of these living insects in different stages of existence, also I took from the windows, where the live weevils were crawling and flying about in large numbers, some scores of them and placed them in among the others, putting in a quantity of sound biscuit for them to subsist on, and then hermetically closed them up; on removing the lid of these tin cases after being closed twelve months, *not one* of the weevils was alive, and it would appear that they had not lived long after being closed up, for the weevilly biscuit showed no signs of being more full of holes than when put into the tin, while the sound biscuit was perfectly free from their ravages, as when first put in, plainly showing that weevils will not live if shut in from the air, so that if new biscuit is slightly affected with weevil, if, at once, it is hermetically closed up, it prevents the further injury of the biscuit. It must, however, be carefully arranged to have the biscuit perfectly dry, and thus ensure its freedom from mildew, which is sure to take place if the bread gets damp from any accidental cause before it gets into the tank, but once in the tank, however damp the external atmosphere from foggy or wet weather, steam, &c., it will be perfectly free from its influence, and come out lighter than when it went in; this was specially manifest in all the experimental tanks, where the bread weighed about *one* per cent. lighter than when it was put in.

I would also remark that in the event of a vessel shipping a sea, or of a fire occurring on board requiring water to be largely thrown about, in the vicinity of the bread rooms, when, from smoke or steam, or both combined, the bread, if stored in bags, would be sure to be spoiled, the tanks would effectually keep it safe from injury, except the fire were so fierce as not to be got under; also, if fire should occur, and only a very short time be available for getting out provisions into the boats, one of the iron cases, or smaller tanks may without ceremony be pitched overboard, or, if time permit, be lowered with a rope, as the cases would swim, and the biscuits be taken out at leisure, or the "cases" may be stowed away in the boats, where it could be kept dry for use, however rough the weather may be.

At the time of the opening of the experimental tanks in the presence of the Officers of the yard, a sample of the biscuit was sent to the Admiralty with an elaborate report, which on the whole was considered to be so satisfactory that it was determined to fit out one vessel of each class with these tanks.

It was, however, afterwards considered that some of the smaller class vessels going out to tropical stations would be the best test, and accordingly the "Dart," 570 tons, was so fitted and sailed to the south-east coast of America, in June, 1872; next came the "Frolic,"

592 tons, composite gun boat, fitted at Chatham, which went to China, on her first commission, early in February, 1873, afterwards the "Amethyst" corvette of 1,405 tons, was so fitted at Devonport; also on her first commission, this vessel went to the south-east coast of America and West Coast of Africa, about August, 1873, and lastly came the "Victor Emanuel," of 3,087 tons, which was fitted at Portsmouth as a hospital ship for the troops, which went out to the Ashantee war, her tanks, 16 in number, contained 20,000 lbs. of biscuit. She sailed for the seat of war on the West Coast of Africa, in November, 1873. Other vessels are now in course of being fitted, viz., "Undaunted," frigate, "Diamond," and "Sapphire," corvettes, also "Juno," and "Wolverine," while other vessels are being considered which are intended for the reliefs on foreign stations during the next year.

Satisfactory reports have been received from each of the vessels, as to the condition of the biscuit. The captains of the ships were directed to forward a detailed account of where it was obtained, the date when each of the tanks was filled, and when emptied, together with the *condition* of the bread on these occasions; the report to be forwarded to their Lordships every six months during the commission.

The first report from Commander Denny, Her Majesty's ship, "Dart," of 22nd May, 1873, after about eleven months' trial, stated "that the biscuit was good, dry, and free from weevil, almost as good "as when put into the tanks." The second report from "Dart," 25th May, 1874, said "that the *service* bread stowed in tanks was very "good. What was obtained from contractor good, *in some cases*, but "in others attacked by mildew, but yet *better* than if kept in bags." I may here observe that the remarks respecting the bread obtained from *contractors* on foreign stations is quite in keeping with the general experience of Officers commanding Her Majesty's ships, respecting the use of this sort of biscuit which is often made of inferior flour, or adulterated with pea-meal, and other deleterious ingredients, added to which it is not dessicated in the very satisfactory manner in which our *service* biscuit is prepared, and hence the great difficulty experienced in preserving this bread; the proposed *remedy* for this will be treated further on.

The first report from Commander Buckle, Her Majesty's ship "Frolic," China station, 30th June, 1873, stated that "the iron cases "keep the bread in excellent preservation and entirely free from damp "and decay, not the slightest sign of maggot or weevil having yet "been observed," but report also stated that tanks fitted with lids for "filling and emptying were best, as the experimental potato cases "were too slight and got broken, and had to be thrown overboard."

The second report from "Frolic," dated 31st December, 1873, stated that these cases keep the biscuit in excellent condition, not the slightest sign of decay or weevil has been discovered in any of the biscuit so protected; biscuit which has been eleven months in the ship is as good as when put on board. Mention is also again made of the slight material of which potato cases were made, advising their being not quite filled in future, in order to prevent their bulging out,

also advising that only *half* the bread-room may be filled with cases. This last recommendation, however, is considered not advisable, as it would necessitate about six weeks stock being put into bags, which is double the quantity that is deemed safe so to dispose of, as the weevil, in two or three weeks, in a tropical climate, has been known to get a large hold on the bags of bread exposed to their ravages. A report was received at the Admiralty from "Amethyst," dated 30th June, 1874, stating that the bread-room fitted with hermetically sealed iron tanks, has answered well, and the bread appears to keep in better condition than when stowed in bags in the ordinary manner. A second report from the "Amethyst," was received after more than twelve months' trial, which stated that "the plan has hitherto answered very well, the biscuit received in England being as good now as when put on board." A remark was also appended, "that the process of filling the tanks occupies more time than stowing bread in the ordinary way." This, of course, must of necessity be the case, but is of little moment compared with the advantages of the ship's company being constantly supplied with perfectly sweet and wholesome bread.

A report from Captain Parkin, Her Majesty's ship "Victor Emanuel," dated Hong Kong, 30th November, 1874, arrived at the Admiralty early in the present year, which said that "the tanks have been most successful in preserving the biscuit, notwithstanding the heat and closeness of the atmosphere at Cape Coast Castle, and the various temperatures passed through during the passage to China, the biscuit came out as fresh and sweet as when received from the victualling yard, and perfectly free from insects. The tanks have been removed from the ship, and will be used for storing bread at Hong Kong Victualling Yard. The reason why the tanks have been removed is, that the vessel is brought near the jetty, and soft bread will be used while she remains in that position."

The Paymaster's report from "Victor Emanuel" is to this effect:—"The biscuit was as fresh and sweet as when received from the victualling yard, not the sign of the weevil or any insects. I consider the tanks an excellent arrangement for preserving the biscuit."

It therefore appears clear that, if biscuit thoroughly desiccated as that is which is so well manufactured in our victualling yards, is put into tanks and hermetically closed, even in the hurried manner in which that was got on board for the Ashantee expedition, it is perfectly safe from harm, either from heat or moisture; as when the joints of the scuttles are puttied, they are quite water-tight as well as air-tight. Bad smells, therefore, arising from exhalations from bilge water, or other causes on board ship, will not affect the biscuit in any way, neither are those pests of a warm climate—the cockroaches—able to get anything to feed on, as they constantly have when the bread is kept in bags, and they are, therefore, far less likely to propagate. And even in our more temperate climate, where the weevil is seldom seen, it would seem very desirable that the bread should be put into tanks, because the ravages of rats and mice in the open bread-room, when the biscuit is stowed in bags, is something very considerable, and causes large quantities of

it to be annually thrown away, to say nothing of the disagreeable idea often pervading the mind, that large numbers of these vermin are running over the bread, leaving their droppings, &c., to the great disgust of those who are obliged to subsist on the biscuit.

In using the tanks, there will also be a great saving in the quantity and cost of bags, which, when stowed in bulk in the bread-room, rot very fast from damp, &c., while the tanks, if painted on the outside once a year, with white enamel paint, will last twenty or thirty years, for the internal coating of lime and sugar effectually prevents rust in that direction.

With regard to the foreign victualling stations, where biscuit is manufactured on the spot, if the climate is tropical and the bread is left in bags for any time after it is fully desiccated, nothing can prevent the weevil and maggot from destroying it, but if put into tanks, of the desired construction, as soon as it is properly desiccated, and then allowed to cool, it may be kept perfectly sweet for years, and can be taken out from the lower scuttle into bags (a few bags of finer texture should, however, be used for this purpose, through the pores of which the weevil could not enter), and the biscuit may then be conveyed on board the ship and immediately put into similar tanks fitted in the bread-room of the ship, and biscuit thus treated will assuredly keep in good condition as long as may be required.

With regard to those foreign stations where the bread is *not* made on the premises, but simply stored, as received from England, I would observe that large quantities of biscuit have been condemned, from time to time, at these places, from the ravages of weevils and maggots, produced from the eggs of the moth. From the valuable report of Mr. Rowsell, Director of Contracts, after personal inspection and from information he obtained on the spot, it appears that at Gibraltar, not long since, 390,000 lbs. of biscuit were condemned in five months, also 19,000 lbs. condemned on board "Hercules."

It has been sometimes customary to send out the biscuit to foreign stations in ordinary water tanks, but they have failed to prevent the maggot from spoiling the bread, because they were not hermetically closed, also casks have been used in many cases, these, from the shrinking of the staves, have either let in the water which happened to fall on them (when all mildewed together) or the weevils being very small, have got in through the joints and destroyed the whole contents, which occurred in the store at Jamaica not long ago, where 27,000 lbs. were condemned as unfit for human food.

To insure success in keeping a stock to meet the wants of the shipping, it will be only necessary to have a good supply of store-tanks (similar to that which has been lately put into the Victualling Yard at Hong Kong, from the "Victor Emanuel," late Hospital ship, specially fitted for Ashantee War); and as to means of transit, the bread can be taken out from England in tanks so constructed as to have shifting lids, the whole size of the top, to be screwed up when filled with bread, and then hermetically closed by using putty in the joint, and afterward pasting over it a strip of calico or Chinese paper. These tanks, which, when full, will contain

20,000 to 30,000 lbs. of bread, can be made to fit into each other when empty, so that about twenty tanks may be brought home again for re-filling, at a mere nominal cost, viz., the tonnage due to the cubic contents of the largest tank, together with the bulk of the covers standing one on the other. The cost, therefore, of returning the "empties," which has been the principal objection to sending the bread out in tanks, or in tin-lined cases, is reduced to a mere trifle, and the cost of sending it out would be more than made up by the entire freedom from condemnations of bread, as heretofore, to say nothing of the comfort and satisfaction of the Officers and crews of Her Majesty's ships, in not having to eat the unwholesome foreign-made bread, nor even to be subject to make use of the otherwise good "service" bread when made loathsome by maggots and weevils.

It should also be observed that the ravages of the weevil in the provision-rooms of Her Majesty's ships, are not altogether confined to the biscuit, for all farinaceous articles of diet, such as flour, oatmeal, pearl-barley, rice, &c., also chocolate, when stored in casks and open cases, are often attacked and destroyed, so that they are condemned and sold at considerable sacrifice; this may be entirely prevented by having the smaller tanks, in which these materials are stored in the issuing room, fitted on a similar principle (although somewhat modified) by having the lower scuttle (which will require opening several times a day), fitted with a strong spring latch to close up tightly on a thin slip of india-rubber, so as not to require to be luted with putty in order to make it air-tight.

I have thus endeavoured shortly to explain the mode which has, to a considerable extent, proved efficacious in preserving the biscuit in Her Majesty's Navy, as well as to point out the further proposed method of supplying the various foreign stations; and, I doubt not, if the scheme be fairly worked, that in a short time the condemnation of biscuit in Her Majesty's Navy (except from accidental causes, over which there is no control) will be a thing rarely known.