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"HYGIENE

IN THE

MERCANTILE MARINE,"

BY

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I N D E X

" HYGIENE IN THE MERCANTILE MARINE "

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The subject of which this work is comprised is the outcome of my experience as Medical Officer to the Glasgow Port Local Authority, and is prompted solely by the opinion that sanitary reform is urgently needed in the majority of vessels arriving in this port.

A ship, like a house, has its own inhabitants, own water-supply, and own system of drainage. Added to this, it has a constant supply of fresh air. A sailor's life, therefore, should be a healthy one. In those few words is expressed the opinion of the general public, and I desire now to show how erroneous such a view is, not only in respect of the health of its crew, but of emigrants and passengers. Were it possible that the crew could be accommodated on deck -- far removed from the effluvia arising from putrescible matter recognised on all vessels -- where fresh air is constantly obtainable, there would then be no question but that a sailor's life would be one of the most healthful and invigorating. But, unfortunately, such highly desirable conditions do not presently exist in the Mercantile Marine, and, until much needed alterations have been effected, a sailor's life must be classified in the list of unhealthy occupations.

A ship on the open sea has the solitary advantage of being surrounded by air free from terrestrial emanations. In all other respects it is placed under unfavourable circumstances; for it combines the drawbacks of inadequate crew-space, of ventilation liable to frequent interruption, and of a moist

atmosphere acting on vegetable matter subject to decomposition. It seems ludicrous to think that conditions such as overcrowding and extreme vitiation of atmosphere should exist in the midst of the boundless ocean -- yet such is the case.

A ship in harbour, though in other respects better circumstanced, is often exposed to the most deleterious emanations from low swampy lands and rich alluvial soils. A seafaring life, moreover, is exposed to great and continuous fatigues, under circumstances otherwise unfavourable to health, and, to a certain extent,-- often for long periods of time -- to the evils of a monotonous existence. Hence the health of the seamen and passengers by sea can only be preserved by the most watchful care and attention to the cleanliness, dryness and ventilation of the ship; by the supply of fresh water; and by sound provisions embracing all the elements of a wholesome diet, with suitable clothes and proper change of clothing, with fitting exercise, occupation and recreation, and with facilities for separating the sick from the healthy. The precise measures to be adopted to ensure those ends can only be fitly described by those who add to a general knowledge of the principles of hygiene, a special acquaintance with the construction and internal economy of ships.

CREW'S ACCOMMODATION.

The crew are usually accommodated in the forecastle, either in a lower forecastle or a top-gallant forecastle, the firemen being placed at one side and the crew proper at the other, with a divisional bulkhead between. Occasionally, however,-- though very rarely -- the men are quartered amidships, the most desirable situation in the ship; for here they have light, dryness, aeration, and general comfort.

The amount of space allowed by the Merchant Shipping Act of 1894 is 12 superficial feet and 72/78 cubic feet per man; in

other words, a space measuring --

6 feet in length,
6 feet in height, and
2 feet in breadth,

a space which he is entitled to demand for his own grave. Picture, then, a man sitting, eating, reading, writing (frequently, even during the day, by the aid of a paraffin lamp), smoking -- usually the heaviest of tobacco, spitting, washing his clothes and person, and sleeping in his own grave. Were he actually in his own grave, the walls of his cubicle would be drier than those of the forecastle, which is only too frequently streaming with moisture, the result of condensation of the vaporous exhalations of its combined inhabitants. In this space, also, is frequently to be found different articles of ship's gear, tending still further to reduce the breathing room, as also to contribute other noxious odours. Yet a lamentable condition of affairs such as this is permitted to continue during an age characterised by the most rapid advances in Public Health Administration on shore. Had the spirit of the Act been strictly carried out, quarters such as lower forecastles for the crew would now be swept away, as they are most unsatisfactory and cannot possibly be kept in a sanitary condition.

Lower forecastles are below deck, and are entered by a hatch or opening in the deck, measuring usually 2½ feet square, sometimes covered with a scuttle, but often left open as the chief means of light and ventilation.

Under no circumstances should a steam windlass or other gear be permitted to remain in a forecastle. The heat and moisture at once render the place unhealthy, and there is, in addition, the danger from bursting of the steam pipes.

Gear stored in Forecastle:-- Such articles may include all the different materials and implements on board which it is possible to stow away there; such as -- sails, cordage, buckets, brushes, cans, wet clothes, paraffin, paint, oil, tar, and fre-

quently provisions. All of them occupy space illegally, to the privation of the crew, and many of them pollute the air considerably.

There can be no justification for the continuance of lower forecastles, as the masters of vessels with deck-houses say that they cause no difficulty in the management of the ship. There is no doubt that in the deck-house is comprised the ideal accommodation, as it meets all the requirements in regard to plenty of sunlight, fresh air, and healthiness generally. The minimum space provided by law is far too small, and, if strictly adhered to, men cannot possibly live in perfect health. To find the bare amount of space required by law is not very common, but still there is a fairly large percentage of such. The Royal Commission on Labour of 1894 recommended an increased air-space of 120 cubic feet for each man. It is not on sea conditions that calculations should be based, but on those which obtain when the vessel is lying in port, when the crew are assembled together in places where they not only sleep but have to live. It is still not uncommon to find men occupying a forecastle in which the deck above is much less than 6 feet from the floor, compelling them to remain in a bent posture whilst inside.

Deck-houses:-- These have the sanitary advantages of light and air which lower forecastles do not possess, and which even top-gallant forecastles have imperfeetly. They are easy of access, and allow of more convenience and comfort for the men. It is difficult to see why they are not more general in the Merchant Service; the testimony both of masters and crews of vessels in their favour appears to be unanimous; nor do they interfere with navigation. The space occupied by crews in forecastles would be much more advantageously used for storage.

Figures 1 and 2 represent the plan and section of the crew arrangements on a German schooner of 150 tons. Dutch and German vessels are built according to the same plan.

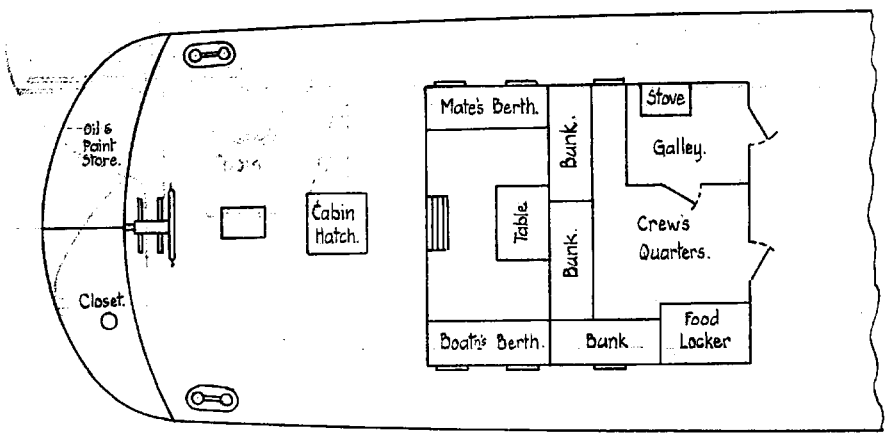

FIG. 1. PLAN OF DECKHOUSE ON A GERMAN SCHOONER (WOOD)

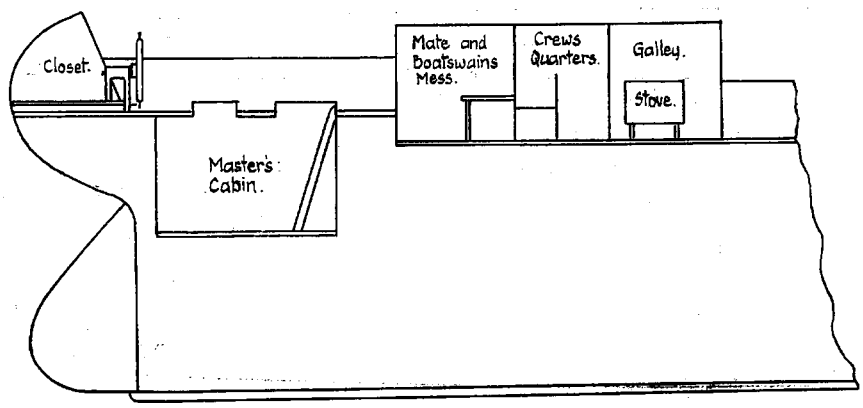

FIG. 2. SECTION SHOWING ARRANGEMENT OF DECKHOUSE ON A GERMAN SCHOONER. (WOOD)

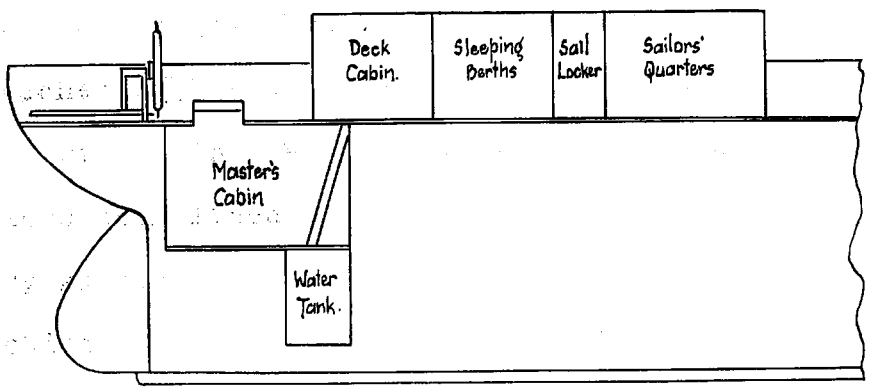

FIG. 3. SECTION SHOWING ARRANGEMENT OF DECK-HOUSE ON A DUTCH VESSEL (IRON)

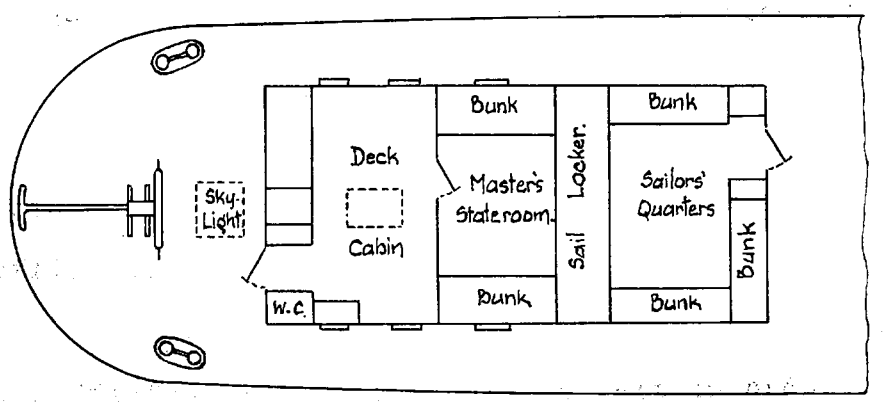

FIG. 4. PLAN OF DECK-HOUSE ON A DUTCH VESSEL (IRON)

Figures 3 and 4 are sections and plan of the crew arrangements on a Dutch sailing vessel, and are typical of the many of this class. For comfort and cleanliness they surpass anything to be seen afloat.

The sides of the forecastle in iron ships contribute towards the production of moisture from condensation of the vapours exhaled by its inhabitants. Sometimes this reaches such a pitch as to keep the walls constantly streaming with moisture. To obviate this, many vessels have since been lined with wood, and, although it thus offers a dry surface, it only tends towards the accumulation of filth behind. Another method is to coat the sides with finely granulated cork; and of the two methods certainly the latter is to be commended, in that it can always be kept clean and regularly painted. All the vessels of His Majesty's Navy are now, I understand, lined with this material. It should be freely applied over all iron surfaces, both overhead and down the sides of the vessel, as there is no more frequent cause of complaint than the wetting of bedding from condensation.

Sweet Boards:--i.e., boards fixed immediately over the bunks,-- to some extent prevent condensation at that point, but it accumulates at the sides and is not thoroughly efficient.

Bunks should not be built close up to the side, but a sufficient interval should be left in order to permit a man to get round them to clean and paint them. Neither should bunks be made of wood, but of iron and painted a light colour; they should be of sufficient length and breadth, and in two tiers only, the bottom tier being at least twelve to eighteen inches from the floor. In some of the larger liners reaching this port it is not uncommon to see bunks placed in all available corners, absolutely dark, and little short of coffins. In the remainder of the forecastle the bunks are all in three tiers, the bottom of the lowest being

only two to three inches from the floor -- thus preventing the possibility of removing filth, which readily accumulates there.

The position of food lockers also requires more consideration, as they are often built up against the partition of paint or lamp lockers, and sometimes against that of a closet. Paint and lamp lockers should never adjoin living rooms, unless separated therefrom by an iron bulkhead. Seldom does one ever see a thoroughly tight and efficient food locker, the majority being composed simply of roughly constructed boxes, usually without shelves or doors. The ideal position for food lockers would be a specially constructed apartment outside the sleeping quarters, and well removed from possible contamination from water-closet, lamp or paint locker.

It is to be remembered that the internal fittings of forecastles do not usually form part of the main structure of a vessel, thus making it easier to obtain the desired reform. For the same reason, therefore, those matters receive little or no attention at the hands of the Board of Trade. They have merely to deal with an empty space where, fore and aft, bulkheads, paint and lamp lockers, boatswain's and donkeyman's berths, and food lockers, as a rule, are left to the discretion of the builders, who in this, as in other important sanitary matters, are allowed too much latitude. What is wanted is a properly recognised authority to supervise the construction of those places whilst the vessel is in the builders' hands. The officer of such an authority would not necessarily interfere with the Board of Trade surveyor in the pursuance of his duties, but would serve as an adjunct thereto -- a recognised person, well acquainted with sanitary principles, to devote himself specially to that portion of the vessel pertaining to the health and comfort of its crew and passengers.

Figure 5 represents the usual accommodation on a well decked vessel. The water-closets are on the same deck as the crew-space, being separated from it by store-rooms.

Figure 6 represents a well decked steamer in which the men's quarters are placed amidships, with good arrangement for light and ventilation. The water-closets are placed well forward.

Figure 7 is the plan of a sailing barque. Those are the best seamen's quarters that the writer has ever seen on any vessel. Their quarters are amidships. Each man has a separate berth to himself of iron, measuring six feet one and a half inches, by five feet one inch, by six feet two inches in height (more than double the space required by law). They are all lined with granulated cork throughout, and painted white; and each has a port and a louvred ventilator in the door. Beneath each bunk is a chest of three drawers. In each berth, also, there is a washing basin and can, a seat and shelf. Abutting on the berths is a saloon with stove, sideboard and skylights. They looked extremely comfortable and were sweet and clean. The captain said the men liked their accommodation, and remained for a long time with him.

It is to the interest of owners to give liberal accommodation to their crews, as, by enlarging the crew-space, they are reducing the dues (harbour, lights, etc.). They are charged on registered tonnage, which is determined by space other than crew-space, the latter being deducted. In factories, the amount of space for each workman must not be less than 250 cubic feet; yet in forecastles, where men have to live, sleep and eat, only 72 cubic feet is allowed. The air-space should at least, therefore, be as ample as for a workshop.

Under the "Passengers' Act" (Board of Trade notice to Passengers), all passenger ships are to be surveyed. The amount of deck-space required is, for each adult on the upper passenger deck, etc., not less than 15, and on the lower

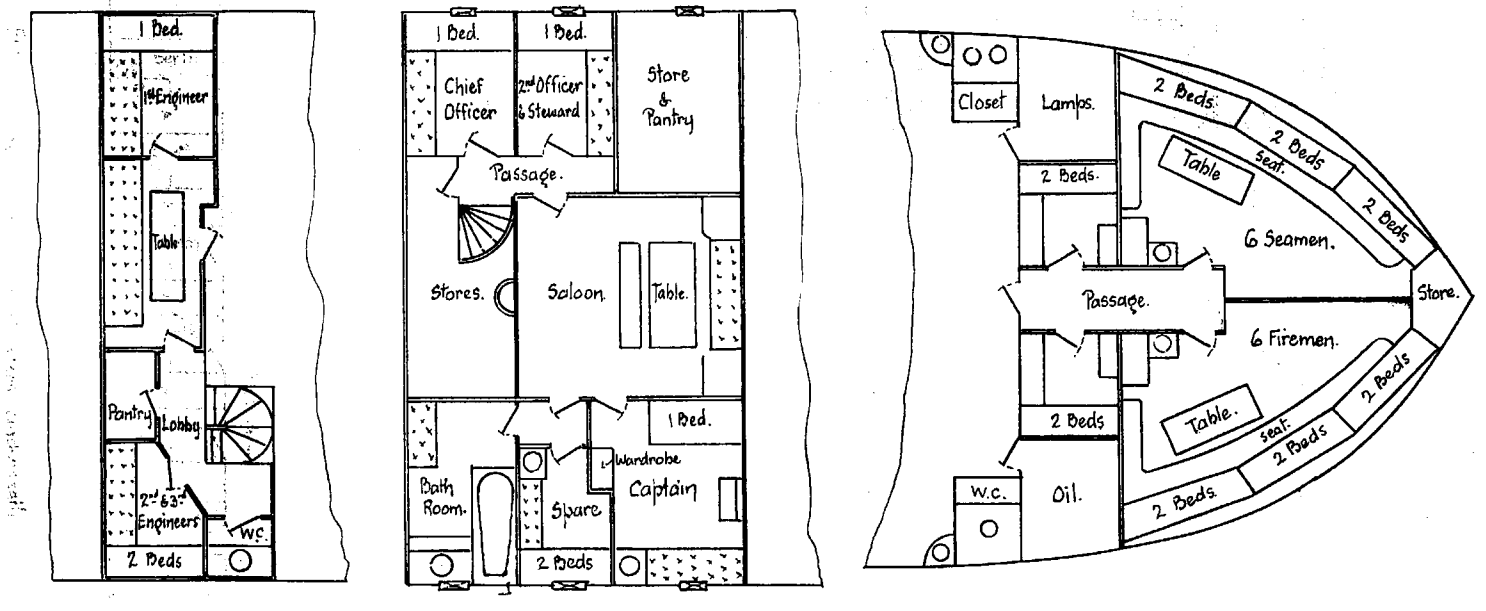

FIG. 5. WELL DECK STEAMER HAVING NO POOP. OFFICERS' ACCOMODATION UNDER BRIDGE AMIDSHIPS.

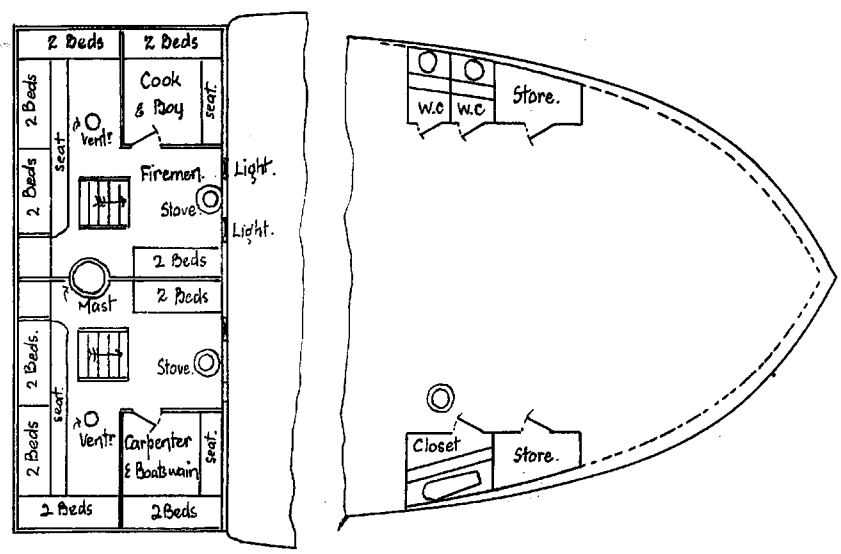

FIG. 6. WELL-DECK BOAT WITH CREW UNDER FOREPART OF BRIDGE.

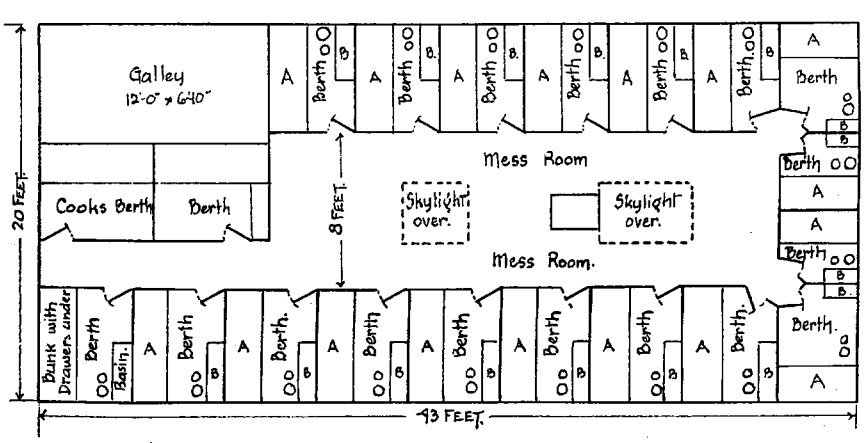

FIG. 7. A = Bunk with drawers underneath.
B. = Basin.

passenger deck 18 square feet. If the height between the latter deck and that above it be less than seven feet, or if the means of lighting and ventilation are below a specified standard, the minimum amount of floor-space per adult is 25 square feet. No ship is allowed to carry "a greater number of passengers on the whole than in the proportion of one statute adult to every five superficial feet, clear for exercise, on the upper deck or poop, etc. The height between any deck on which passengers are carried and that above it should not be less than six feet, under a penalty not exceeding £50. There should not be more than two tiers of berths on any one deck, and the interval between each tier, and between the uppermost tier and the deck above it, shall not be less than two feet six inches. Hospital accommodation in the proportion of not less than 18 clear superficial feet for every fifty passengers must be provided. The lighting and ventilation must be such as the circumstances of the case may, in the judgment of the emigration officer at the port of clearance, require."

The sixth schedule of the Merchant Shipping Act of 1894 provides that all crew-spaces should be:--

Securely constructed;
Properly lighted;
Properly ventilated;
Properly protected from weather and sea; and, as far as practicable,
Properly shut off and protected from effluvium which may be caused by cargo and bilge water.

SECURITY OF CONSTRUCTION.

Little comment need be made in regard to this point, as, for obvious reasons, it is usually complied with, only, however, in so far as the general strength of that portion of the ship is concerned; but, apart from this, leakage is frequently complained of, through plates and inefficient ports on the ship's side, as also from the deck overhead, the planks

having become sprung as the result of the straining of the windlass overhead in raising and lowering the anchor.

LIGHTING.

On this point alone, without going any further, the Board of Trade subject themselves to condemnation. Few are the forecastles sufficiently lighted, and many of them are very dark. In almost all, the only provision to be found is that of side ports; the rays of light coming in therefrom, being in a lateral direction, are usually obstructed by bunks, etc., and therefore only serve to illuminate that portion of the quarters upon which the light directly falls, leaving the remainder in comparative darkness. The floors are always in the dark, and dampness and dirt are thus encouraged.

Deck-lights:-- i.e., glass prisms, let into the deck overhead,-- are only available in upper forecastles, but those are, as a rule, conspicuous by their absence. Deck-lights could be more frequently supplied with benefit. Companion-ways, hatches, etc., cannot be depended on, either as a means of ventilation or lighting, as in bad weather they would be closed.

VENTILATION.

It is well recognised that ventilation on board ship is one of the most important points requiring consideration, and one which presents great difficulty in properly arranging. At best, the amount of breathing space in any forecastle is very limited, and, recognising that a healthy adult requires at least 3,000 cubic feet of air per hour, it behoves local authorities to give this matter their attention, in the interests of the merchant sailor.

The larger the vessel, the more complex does the question of ventilation become. The crews of war vessels are worse off than those of merchant-men in regard to the purity of

the air they breathe, owing to the larger number of hands and the difficulty of ventilating properly their quarters, all or most of which are, of necessity, below deck. The ventilation of ships might well be compared to that of an uncorked bottle. In two instances coming under the notice of the writer, the engineers' quarters opened directly into the engine-room, and the only means of ingress and egress was over an iron platform, above the engines, leading to the deck. It requires little stretch of the imagination to understand that those men, when the vessel was in hot regions, would be practically stewed.

Ventilators are too frequently absent, and, when present, are either stopped up with rags or are placed in positions apparently with little idea as to the purpose for which they are intended. Ventilators ordered by Port Local Authorities are placed in the most readily available spots, with regard only to the arrangements on the deck above. The majority of such forecastles have a hole about six inches in diameter through the roof, fitted with a cowl or mushroom ventilator, as in Figure 8.

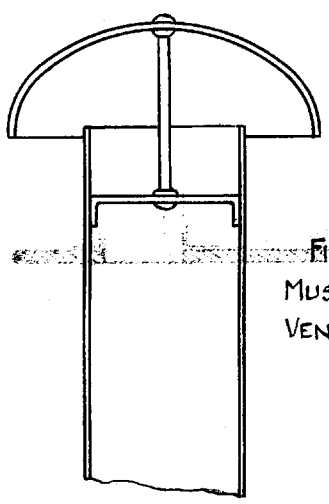

Fig. 8.
MUSHROOM
VENTILATOR.

By placing two swan-necked ventilators just inside the knightsheads, where they will be well protected, and connected

below the deck to each side of the forecastle by a pipe; and in the passage way, near to the doorway, on either side, a cowl ventilator: a constant through current would thus be induced, and there would be no necessity to close them during rough weather.

Top-gallant forecastles have ports opening to the outer air, in addition to the other means of ventilation. The engine-rooms of steam vessels, and the cabins and saloons of passenger ships, are ventilated by hinged skylights. Holds are generally ventilated by cowl ventilators, the height of which is regulated by the height of the structure in front of them, but in no case must they be less than six feet from deck to bottom of cowl. For vessels with one deck, the ventilation is as shown on Figure 9A.

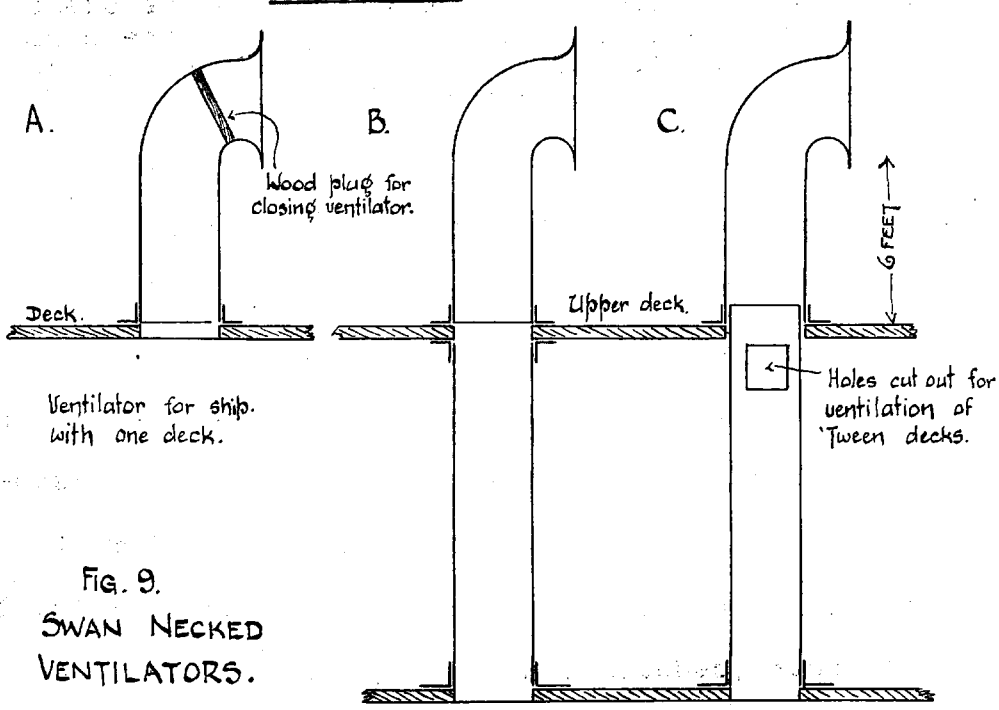

FIG. 9.
SWAN NECKED VENTILATORS.

In vessels with two decks the form is given in Figure 9, B. and C.

In the "Instructions as to Survey," issued by the Board of Trade regarding the ventilation of a crew-space, the following is the text:--

> "The simplest method is to have an iron pipe with a revolving cowl, which in lower forecastles must be as high as the bulwarks, fixed at each end or side of the crew-space, so that while impure air escapes at one, pure and fresh air

> will enter at the other, and a constant circulation be kept up. When such means for ventilation is adopted, one of the ventilators should pass through the deck to at least the lower side of the beams."

They discourage mushroom ventilators for forecastles. They are not fitted to these places unless they are at least 30 inches high for top-gallant forecastles, and as high as the bulwarks for lower forecastles. "There must always be two ventilators." It is needless to say that only too frequently are those points disregarded, and many vessels has the writer personally visited where no ventilators were to be seen at all, and single ones are very common.

Under the "Passengers' Act" it is enacted that --

> "No passenger ship shall clear or proceed to sea without such provision for affording light and air to the passenger decks as the circumstances of the case, may, in the judgment of the emigration officer at the port of clearance, require; nor, if there are as many as 100 passengers on board, without having an adequate and proper ventilating apparatus as to be approved by such emigration officer and fitted to his satisfaction; the passengers shall, moreover, have the free and unimpeded use of such hatchway situated over the space appropriated to their use," etc.

The means of ventilation hitherto mentioned include those available through the ordinary openings of the different compartments of ships, and the simpler appliances in general use. Some of these are applicable only to the upper compartments; others are liable, from their height, to be swept off the deck in rough weather, and to leave openings for the inrush of water. As already mentioned, many of the so-called natural means of ventilation -- such as, hatches, companions, skylights, doorways, etc.,-- are of no service for this purpose, during a storm, having then to be closed. They are also generally closed at night, and at other times when the apartments to which they belong are occupied, and when their action as sanitary appliances is most wanted. It is therefore necessary to provide more elaborate apparatus, such as can be worked at all times, in all climates, independently of weather, on vessels for cargo or passengers, and on different parts of those vessels. Many forms of apparatus for artificial ventilation have been proposed:--

Boyle's System:-- Upcast and downcast ventilators are employed in combination. The foul air is exhausted by means of air pumps, which are fixed and do not get out of order, and the fresh air is introduced by downcast pipes into the lower parts of the vessel. In this method, also, the fresh air is warmed or cooled to the desired temperature. The only objection that can be offered to this plan of ventilation is that the shafts may be carried away by heavy seas, etc.

Rotatory Fans:-- Various forms are in use for purposes of ship ventilation. Their special advantage is that they work without noise, and can be made to act either as inlets or outlets. The air can be similarly tempered before its supply to the saloons, etc. Crossley & Blackman's air propellors are examples of these.

Those systems are an improvement on the crude methods of introducing currents of cold fresh air from the outside, allowing the foul air to find its way out as best it could. The inlet air must enter freely, else the action of aspiration will be feeble. In large saloons the passage of air from inlet to outlet necessitates considerable force. To produce a steady and gradual removal of the products of respiration, and the interchange for them of fresh respirable air from the outside, extractive and propulsive power in combination would seem to be necessary. The latter must be so provided that, though ample, it is under ready control, and the air it sets in motion must be diffused gently and evenly without creating perceptible draught. On board ship they should necessitate no long shafts, which might be carried away by wind and sea. None of the above methods appear quite to meet the requirements.

Other Methods:-- have been suggested, such as that by means of compressed air (3 lbs. to the square inch). They claim that every cubic foot of compressed air will induce a current of 25 cubic feet of air, tempered or not, as desired. Some other ingenious inventions have taken advantage of the

movements of the ship at sea for the purpose of ventilation, one acting by rolling and the other by pitching. It is obvious, however, that any system of ventilation based on the roll or pitch of a ship must fail in its operation when the vessel is at anchor, becalmed, or moving steadily.

STOKEHOLDS.

Those, from a sanitary point of view, are important parts of ships, as it is from here the furnaces are coaled, situated as they are at the bottom of the ship, deeply below the water. In the smaller class of vessels there is only one stokehold to each steamer, but larger ships have two or more. They are generally provided with wide cowled shafts for the delivery of cold fresh air from the upper deck, the hot and consequently light air being allowed to escape upwards. For economy of space, the stokehold is usually made no wider than is absolutely necessary -- say, 8 feet, -- the width and depth being those of the ship. The stokers, therefore, work in a deep well, and are exposed to great heat from the furnaces, from which they are unable to withdraw whilst on duty. The air at the bottom of the stokeholds tends to become very foul, by reason of the escape of various gases of combustion from the fires. These gases, from their greater density, are not carried upwards with the warmed air, and the supply of fresh air by the cowled shafts, before-mentioned, does not counteract their evil effects. The effect of the stokehold on the stoker is detrimental to a high degree, and firemen are, in consequence, proverbially unhealthy. There is little difficulty in distinguishing a fireman from a seaman, as his emaciated look bears the impress of his calling. It is not uncommon for men to work at firing in a temperature of 150° F., and 110° F. is quite common. There has been very little heed paid to this matter hitherto; the ship designer does not seem to think of it; enough for him if his speed is attained at the trial trip. The result of this incessant heat is the

number of firemen who commit suicide, which is out of all proportion as compared with other classes of men. It is unfortunate that the Board of Trade, in working up their annual statistics, do not inquire more rigorously into the causes of such a high mortality of this kind amongst firemen of the mercantile marine.

The heat of the stokehold is not so great as that of the Side Bunkers, as the boiler-room is not insulated from them by non-conductors, and a temperature of 160° F. and upwards is often found there, viz., almost twice the temperature of the body in health. Considering, therefore, the trying conditions under which the duties of marine engineers and firemen are carried on, it might be expected that everything possible would be done to minimise the unhealthiness, discomfort, and difficulties of their work. But, unfortunately, that consideration does not obtain to the extent it might. Tunnels are often without ventilation. Engine-rooms and stokeholds have it, but only partial and ill-directed. Furnaces are either extremely high or extravagantly low, all adding unnecessarily to the labour and exhaustion of both classes and to the cost of working the ship. When the direction of the wind is at right angles, or in a line with the ship,(that is, abeam or abaft) ventilators of the cowl variety are next to useless; consequently the little air that can be obtained is by induced currents, and is all that can be relied upon. Under these circumstances, for men to remain stoking four hours without going on deck may be possible in high latitudes, but it is practically impossible to do so in hot climates, when the temperature is between 110° and 140° F. It is a common occurrence for the men to go on deck after every "fire up" for fresh air, in a half-exhausted state and in clothes dripping with perspiration, to encounter a difference of temperature of from 30° to 60° F. When the wind is blowing in a direction opposed to that of the ship (that is, ahead or before the beam), firemen are able to remain below, by standing immediately beneath the venti-

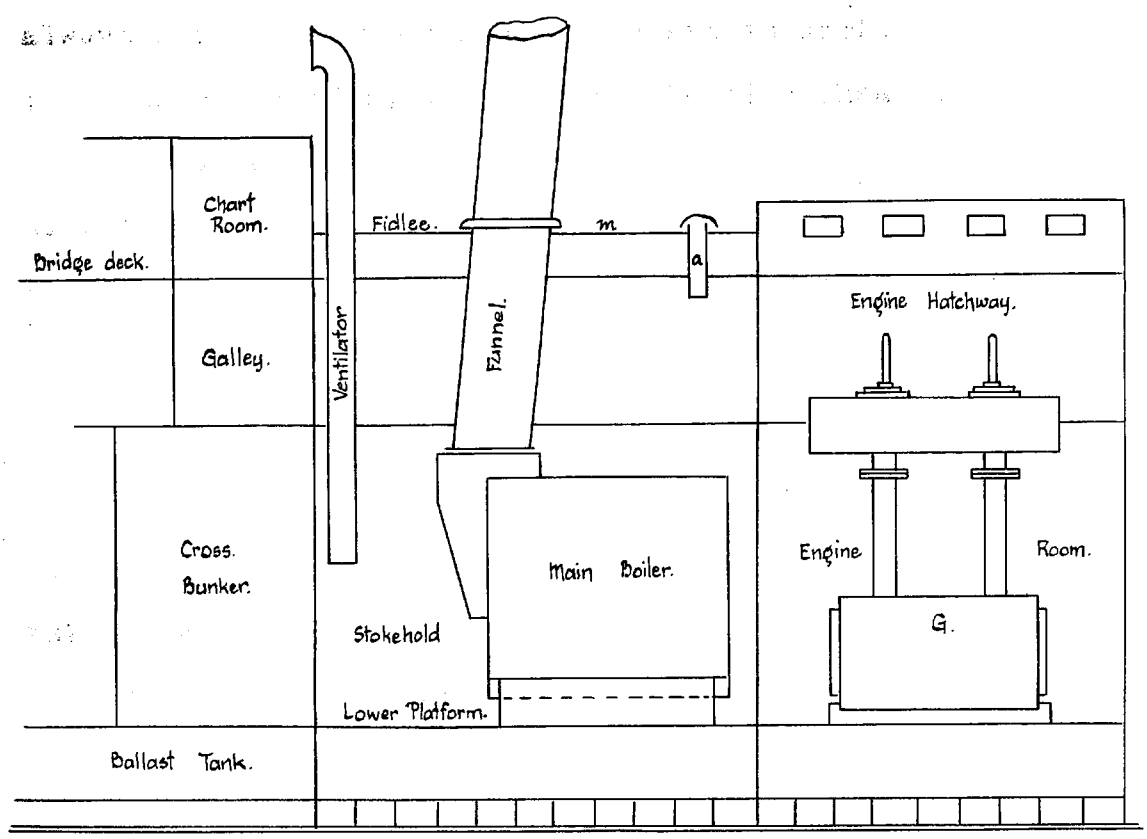

FIG. 10. SECTION SHOWING STOKEHOLD ETC.

lator. This they do after stoking the fires, thus exposing themselves, in their enervated condition, to a greater difference of temperature than by going on deck, a proceeding which cannot but be deleterious to health.

Figure 10 represents the stokehold and engine-room of a vessel of 1,000 tons, with a hold 22 feet deep, the space between the furnaces and the stokehold bulkhead being 7 ft. 5 inches, ventilated by two 27-inch cowl ventilators. Whether these will always prove effective and sufficient in admitting fresh air into the stokeholds, except with the wind ahead or before the beam, is a question which may be answered in the negative, and no proper diffusion of air throughout the stokehold can be expected. This method of ventilation, therefore, cannot be relied upon for the following reasons:--

(1) There is too little space on the platform.
(2) The ventilators are too near the funnel and boiler.
(3) The egress for the hot air is inadequate.

There should be at least 10 feet space between the furnaces and bulkheads or bunkers, and sufficient space above the uptake of boilers, so that the escape of hot air should be facilitated in every possible way.

PROTECTION FROM WEATHER AND SEA.

Lower forecastles may be considered sufficiently protected from weather and sea, but not so in the case of upper forecastles, where, as already mentioned, leakage is common, due to the strain of the windlass, bits, etc.

EFFLUVIUM CAUSED BY CARGO AND BILGE WATER.

The Act reads -- "as far as practicable shut off and protected from effluvium, which may be caused by cargo and bilge water." The qualification is a saving one, and this provision, therefore, from a hygienic point, is a dead letter, for practically no vessel is without effluvium from cargo or bilges. The reason is only

too evident, and is to be found in inefficiently caulked linings and floors, and defective bulkheads; and is the result of the constant straining of the ship. All possible crevices or inlets to sleeping quarters should therefore be carefully examined, and re-caulked or remedied immediately when found.

Before proceeding to describe the effect of the effluvia from those quarters, it will be necessary in a few words to enter into a description of the construction of a vessel, in order to thoroughly comprehend the situation of those parts and their relation to the health of its crew and passengers. The skeleton of a wooden ship consists principally of the following parts:--

(1) The keel, running the entire length of the bottom of the ship, terminating in (2), the stem or foremost part of the ship, with which it forms an angle of about 90 degrees; and behind in (3), the sternpost or aftermost part of the ship proper. To the keel, at regular intervals throughout its entire length, and curving outwards not unlike the ribs of the human spine, are (4), the timbers. Those in the bow or front part of the ship are termed cant timbers; those aft of the cant timbers are the frames. The sternpost supports (5), the stern, which curves underneath as the counter. The planking (6) is fixed external to the frames, and runs horizontally the entire length of the ship; the main-rail (7) fixes in position the upper ends of the frames. The curved part of the outside and bottom of the ship below the water-line is the bilge (8). The highest part of the side above the level of the upper deck is the bulwark (9). The framing is lined inside with planks. This and the planking on the outside of the frames are called the "skins" (10), the whole forming the wall of the ship. Between the skins in the intervals of the frames is a space in the wall, closed in at the top by the covering board (11), and extending downward to the bottom of the vessel, where it ends in the limber

or bilge, a longitudinal channel parallel to, and one on each side of, the keelson (12) -- a kind of inner or upper keel.

Figure 11 represents diagrammatically a midship section of a wooden three-decked vessel. The parts of hygienic interest in connection with it are -- (1) the Decks, each resting on beams extending transversely from one side to the other, and supported on shelf-pieces or projections from the inner skin; those beams are planked on the upper surface, which is slightly curved, especially on the upper deck, so as to throw off water to the side, where it comes in contact with the waterway, a projection from the inner planking above deck, corresponding in position, etc., to the shelf-beam below deck; (2) the Hold, situated below the lower deck; (3) the Limbers or bilges, shown on Section, one on each side of the main keelson, with covering or limber-wood, and forming by means of water-courses through the floor timbers a continuous longitudinal channel; and (4) the Ventilating Channel in the inner skin below each deck, which may, as shown in the diagram, serve either as an outlet from the 'tween decks or an inlet for foul air from the bilge.

From the foregoing description it will be seen that water falling on the upper deck will flow to the waterways, where it is discharged overboard by means of the scuppers or outlets through the bulwarks. Drainage and liquids from cargoes falling on the lower decks and floor of the hold pass into the bilge. Leakage from the sea through the seams of the outer planking finds its way between the skins into the bilge, and thence to the well or sink where the pumps are placed to discharge it overboard. In steamships the water on the floor of the engine-room, and drippings of oil from machinery, etc., flow to the bilges.

Iron ships have keel, stem, sternpost, frames, beams, etc., as in wooden ships, but all are made of metal; the planks of the latter are in the former replaced by iron plates; and the decks and transverse partitions (bulkheads) dividing the vessel

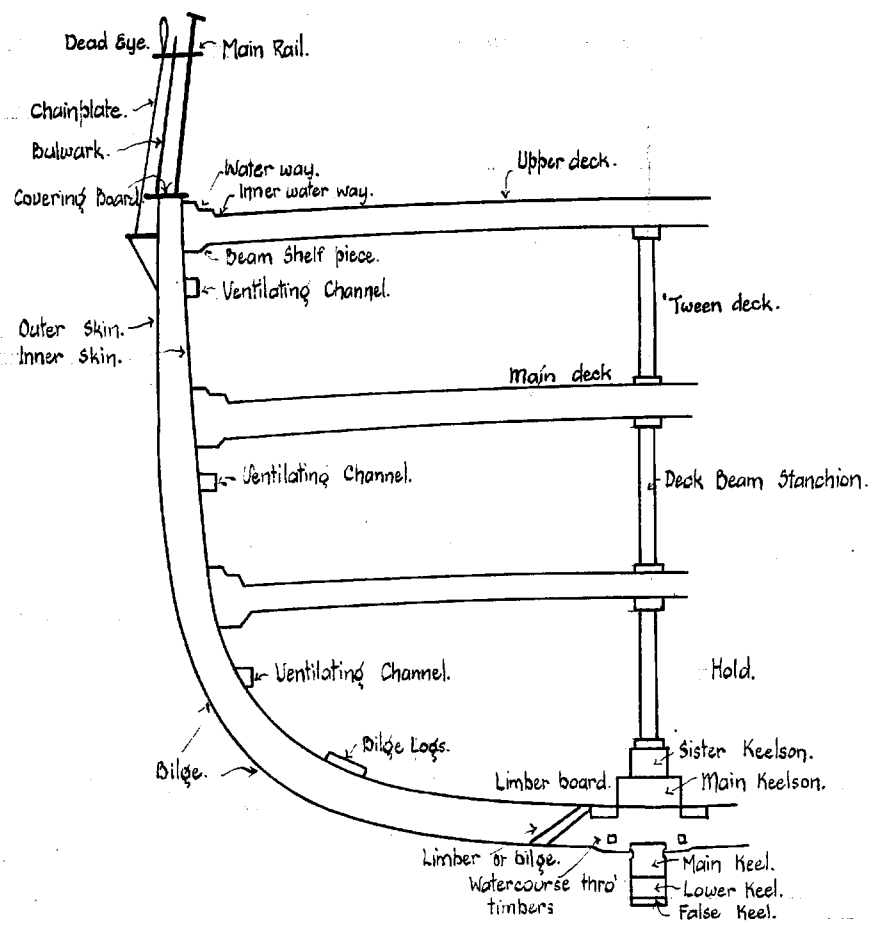

FIG. 11. MIDSHIP SECTION OF WOODEN SHIP.

into compartments also consist of iron plates.

Bilge Water is the essence of nastiness, and its effluvia one of the most serious nuisances on board. The bilge is the sink of the ship, and the exhalations from it are much more offensive than the "ground air" of a house. It is, in fact, more like sewer air. The perpetual motion of the ship, although available for purposes of ventilation, only tend to increase the evolution of gases from below, by the constant agitation of the bilge water. The sea-water in the bilges concentrates, and, under the action of organic matters of various kinds mixed with it, becomes decomposed, giving off sulphide of ammonia, sulphuretted hydrogen, and other gaseous vapours and compounds, which are diffused through the ship. One of the most abominable of all the many stenches of bilge water is that resulting from the drippings of a sugar cargo into the bilges, as sugar cargo is liable to heat and give off offensive effluvia. Few occupations are more noxious and revolting than that of cleaning out the bilges of a vessel which has been employed in carrying a sugar cargo. I have personally witnessed the procedure on several occasions at Greenock, and any description of mine would fall far short of conveying anything like a correct impression of the nature of that duty.

Another cause of foulness of the air of ships is the cargo itself, which may consist of guano, manure, fish, cattle, etc.; gas tar, paraffin, etc., from leaking casks in cargoes also make their presence felt. In cattle ships the accumulation of dung, etc., pollutes the air of ships greatly,

Figure 12..shows what is common to most lower forecastles. The hidden bilge (a) (a) (a) is probably the worst feature to deal with, as it cannot possibly be thoroughly cleansed. The older the vessel, the more liable will this be to pollution from impurities due to decay and other causes. (b) is the coal-bunker below the forecastle floor, access to which is usually by

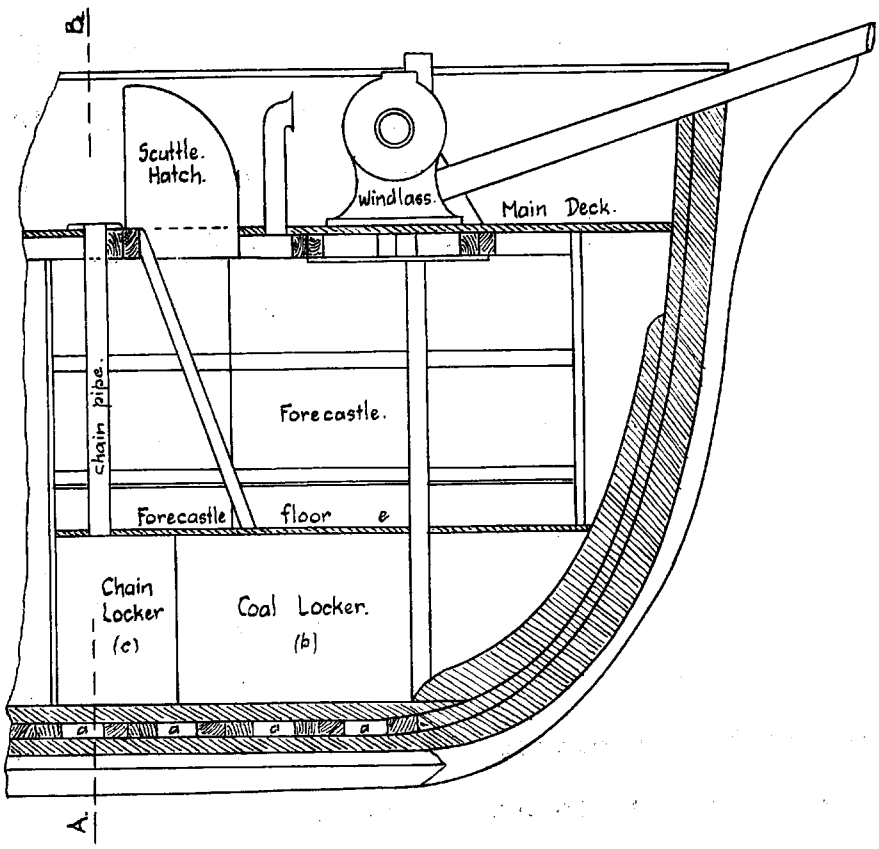

FIG. 12. SECTION THRO' LOWER FORECASTLE.

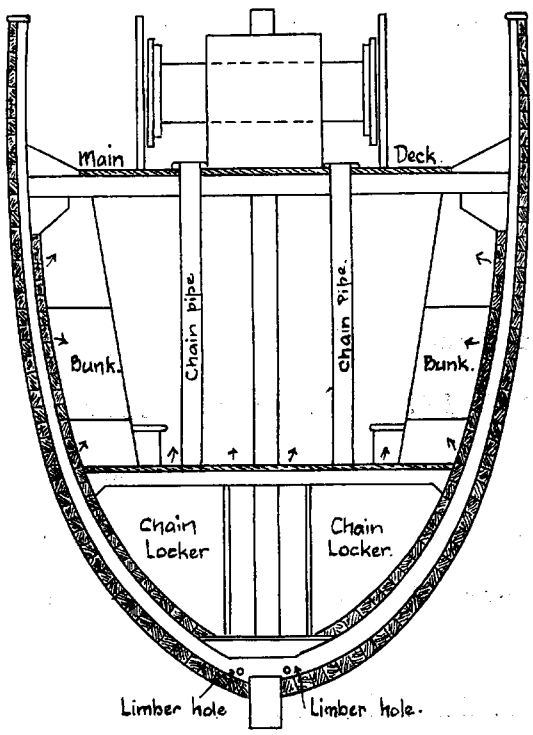

FIG 13. TRANSVERSE SECTION AT A.B.
(LOOKING FORWARD)

an ill-fitting hatch. The floor (e), from constant traffic, is never properly tight, and any water spilt or used in cleansing purposes finds its way into the coal and chain lockers (c). The foul air arising from the bilges finds its way between the frames and through the uncaulked and defective lining (marked by arrows in fig. 13), which have been caulked when the vessel was new, but is seldom renewed afterwards.

Taking into consideration the fact that bunks where men have to sleep, and food-lockers where the daily and weekly provisions are stored, are built up against this lining, it can well be imagined that the existence of human beings in these stuffy and malodorous places is not to be envied. Similarly the Fore-peak is a source of nuisance; the entrance to it is through a trap in the floor of the crew's quarters. This hatch is likewise seldom tightly secured, and hence offensive odours find their way readily into the crew's sleeping quarters. The situation of the fore-peak is thus a bad one, as everything has to be carried through the quarters. The fore-peak should never open directly into the forecastle, but ought to be separated therefrom by a passage leading direct to the hatch.

The Chain-locker is another source of nuisance, situated, as it is, below the forecastle floor. There is always a certain amount of mud adhering to the cable, and consequently we have a damp mass giving off a most unpleasant smell, immediately below where the men sleep. This is still further increased when the pipes which enclose those chains are defective, when a direct communication is thus established between the two places. All chain pipes should be regularly examined.

DRAINAGE.

All decks' surfaces are curved to cause the flow of water towards the sides, where it is drained into the scuppers and discharged through the bulwarks. Lower decks are similarly

curved upwards in the middle, being drained by scuppers leading to the bilges. Leakage through the seam of the outer skin of the ship also finds its way to the bilges. All this water, therefore, charged with whatever it has come in contact in its passage through the ship reaching the bilges, is drained to the limbers, and thence to the well or sink, where it is pumped overboard from time to time. If the bilges be flat, the water becomes stagnant; the suspended matter it contained sinks to the bottom, causing filth and evolution of foul gases. This defect produces, as already described, a great danger to the health of the ship's crew and passengers. The pumps should be used at regular intervals, and should be capable of clearing out all of the bilge water.

Limber chains -- i.e., chains disposed so as to work in the length of the limbers by stirring up dirt lodged there -- prevent deposit. All bilge floors should be cemented over and made perfectly smooth, with a fall on both sides to the well. The bilges should be regularly pumped dry, and flushed with disinfectant solution, a sufficient quantity of disinfectant being left in order to cover the floors well on each side of the well.

CLEANSING.

In well conducted ships a periodic inspection is made by the officers of the ship of the quarters occupied by the crew, in order to ensure their being kept clean. This rule, although carried out on board most of the larger vessels, is seldom, if ever, given effect to on smaller vessels. The commonest fault is to use water too frequently and in unnecessarily large quantities. Thorough scrubbing and cleansing can be effectively carried out without the use of large quantities of water, which very often (charged, as it is, with organic matter) by accumulation in out of the way corners, is productive of more trouble than the original dirt. Great care should be taken to see that

all superfluous water is got rid of, and that the forecastle is dried as quickly as possible; in wet or damp weather dry scrubbing should always be resorted to. "A damp ship is an unhealthy ship." This may be accepted as an axiom, the truth of which has been constantly demonstrated. Air is dry or moist, not in proportion to the actual amount of water it contains, but according as it is more or less removed from saturation. This degree of saturation is termed "relative humidity"! The normal amount of moisture exhaled by an adult is more than sufficient to render the cubic space provided saturated, without any additional means; apart from the pernicious effects of moisture per se, it has a powerful influence upon the development and growth of germs of disease It is to be remembered that there can be no more fatal source of disease amongst seamen than the constant inhalation of a damp atmosphere, whether sleeping or waking, but particularly is this influence injurious when the moisture exists between a ship's decks, where it may be at the same time more or less impure and hot or cold, according to circumstances. Bearing these facts in mind, the greatest care should be at all times taken to keep the crews' quarters as dry as possible. It should also be a rule that, whenever the weather will permit, all bedding should be removed from the forecastle and exposed to the action of the wind and air for a certain time every day.

CABINS AND SALOONS.

Between the men and any officer, however low his grade, there should be a distinct and decided difference made and maintained, especially with regard to his housing. It is, unfortunately, often the case on large and well-found steam-vessels that the junior officers are even worse off than the men with reference to space. A cabin constructed to accommodate two seamen is utilised for two officers. This is a point which requires attention. Again, officers' cabins are frequently badly ventilated. Situated at the side of an alley-way, close to

the engine-room and stokehold, from which there is always a current of hot air, they really require more thorough ventilation than the forecastles, while, as a rule, they obtain less. Good large scuttles should be provided, as well as some simple arrangement for ventilation in the door and over the bulkheads. In addition, when possible,-- and this is nearly always the case -- ventilating tubes should be carried through the deck, terminating, according to circumstances, either in cowls or swan-necks. As in the forecastles, the decks should be permanently laid and water-tight; and the side and deck, if of iron, carefully insulated with granulated cork. It is even common for passengers and captain to have closet and bathroom placed together. This is a most objectionable arrangement, and, except where both are used by the one person only, it is difficult to conceive any advantage. The discharge pipes should always be separate and distinct, to avoid the possibility of the bath being fouled by the washing back of the soil from the cabinet. For the same reason, also, water-closets should not adjoin, nor be immediately above passengers rooms, as when these go wrong evil odours result, the fluid sometimes finding its way therein.

HEATING.

In almost all the larger liners, a proper steam-pipe arrangement is supplied. This, probably, is the best, safest, and cleanest method of furnishing the necessary amount of heat consistent with the requirements of health. It is only in regard to their situation that complaint can be offered. Frequently the radiator is placed either in the passage-way between the two forecastles, in a corner, below a bunk or at either door, and thus a proper diffusion of heat throughout the whole forecastle is not afforded. If placed in the centre of their quarters, of fair size and properly insulated, more benefit would thereby be obtained.

The old-fashioned bogie, which still exists on board the smaller vessels, is of little use. This takes the form of a small square stove, constructed of thin cast-iron, and is either red hot, choked with ashes, or broken beyond repair. A circular wrought-iron slow combustion stove, lined with fire-clay, would be more serviceable, less costly, and supply a steady heat when charged.

TEMPERATURE.

The temperature of a ship depends on three factors:--

(1) Whether or not she is constructed of metal.
(2) Whether or not she is propelled by steam.
(3) The nature of her cargo.

(1) In tropical climates, all the iron portions of the ship, decks, divisional bulkheads, state-rooms, officers' and seamen's quarters, etc., become exceedingly hot, and this heat, by conduction, etc., is imparted to all parts of the ship. This could be obviated, to a great extent, by painting the sides of the ship white, which less readily absorbs the sun's rays. Conversely, iron ships in high latitudes become extremely cold, even to the extent of coating the walls of the crews' spaces with ice from the freezing of the condensed vapour. Such extremes of heat and cold are not experienced on wooden vessels, those latter being cooler in hot climates and warmer in cold.

(2) Steam vessels, from the large amount of coal consumed, attain a much higher temperature than wooden ships. This extra heat is, of course, greater in the neighbourhood of the furnaces. The heat is most excessive in the engine-rooms and stokeholds. Temperatures of 181° to 198° F. have been registered in stokeholds. Firemen's quarters, when they open into the engine-room, are very unhealthy from high temperature, and the evil effect on stokers from working under continued heat and living in such surroundings accounts for the large percentage

of ~~Whom~~ who die of heat trouble, affections of the respiratory and nervous systems, and frequently from suicide by jumping overboard from the same cause.

(3) Cargoes also raise the temperature of a ship. Lime, coal, grain, sugar, etc., are apt to undergo chemical changes attended with the evolution of much heat. Cases of spontaneous combustion from cotton waste under pressure have been reported. The obvious remedy for overheating is copious admission of air by ventilating shafts.

LATRINE ACCOMMODATION.

All sailors' water-closets on board vessels of the mercantile marine are, generally speaking, abominations:-- a small space in which a man cannot stand upright, the seat too high, and furnished with a step such as to render its use well nigh impossible; others simply a long hopper with a plank across; others trough in shape, filthy and corroded, and the majority of the seats broken. Generally flushed by hand-pump and hose-pipe, or by means of a bucketful of water thrown in by the hand, they are almost invariably very dirty, and frequently choked to the full. The soil-pipes sometimes discharge through the bulwarks, or near the top of the covering board which closes in the upper border of the two "skins" of the ship. In the latter there is risk of leakage into the space between the"skins."

The structure should be sufficient for a man to stand in upright, and should have ample light and ventilation. This latter point ought to be carefully attended to, a port window being supplied, if possible, and the door below furnished with a grating and a few holes near the top. The floor should be of cement, with a good fall outwards. The closet itself should be a galvanized iron hopper, attached to an iron soil-pipe open to the air, the seat to which might with advantage be made to lift

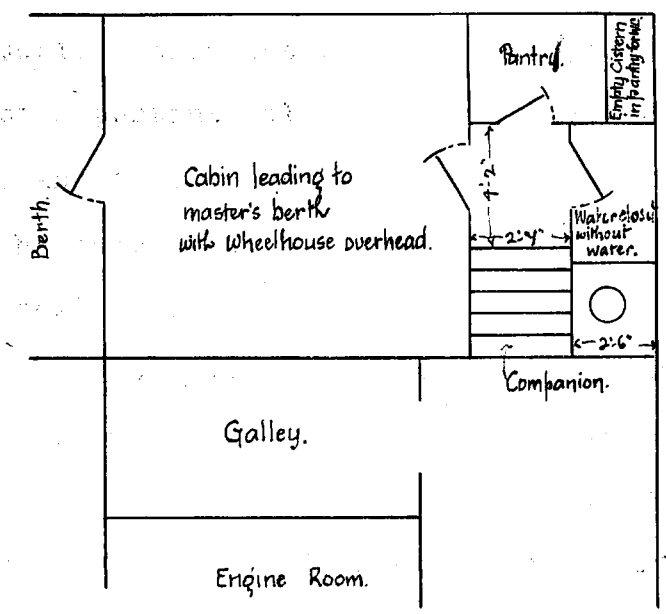

FIG. 14. SECTION THROUGH MASTER'S CABIN W.C. & PANTRY.

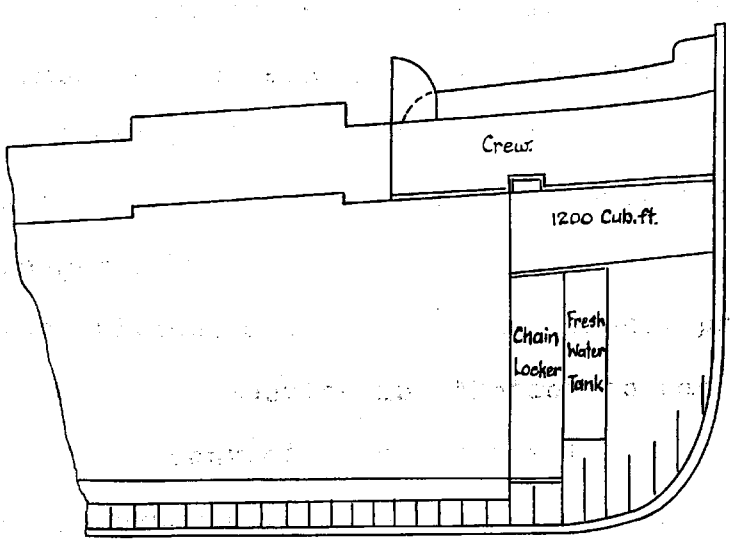

FIG. 15. SECTION THROUGH FORECASTLE.

upon a hinge. The walls of the water-closet also should be regularly limewashed, and kept sweet and clean. Closets should not be close to sleeping quarters, and, if this is not possible, should be divided therefrom either by an efficient iron bulkhead or a double wooden one with a layer of felt between. Lastly, and most important, all closets should be flushed from the engine, and those which are flushed only by hand should no longer be tolerated, as they are only open cesspools, and are always neglected.

Figure 14 is an example of a faulty arrangement of the conveniences on a steamer. The water-closet is at the bottom of the companion, and exactly opposite to the door of the master's cabin. It abuts on the pantry.

The after part of the ship is the best place for the closet, as then the soil-pipe may shoot over the rudder-trunk. When this situation is chosen, a storm-valve may be added to protect the lower end of the soil-pipe, closing against pressure from the outside, to prevent flooding. On some of the smaller schooners there is no latrine accommodation, the men being compelled to defæcate over the ship's side. In the Board of Trade's "Instructions as to Survey," section 55, two privies for every 20 of a crew are required on passenger ships. No passenger ship is allowed to clear out unless fitted with at least two privies, and with two additional privies for every 100 passengers. Section 25, "Notice to Passengers," also requires special conveniences for female passengers. Fore-cabin and deck passengers on home-trade ships are to have closets in the ratio of three to every 200 such passengers; and in Section 13, "Board of Trade Instructions as to Survey," it says -- "a fair proportion must be allotted to the sole use of women and children." To the Board of Trade surveyor falls the duty of seeing that the various necessary details for the proper drainage and cleansing of merchant ships are carried out; and specific instructions are given him to act upon. Those instructions,

falling far short of what is required in the interests of health, would receive no approval at the hands of a Medical Officer of Health.

LAVATORY ACCOMMODATION.

It may seem incredible to hear it stated that, in scarcely a vessel in the Mercantile Marine is there such a thing as lavatory accommodation for the sailor. In other words, there is not a wash-hand basin or bath, where he might wash himself and his clothes, and yet in all vessels carrying Lascar crews a bathroom is provided. This provision for Lascars is simple certainly, in that it is only a square iron compartment which drains out into the scupper; but not even such is provided for the European sailor. Some provision, however simple -- it need not be elaborate -- should be made to enable a man to wash himself. To talk of the want of space for such a purpose is simply to expose a niggardly spirit. If there is room for the cargo, surely there should be at least the barest necessary room for the requirements of the men who work that cargo into port. A small space is all that is required, with an enamelled wash-hand basin or two, depending on the number of the crew, and a similarly cheap bath. This could be placed in an iron compartment, like that supplied the Lascars; or, if such could not be obtained, the floor might be cemented or lined with sheet lead and efficiently drained. Nor should there be any difficulty in furnishing a hot supply in any steamer for the water, at any desired temperature, is there, and it only wants a pipe to convey it. It is to be remembered that, after all, the seaman is a civilised human being, and requires, therefore, at least the barest necessities as such. Too long have his wants been disregarded, and so utterly disregarded as to furnish the explanation for the gradual diminution in the number of British seamen sailing on British vessels. It does not stimulate the feelings of a loyal British subject to listen to

the Babel of languages to be heard in many of the forecastles of our British vessels. The conditions of life at sea are not such as will attract any others than a class who can do no better, conditions which inevitably lower the tone of any individual who follows the sea as a profession. If we wish to sustain our maritime supremacy, depend upon it we must do more for the sailor, in order that the race which has made Britain what it is -- the mistress of the seas -- may not be allowed to die out.

Port Local Authorities should combine in one strenuous effort to take over into their own hands the sanitary supervision of ships, and displace the Board of Trade from a position which, up till the present, has been nothing short of a sinecure. The officers of the Board of Trade have no knowledge of the sanitary requirements of a ship, and why not therefore transfer the power to those who are qualified to know. Once Port Local Authorities had obtained such power, a vessel, even during and after construction, would then be kept under surveillance in regard to sanitation by competent officers, and the onus of the responsibility in regard to the health of the sailor would then rest on the shoulders of the proper party -- a party prepared to do good and to accept such responsibility.

CATTLE SHIPS.

A large number of such vessels reach this port annually, each carrying, on an average, between 600 and 800 head of cattle, packed away in all available corners of the ship -- on the hurricane, upper and main decks. Planks are laid along the decks to permit of a foothold for those animals in rough weather, and during the voyage, which may be of fourteen days' duration or longer, their droppings collect beneath them. Great accumulations of manure consequently reach this port, as much sometimes as between 50 and 60 tons of decomposing, fermenting refuse, the juice expressed from which finds its way through crevices to

all parts of the ship -- invading sleeping quarters, circulating around drinking water tanks, and contaminating bilges.

After a ship has been employed in this trade for some time, it becomes thoroughly saturated with this heavy evil odour, and practically nothing can be done to remove it; and yet those same vessels are permitted alternately to act as passenger and cattle ships. Cattle ships should be built specially for the purpose, and should continue to carry cattle only. The floors of the pens should be properly cemented, with a fall outwards, and several large port-holes should be provided for discharging litter by, as well as other structural arrangements to allow of this being done daily whilst live stock are on board. The present system of conveying passengers in vessels soaked throughout with the concentrated essence of animal emanations cannot be too strongly deprecated.

WATER.

Water at all foreign ports is procured from several sources, such as springs and streams, when having run short on a long voyage. The nature and possible contamination along the course of such streams is disregarded, and has frequently been the cause of producing epidemics of Cholera and Enteric Fever. Frequently ships are supplied from water-boats, from which it is pumped into the ship's tanks. But how long such water has remained in those water-boats, how often they are emptied and thoroughly cleansed out, and a fresh supply taken in, are questions which must remain unanswered. On many occasions the water is taken directly from the river, with consequent evil results. When water above suspicion (preferably a town's supply and well filtered) is not obtainable, then distillation from sea-water, as practised on some of the larger vessels, should be carried out as a safeguard. It is not only necessary that the water-supply be of the purest quality, but it is also

requisite that its storage on board ship should receive particular attention. In large vessels the water is stored in galvanised iron tanks, each with a capacity varying from 300 to 900 tons. Iron tanks have many advantages, and are generally recommended as being the most suitable, economical, and, at the same time, the most sanitary receptacles. Those tanks are usually stored in the holds, amidships, aft the engine-room, after part of the vessel in the hold, forward or sometimes in the fore-peak, immediately below the seamen's quarters. This latter situation is undesirable for the above-stated reason, as also on account of its proximity to the chain locker, water-closets, paint and lamp lockers.

Figure 15 represents a section through the forecastle of a vessel in which the fresh water tank adjoins the chain locker, immediately below the crew's quarters.

Tanks are sometimes placed under cabins below deck, and sometimes under lower forecastles -- situations open to many objections, the principal one being the pollution of water by dirt finding its way, through defective floors and ill-fitting hatches, on to the top of the tank or the interior through the dripping hole.

The most common situation for drinking water tanks is in the lower holds, abutting on the engine-room bulkhead. The only objection to this arrangement exists in its close proximity to the engines, where the water is usually raised in temperature. In such cases a gravitation tank on the lower bridge, fed from the lower ones by means of a steam pump, would meet the difficulty, and furnish water in a measure cooled and aerated.

The chief objection to tanks is their inaccessibility for cleansing and repairs. They should be furnished with large manholes for the purpose of cleansing, which should be carried out as a matter of routine after every voyage.

If possible, the manhole should be placed in such a position that natural light finds its way into every part of the tank when the cover is removed. They should be regularly cleansed, cement-washed, and then limewashed; and water ballast tanks used for storage of drinking water, being dangerous to health, should be discontinued.

Under the Passengers' Acts, it is provided that the supply of fresh water to passenger ships shall be sufficient to secure throughout the voyage three quarts daily to each statute adult (exclusive of the amount necessary for cooking), and that the latter shall be shipped "after the rate of at least 10 gallons for every day of the prescribed length of the voyage for every one hundred statute adults on board, and also for the use of the crew and all other persons on board an ample supply," etc.

F O O D.

The true economy and importance of providing the sailor with plenty of good food should be self-evident, and its advocacy unnecessary. Yet sufficient attention to this matter has not been given, and even the diet to-day falls far short, in many instances, of what is required for the sustenance of health. Not only is the bare amount required not supplied, but no consideration is given to varying circumstances of ship-life in port and at sea, in temperate and tropical climates. There is not sufficient variety, and even now, in spite of the great improvements in packing and preserving fresh meat, too great reliance is put upon salt meat. It has been stated by many observers that the too frequent use of salt meat is a cause of digestive ailments, and by others that brine alters the composition of flesh, separating the albumen. If long kept, it becomes hard and indigestible. Salt provisions and dry vegetables as a continued diet are important factors in the causation of Scurvy and Beri-Beri. Preserved meats

also frequently undergo fermentative changes, producing Ptomaine-poisoning, etc., when consumed.

The quantity of fresh vegetables might be considerably increased. There is no difficulty in drawing up a far more liberal and varied diet scale without in any way increasing the cost to the owner, and it is scarcely necessary to point out how largely the nature of the food supplied affects, not only the health but the temper of the men. Moreover, there is good reason to believe that the compulsory issue of lime-juice has not been an unmixed benefit. It undoubtedly is a powerful anti-scorbutic, and is valuable ad hoc, but, at the same time, with some there has been a feeling that, by this law, the Government has accepted a certain amount of responsibility, and so far relieved the owners from the necessity of raising the diet scale.

All food-stuffs supplied to ships should be carefully examined as to quality. The Merchant Shipping Act of 1892 provides that, in the case of ships trading, or going from any port of the United Kingdom through the Suez Canal, or round the Cape of Good Hope or Cape Horn, an officer of the Board of Trade shall, before shipment, whenever practicable, inspect the barrels of beef and pork, preserved meat, and vegetables in tins, and the casks of flour and biscuits intended for the use of the crews of such ships, and, if satisfied they are fit for such use, certify the same accordingly. He may also proceed on board the vessel to ascertain whether the stores and water provided have been duly inspected, or, if not, whether they are of a quality fit for the use of the crews of such ship. If he finds the same not to have been inspected, and deficient in quality, he is required to detain the ship until such defects are remedied to his satisfaction. Rules for the inspection of provisions and water under this Act of the Board of Trade, March 1893, define the conditions of inspection and provide for the inspection of surplus stores left over from

a previous voyage, and for exposing the contents of all casks of wet provisions among such surplus stores. Other provisions of these Rules relate to notice being given to the inspector for the inspection of stores, and for furnishing him with a list of the stores. The condition of pork, beef, preserved vegetables and meats, and vegetables in tins, biscuits, and flour required by them is stated. In short, animal food is to be sweet and properly packed, and pickled in pickle of full strength; vegetables to be fresh and sound, properly preserved, and in strong and suitable tins. Flour must be of fine quality, milled from fully matured good sound wheat containing a proper proportion of nutritious matter. When stored in tanks, they are to be thoroughly cleansed, lined with fresh lime and dried before being refilled.

Any water remaining in the ship's tanks from a previous voyage must all be completely emptied, and the tanks thoroughly cleansed and re-filled with good fresh water. The inspector is empowered to require that all stores deficient in quality shall be landed, and it is his duty to grant a certificate if he is satisfied that he has seen all the stores intended for the particular voyage, and that they are of a quality fit for consumption by the crew.

Another Rule provides for the exemption from inspection of the stores of a ship trading only in parts of the United Kingdom, and which have not been broached. It will be seen, therefore, from the above, that the Board of Trade are not wanting in rules and regulations, but, as for rigorously carrying them out, that is a different matter.

COOKING.

While, however, an improved dietary need not increase the cost, there is another very important point, which, if properly dealt with, can only lead to increased economy and actual saving -- i.e., cooking.

Of late years a considerable amount of attention has been called to the absolute necessity of some proper system of training and certifying cooks on board ship. It is scarcely possible to exaggerate the importance of this responsible personage, holding as he does completely under his sway the stomachs and digestion of all on board. Notwithstanding this responsibility, there is no provision for his training, and, as a general rule, he grows up into the position -- learns his art, if it can be so called, by tradition from others, possibly more ignorant than himself. The Royal Commission on Labour of 1894 said:-- "We regard it as important to the seamen's health that some qualification, however elementary, should be required before a man is engaged as cook."

There is no reason why a school of ship's cookery should not be established at every large port, and a regular course of instruction given to those who are desirous of obtaining billets; after a certain time it might be found advisable to insist that every cook on board a vessel beyond a certain size should be required to attend such a school and obtain a certificate of proficiency. In the meantime much can be done by such institutions as training ships, etc., which have already moved in this direction; obviously such a regulation would lead to some slight additional cost, but this would be far more than balanced by the economy of food and the improved dietary it would undoubtedly bring about.

PRESERVATION OF FOOD.

The following are some of the processes for preserving food of different kinds:--

Desiccation;
Salting;
Smoking;
Immersion in Vinegar (animal and vegetable foods);
Immersion in Oil.....(fish, etc.);
Immersion in Molasses.....(potatoes);
Refrigeration;
Heating; and
Seclusion from atmosphere (as in tinned foods, soups, fruits, etc.).

Drying is not in general use in this country.

Salting reduces the nutritive value.

Desiccation by pressure for vegetables is practised, when they are said to regain their former freshness after immersion in warm water for about 30 minutes.

Probably the best method of preserving meat is that of plunging tins of meat into water at a temperature of about 260° F. This temperature is obtained by dissolving certain salts in the water to raise the boiling point. The steam created by this high temperature then drives out the air, when the tins are closed and soldered.

PROVISIONS.

Boyd's Merchant Shipping Laws, 1876, states--

> "Any three or more of the crew of a British ship may complain to any officer in command of Her Majesty's ship or any British Consular Officer, etc., that the provisions or water for the use of the crew are bad; the person who receives such complaint, after inspecting the food and finding it defective, may inform the master of the ship, who shall be liable to a penalty of twenty pounds in case of failure to provide proper provisions, etc., in lieu thereof."

The average food allowance in foreign-going British Merchant Ships is:--

1½ lbs. of beef, or 1¼ lbs. of pork, on alternate days.

½ lb. of flour, or ¼ lb. of peas, on alternate days.

1 lb. of bread every day.

The defects of such a diet may be stated briefly under three headings:--

(1) They are too unvarying in all latitudes, tropical or temperate.

(2) The same diet is given in warm and cold regions, instead of one less nitrogenous and stimulating, especially in the tropics.

(3) The small supply of vegetable matter and very salt pork and beef are injurious, especially in the tropics.

SCALE OF DIETARY FOR PASSENGERS.

(Board of Trade Notice to Passengers, 1887.)

	SCALE A. For Voyages not exceeding 84 days for sailing vessels or 50 days for steamers.		SCALE B. For Voyages exceeding 84 days for sailing vessels, or 50 days for steamers.	
	Lbs.	Ozs.	Lbs.	Ozs.
Bread or Biscuit (not inferior in quality to Navy Biscuit),	3	8	3	8
Wheat Flour,	1	0	2	0
Oatmeal,	1	8	1	0
Rice,	1	8	0	8
Peas,	1	8	1	8
Potatoes,	2	0	2	0
Beef,	1	4	1	4
Pork,	1	0	1	0
Tea,	0	2	0	2
Sugar,	1	0	1	0
Salt,	0	2	0	2
Mustard,	0	0½	0	0½
Black or White Pepper (ground),	0	0¼	0	0¼
Vinegar,	One	gill.	One	gill.
Lime Juice,	-	-	0	6
Preserved Meat,	-	-	1	0
Suet,	-	-	0	6
Raisins,	-	-	0	8
Butter,	-	-	0	4

SUBSTITUTIONS.

1 lb. preserved meat.....for 1 lb. salt pork or beef.
1 lb. flour or bread or biscuits only,..... } " 1½ lbs. oatmeal or
½ lb. beef or pork,..... } " 1 lb. rice or 1 lb. peas.
1 lb. rice,..... " 1½ lb. oatmeal or vice versâ
¼ lb. preserved potatoes,..... " 1 lb. potatoes.
10 ozs. currants,..... " 8 ozs. raisins.
3½ ozs. cocoa or coffee roasted or ground,..... " 2 ozs. tea.
¾ lb. treacle,..... " ½ lb. sugar.
1 gill mixed pickles,..... " 1 gill vinegar.

The master is liable to a penalty not exceeding Fifty Pounds in case of failure to supply issues of good and wholesome provisions, in accordance with above scale.

CLOTHING.

There are no regulations in the British Mercantile Marine as to the outfit of seamen. Each man provides for himself as he thinks fit, and the result is want of uniformity. The United States' Mercantile Marine affords us a good lesson in this respect, for it is directed by Statute "that every vessel is to be provided with at least one suit of woollen clothing for each seaman." The hygienic advantage of warm underclothing for seamen need not be enlarged on. It is somewhat surprising that the Cholera Belt, a girdle of flannel, three to four feet long and four inches wide, is not more universally worn in warm climates as a preventative against chills and dysentery.

CARGOES.

Cargoes play an important part in the sanitary condition of a vessel. They may be dangerous to life and health from the following causes:--

(1) Infection.
(2) Decomposition and evolution of noxious gases.
(3) Combustion.
(4) Shifting.

(1) Infection:-- One of the most dangerous cargoes on account of infection is that of rags, of which a large quantity reach Glasgow yearly from foreign. It is recorded that Small-pox and Cholera have been communicated by this means. The following table shows the total amount of such goods arriving in Glasgow from foreign and coastwise during the year, comprising articles which experience has shown are either likely to be diseased or to convey disease to this country.

With special reference to the introduction of	Articles.	From Foreign.	Coastwise.
PLAGUE,.....	Rags,.....	110 tons.	2,142 tons.
	Cotton Rags,.....	35 do.	.. .. ..
	Cotton Waste,.....	6 do.	1,027 tons.
	Cotton Wool,.....	9 do.	5,462 do.
	Jute,.....	667 do.	474 do.
	Oakum,.....	10 do.	14 do.
	Empty bags and sacks,	53 do.	767 do.
	Paper Waste,.....	80 do.	733 do.
ANTHRAX,.....	Hair,.....	2,259 tons.	87 tons.
	Hides (Dry, Wet, and Cuttings),....	448 do.	1,428 do.
	Skins of all kinds,..	307 do.	395 do.
	Skin Waste for Manure	.. .. ..	46 do.
ENTERIC FEVER,.	Mussels,.....	.. .. ..	882 tons.
	Shell-fish,.....	... .	62 do.
	Whelks,.....	.. .. ..	420 do.

(2) Foul Cargoes:-- Bones, potatoes, fish, fruit, onions, guano, manure, etc., are apt to be a nuisance or injurious to health.

(3) Cargoes liable to undergo spontaneous combustion, thus endangering the lives of those on board:-- coal, cotton, hemp, rags, grain, sugar, lime, and soda.

(4) Shifting:-- Sect. 22 of 39 and 40 Vict., c. 80, provides that -- "No cargo of which more than one-third consists of any kind of grain, corn, rice, paddy, pulse, seeds, nuts or nut kernels, shall be carried on any British ship unless contained in bags, sacks, or barrels, or secured from shifting by boards, bulkheads, or otherwise.

FOOD INSPECTION.

Frozen meat from Australia is brought here in large quantity, and occasionally goes wrong during the voyage from accidental or other causes. Dr. Williams, the Medical Officer of Health of the Port of London, has done much valuable work in

the detection of such, and, as a result, has condemned many thousands of tons of meat which would otherwise have found its way into the various London markets, much of which would probably have escaped the vigilance of the authorities and been consumed by the public. Dr. Williams deserves all credit for this departure, and other Port Local Authorities should adopt similar measures. He reports that during the year 1902 three large quantities had to be dealt with, viz.:--

1,181 carcases and sundry pieces of mutton.
17,643 carcases of mutton and lamb.
18,399 carcases, 32,381 pieces of mutton, and 2,229 quarters of beef.

The following is a summary of the articles seized and destroyed during the year 1902, from which it will be seen that the quantities are not only large but of a most varying description:--

Description.	Number of original packages.	Sundry Oddments, etc.	Sundry Quantities by weight.
MEAT.-- (Fresh or Frozen)			
Beef,.....	2,292 quarters.	108	-
Mutton and Lamb,..	38,373 carcases.	33,368	-
Veal, Pork & Offal,	110 cases.	-	-
Do. Do.	-	-	17¼ cwts.
Preserved.--			
Tinned,.....	369 cases.	516 tins.	-
Smoked & salted,	41 packages.	34 pieces.	-
Do. Do.	-	-	3 tons.
RABBITS.--			
Frozen,.....	27 crates.	-	-
Tinned,.....	2,987 tins.	-	-
POULTRY & GAME.--			
Frozen,.....	3 packages.	310 loose.	-
Do., ...	-	-	3 cwts.
FISH.--			
Wet,.....	2 packages.	-	-
Do.,.....	-	-	4 cwts.
Preserved.--			
Tinned,.....	124 cases.	-	-
Do., ...	2,339 tins.	-	5 cwts.
Dried,.....	3 packages.	-	-
FRUIT.--			
Fresh,.....	3,641 packages.	-	-
Preserved.--			
Dried,.....	2,340 packages.	-	-
Do., ...	- -		9¾ tons.
Tinned & bottled,	1,215 cases.	5,686 tins.	-
Do. Do.,	-	-	176 tons.
VEGETABLES.--			
Fresh,.....	1,312 bags.	-	-
Do.,.....	-	-	37½ tons.
Preserved.--		-	
Dried,.....	128 bales.		

(Continued over)

(Continued)

Description.	Number of original packages.	Sundry Oddments, etc.	Sundry Quantities by weight.
NUTS.--			
Cocoanuts, whole,.	5,390	-	-
Do. desiccated,	-	-	10¾ tons.
ALMONDS.--	5 boxes.	-	-
Do., ...	-	-	9 cwts.
PROVISIONS.--			
Tea,.....	830 chests.	-	-
Do.,.....	-	-	11¼ tons.
Coffee,.....	504 packages.	-	-
Do., ...	-	-	146 tons.
Cocoa,.....	638 packages.	-	-
Do., ...	-	-	743 tons.
Butter, Cheese,Lard,	337 packages.	-	-
Do. Do., ...	-	-	10 cwts.
Condensed Milk,...	2,003 cases.	395 tins.	-
Tapioca & Semolina,	41 packages.	-	-
Do. Do., .	-	-	1 cwt.
Prepared Foods,...	2,587 packages.	-	-
Biscuits & Confectionery,....	518 packages.	-	-
Do., ...	-	-	1¼ tons.
Sugar,.....	2 packages.	-	-
Do.,.....	-	-	56½ tons.
GRAIN.--			
Wheat, Maize, Rice and Barley,....	8,111 bags.	-	-
Do. Do., ...	-	-	28 tons.
Oatmeal and Flour,	27 packages.	-	-
Do. Do.,.	-	-	60¼ tons.
MISCELLANEOUS.--			
Condiments & Spices,	2,646 packages.	-	-
Do. Do.,.	-	-	1½ cwts.
Eggs, whole,.....	2 cases.	2,000 loose.	-
Yolk, tinned,.....	5 cases.	-	-
Do. Do.,.....	-	-	1¼ tons.
Sugar Scrapings,..	35 packages.	-	-
Sundries,.....	3,343 packages.	-	-
Do.,.....	-	-	129 tons.

Some casks which, according to the manifest, contained "grease", were found packed with livers, kidneys, and hearts in a putrid condition, intended for the preparation of "table delicacies." Other casks supposed to contain "meat" were found to contain flesh chopped up into small pieces of about one inch cube, putrid and intended for manufacture into sausages, the nature of the "meat" in question being extremely doubtful.

DISEASES AND DEATHS.

The most frequently occurring febrile disorder amongst Merchant Seamen is Enteric Fever; then come Small-pox, "Continued Fever," Scarlet Fever, Erysipelas, Measles, and Diphtheria. Boils and obstinate constipation are also very common. But the most prevalent diseases are Rheumatism, Catarrhs, Pleurisy, and Pneumonia.

C H O L E R A.---- This is a disease which is more frequently met with in tropical regions, such as India and China. Occasionally, however, it assumes an alarming increase, and spreads rapidly along definite lines of traffic, even reaching our own shores on several occasions. During 1902 this disease was in virulent and epidemic form in many localities -- in India, China and Japan, Arabia, Egypt, and other countries. It extended from China to the Philippine Islands, and also from Egypt to Palestine. The Egyptian outbreak seems to have originated from Mecca in Arabia, and may almost certainly be ascribed to pilgrims from India, the home of Cholera. Those pilgrims carried it to Egypt, where Cholera broke out on a considerable scale. The village first attacked was Moncha in the Delta -- here the wells became infected, and the disease spread rapidly. Several days afterwards it broke out in Cairo, in a refugee from Moncha; next day there were 30, and on the following day 100 deaths all over. It even spread to Alexandria, Port Said, Suez, Gaza, and Jaffa. As the winter approached, the epidemic greatly declined, and last year Egypt was free from the disease.

Recent information points to the fact that an outbreak of Cholera has occurred in St. Petersburg, and that precautions have been adopted in order to effectively deal with it. -- All masters of vessels should avoid, if possible, obtaining water and fresh vegetables in countries where Cholera occurs.

Y E L L O W F E V E R.-- The old haunts of this disease are the coasts of South America, the River Amazon, and the Gulf of Mexico, where it still lingers. The disease has been eradi-

cated at Cuba. The following ports are still affected:-- Manaos, Rio de Janeiro, Para, Panama, and the chief ports of the Gulf of Mexico.

P L A G U E:-------- is closely connected with ships, and the contagion of it has been brought by them to this country. Glasgow was infected with Plague during the years 1901-02, but, as a result of the precautionary measures adopted by the Health Authorities there, a recrudescence of the disease was prevented. In Egypt, the cities of Alexandria and Assiout, and the provinces were infected up till last year. It also reached Odessa, Constantinople, and Smyrna. It is, however, in India, and the farthest East, that the disease is working greatest havoc, where just now tens of thousands are dying weekly. China is still infected; Formosa and Yokohama have had cases up till quite recently. From Yokohama it was conveyed to Tokio, and, according to official reports, was brought to that city in cotton imported through a Japanese firm doing business in Yokohama. In South Africa, Cape Colony has had some cases during the year, and two cases with one death are to-day recorded at Port-Elizabeth. Plague-infected rats continue to be found in that town and East London. Mauritius has had a bad record, also, for the year, and again this fortnight 50 cases are reported, with 32 deaths. A heavy mortality was noticed amongst rats in the infected districts during the time of the last outbreak of Plague at Durban.

United States:-- Considerable danger to the United States lay in the existence of a definite nidus of Plague at San Francisco, which was for a long time ignored by the official State Board of California. This danger existed during nearly three years in that part of San Francisco known as "China Town." At a special conference of the United States' Boards of Health a resolution was passed, emphasising the fact that the gravity of the circumstance was greatly increased by the gross neglect of official duty of the State Board of Health of California.

Mexican Coast.-- Plague appeared at Mazatalan on the Mexican coast. From here it was carried to Ensanada, which is close to the United States' frontier. Chinese direct from China are presumed to have brought the disease direct or after transhipment at San Francisco to Mazatalan, afterwards making their way to Ensanada. No extension eastwards across the States occurred, and the North Atlantic seaboard remained free from Plague.

ENTERIC FEVER:-- Masters of vessels should avoid water of a suspicious nature whilst in foreign ports, especially along the South American seaboard, and adopt as a safeguard either boiling all the water obtained from those rivers or use distilled water.

BERI-BERI & DYSENTERY:-- are reported to have occurred amongst the troops now engaged in the Far East.

In the Statistics of medical cases admitted into the Seamen's Hospital, London, in the decade, 1880-89, Drs. Curnow and Smith state that:-- "Sailors suffer in greater proportion than residents in this country from such diseases as -- Enteric Fever, Malaria, Aneurisms, Dysentery, and Abscess of the Liver." The authors specially call attention to the large number of cases of Phthisis (nearly one-seventh of the total), and believe that, with better food and improved ventilation of the sleeping rooms, this could be decreased. Chronic rheumatism, as might have been anticipated from the constant exposure to wet and cold and from a poor diet, "figures very largely." Pneumonia is"always very severe." "Enteric Fever is still very common, and, like Dysentery, is due to the water-supply being infected." Cases of Scurvy have been reduced in number from 101 in 1865 to 2 in 1902, the reason attributed being the increase in steam-shipping and decline in the number of sailing vessels in recent years. Shorter voyages mean fresh supplies of food, and this must eventually lead to a practical extinction of the disease.

The Registrar-General of Shipping and Seamen calculated that the rate of suicide amongst firemen and trimmers in the Mercantile Marine was about 1 in 900, as against 1 in 5,000, taking ages between 20 and 55 furnished by the Registrar-General of Births and Deaths on shore. "There can be little doubt, concludes the Registrar, that the figures as regards suicide or supposed suicide fairly represent the actual condition of things, and though the rates of suicide I have given, based as they are on estimates, may be criticised, no amount of criticism will obscure the fact that suicide amongst firemen in our Mercantile Marine Service is prevalent to a degree calling for serious attention."

CONCLUSION.

It is surprising how few people there are, except those immediately concerned, who have any practical knowledge of the amount of sanitation or otherwise which obtains in the ships of the Mercantile Marine. It is a subject that deserves attention, as it affects a class of men whose hardships and privations we daily read about, and the death-rate amongst whom compares very unfavourably with that of other dangerous callings. Crew's quarters can, and ought to be in such a position on a vessel as to render them habitable under ordinary conditions; and, until that is done, the main object, from a hygienic point of view, is not attained. With vessels built of all shapes supervision when in the hands of the builders is absolutely indispensable. The structural alterations ordered by Port Local Authorities, after the vessel leaves the builders, are frequently indirectly the fault of the administration. Again, and this is a point which is frequently overlooked, it costs no more in the first place to provide accommodation for crews in accordance with sanitary laws than to follow a contrary course.

Perfection should always be the direction aimed at by human efforts, however imperfect may be the result; and the success of sanitary legislation will be measured by the nearness or the distance of its actual results from the perfect idea. This is the spirit in which the Public Health Acts of this country have been enacted from time to time for the good of the people and the country generally. To Sanitary Scientists much is due for their untiring energy in this direction, but, however much they have advanced the science of how to live healthily, their efforts in the main have been devoted to the laws which govern the elements on shore; and, although the same natural laws apply to vessels afloat, still the construction of a ship differs so much from that of a house that, to obtain a like degree of success, a greater attention to the subject is needed.