smallpox hospitals. The results, instead of proving beneficial, were the reverse. In fact, there were more cases of smallpox in Hampstead under the new order of things than when 600 were in hospital at one time. Formerly, the patients had been retained in hospital until they were free from infection; the new conditions necessitated the frequent removal of patients during the desquamation stage to the camp hospitals. Further than that, mild, but nevertheless acute cases, were, after detention in hospital for a few hours, also removed. By seeking to overcome aggregation, the authorities only encouraged the diffusion of infection by the off-repeated removals of patients to and from the hospital. In the face of such facts, one cannot be expected to place much reliance upon spot maps and circles as evidence against smallpox hospitals.

In conclusion, if reports are to be formulated regarding the alleged evil influences of smallpox hospitals, the reporter must follow at the heels of those actively engaged in combating the spread of the disease itself. He may observe for instance, infected bedding being thrown from a window three storeys up to the waiting "bedding van" down below. He must be careful to observe the manner in which contacts are traced and kept under observation. I need not, however, outline the plan for the would-be investigator. He must do his own prospecting. I might, however, turn his serious attention to the possibilities from crowds of sightseers who press forward and jostle the bearers and stretcher conveying the patient to the ambulance.

I began as a believer in the aerial diffusion theory. Actual participation in several smallpox outbreaks has changed my mind.

A NOVELIST'S VIEW OF THE MEDICAL OFFICER OF HEALTH.—"It should be a part of the organisation of a civilised State to have a public health service of well-paid, highly-educated men distributed over the country and closely correlated with public research departments and a reserve of specialists, who would be as ready and eager to face dangers and to sacrifice themselves for honour and social necessity as soldiers and sailors. It is, indeed, a transition from private enterprise to public organisation that is already beginning. We have the first intimation of the change in the appearance of the medical officer of health, underpaid, overworked and powerless though he is at the present time."—*H. G. Wells, "New Worlds for Old."*

ENTERIC FEVER ON BOARD SHIP.*

By A. K. CHALMERS, M.D., D.P.H.,
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DURING the year 1907, an outbreak of enteric fever occurred on board a liner trading with America, which presented several features deserving of notice. In all, there were ten cases between August 10th and September 19th—a period long enough to allow of the vessel returning to this country from America, and again completing her voyage outward.

The patients included the saloon steward, two stewardesses, an engineer, two lady passengers travelling in the saloon, and the third officer, the purser, the second cook, and the captain. The first illness dates from August 10th, three days after the arrival of the ship in the foreign port, and was in the person of the saloon steward, whose berth was in what is colloquially known as the "glory-hole," or sleeping quarters of the stewards, and was in this case situated under the water line, in the fore-peak. He was nursed here for two days by the stewardess, who sickened on August 21st. From August 12th to 15th he was treated in the ship's hospital as a suspected case of enteric fever, the stewardess meanwhile continuing in attendance on him. The sequence of sickenings thereafter was as follows:—

August 21	...	The stewardess.
" 22	...	An engineer.
" 25	...	Two lady passengers and third officer.
Sept. 6	...	Another stewardess.
" 8	...	The purser.
" 12	...	Cook.
" 19	...	Captain.

These cases would appear to fall into three groups, the first sickness standing alone, the second group including the five sickenings within four days, August 21st to 25th, and thereafter the four sickenings occurring separately at intervals between September 6th and 19th. The three officers of the second group remained on duty till the arrival of the ship in Glasgow on August 25th, and the first patient of the subsequent group sickened on the thirteenth day thereafter (September 6th.) During the first six days of the interval (August 25th to 31st), the ship was in dock in Glasgow.

*Annual Report, 1907.

With regard to the origin of the first illness, as the ship left Glasgow on July 28th, it is probable that the infection was obtained in this country. But from the eleventh to the fifteenth day after this sickness began, five others became ill, and was undoubtedly secondary to this attack.

During the first two days of his illness, the patient was attended, as has above been said, in his bunk by the second cabin stewardess, who meanwhile also performed her other duties.

She herself sickened on August 21st, an engineer on 22nd, and two lady passengers who had joined the ship at Montreal not later than August 15th, sickened ten days thereafter, namely, August 25th, when, also, the third officer sickened. This date corresponds with the arrival of the ship in Glasgow.

We may now endeavour to discover the relation which each of these bore to the patient in the "glory hole." The stewardess's infection is easily accounted for. She was dealing with an infectious disease without knowing it, and her experience is frequently repeated elsewhere. The two lady passengers who joined at Montreal not later than August 15th travelled in the saloon, and used the same lavatory accommodation as the stewardess. The engineer's quarters were in a different part of the ship, while the third officer's quarters were in a house on deck aft, and opposite those of the engineer.

The interval which now occurred extended from August 25th to September 6th (and during the first six days of which the vessel was in the harbour of Glasgow), when another stewardess sickened, and thereafter on the 8th, 12th, and 19th the purser, second cook, and captain fell ill in sequence.

Regarding the illness of the stewardess of this group, it may be observed that she used the same lavatory accommodation as the one who had formerly sickened.

The purser had accommodation on the deck amidships, but had transferred on August 28th to another ship, on which he sickened eleven days thereafter. Regarding the second cook, it is noted that he slept in the same "glory hole" occupied by the first patient during his illness, while the captain sickened, as stated, on September 19th. Some time between September 19th and 27th the ship was in collision, and this led to considerable repairs, and the cessation of the enteric fever.

Source of Infection and Method of Spread.—

As has been said, it is possible to separate the source of infection of the first case from the others which followed. The first patient obtained his infection before joining the ship, most probably Glasgow.

During the development of the sicknesses, the vessel made a voyage each way across the Atlantic, and was for some period in ports on both sides. Two only of the patients were passengers, and these were ladies on whom the stewardess, who was the second case to sicken, attended, along with her other passengers. All the other patients were officers or members of the crew.

The first group of secondary cases, numbering five, sickened within four days, namely, between August 21st and 25th; the second group, numbering four, sickened, as has been said, over a period of a fortnight, between September 6th and 19th. Between the concentrated stream of infection, which in four days claimed five victims, and the irregular movement, which in a fortnight only caused four, there is a contrast, which suggests that the method by which the infection was spread in each case was different. Water was excluded by the absence of cases among the passengers (save in the two instances quoted), and by the lack of any considerable degree of simultaneity in the dates of sickening of all. Even common use of the lavatory accommodation lacks a sufficient basis of argument in its favour, because six of the ten patients used lavatories in common with a large number of both passengers and crew. It was observed that many of the patients remained on duty, or without attendance, during the early days of their illness, and the sequence of events, and particularly of the cases occurring in September, suggests that the infection was such as must necessarily happen where infectious disease is handled without being recognised, and food becomes liable to contamination either by direct soiling from unclean hands, or by other methods of transference by insects, which are now recognised.

If, indeed, one could imagine accidental transmission of infection on the feet, not only of insects, but of vermin on board ship, the distribution of the cases in the last fortnight would be explained. It suggests an occasional and not in any sense a constantly acting infecting agent. Here one of the patients was the stewardess, another the

purser, the third was second cook, and the last patient of all was the captain.

Sleeping accommodation, lavatory accommodation, almost everything was different, and yet unquestionably these illnesses arose from a strain of infection remaining on board from a patient who sickened on Aug. 21st.

It was impossible, however, without inquiry, to set aside the question of the part played by the water supply, and as the result of this I have asked Dr. Wilson to prepare a report on the methods of storage and distribution of water on board ship, and that report is appended hereto.

STORAGE AND DISTRIBUTION OF DRINKING WATER ON BOARD SHIPS.

The importance of a pure water supply stored and distributed free from contamination is as much a necessity to health on board ship as to health on land.

Quicker voyages and the possibility of more frequent renewals of fresh water may counter-balance the vastly greater amounts required on the great ships of to-day, but the sources and dangers of contamination, both in the methods of storage and distribution, are proportionately increased with the elaboration and complexity of the methods adopted.

METHOD I.—The simplest and earliest method is that still in vogue on the smaller sailing vessels, viz., two or more stout wooden barrels, usually of a flattened oval shape, securely fastened to the deck in pairs abaft the masts. In these the water may be kept wonderfully clean and sweet, since they are movable and easily enough cleaned. The water for use is withdrawn by means of a long, round, narrow tin, called a "dipper," which passes through the bung-hole, and is kept suspended in the water by a cord attached to the bung.

METHOD II.—This method, used in larger sailing vessels and smaller steamships, differs from the first only in that the reservoirs are square-shaped iron tanks provided with an oval manhole, the cover of which is perforated, and the water withdrawn either by a suspended dipper, as described, or by means of a tap placed an inch or two above the level of the bottom.

METHOD III.—In the large tramp steamers, built fifteen to twenty years ago, huge tanks were built into the ship.

In these older vessels one finds such tanks resting on plates or supports, e.g., in the forward hold, reaching upwards nearly to the 'tween-deck. They are placed one on each side of the vessel, the inner side plates being perpendicular and parallel to each other, the outer side plates following the curve of the ship's sides, but leaving a space between, which is intersected by the connections between the tanks and the ship's frame. The bottom of such a tank would thus measure only two or three feet in width, whilst the top of each would be almost the width of half the 'tween-deck, and to reach the manhole, one must crawl between

the tank top and the 'tween deck. Such tanks are sometimes met with singly, built into the fore or after-peak of a vessel. Large built-in tanks are also sometimes found built one on each side of the engine-room, and resting on the 'tween-deck.

If a single large tank is used, and not placed either in the fore or after-peaks, it is usually found in the hold amidships, supported on plates raised a foot or so above the keelson. They are often oval in shape, and reach up to the 'tween-deck, the manhole having an outward curved lip two or three inches above the level of the 'tween-deck to keep deck washings, etc., from getting on to the manhole cover.

All large tanks are provided with movable plugs on a level with the bottom for washing out sediment, etc., the water tap always being on a higher level.

The water for use is raised to the deck by means of hand-pumps, usually fixed somewhere near the galley.

METHOD IV.—Cellular Tanks.—Recently, where large tanks like those described would be required, either a number of smaller square ones or one (or two) large "cellular" ones are used for the storage of drinking water. (Tanks of all sorts when used as reservoirs for water intended for domestic purposes are called "domestic tanks.")

The cellular "domestic tank" is a large square iron box divided into cells by means of partitions, inserted for the purpose of restraining the weight of the water when the vessel rolls at sea. These partitions are perforated by manholes which allow the water to pass from one section of the tank to another, and no manhole in one partition is opposite that in any other. They are large enough for a man to crawl through, so that the whole tank can be thoroughly hand-cleaned and cement washed when necessary.

The most usual site chosen for "domestic tanks" is somewhere amidships, and the water is withdrawn from the tanks by means of hand-pumps or direct cocks. The former is usually necessary if the tank site be on or below the level of the main deck, whilst the latter is sufficient when the site is far enough above that level for gravity to provide the effluent force.

In attempting to classify tanks and methods, the object has been to facilitate description, and it should be noted that there exist many combinations of the methods described.

Out of the water, instead of the fine lines ending at the bottom in the sharp keel, in front in the graceful bow and astern in the rounded counters, which one associates with sailing ships, the present-day steamship more nearly resembles a great box or rather warehouse. The bottom is almost flat, and near its junction with the more or less perpendicular sides a sort of keel is placed, one on each side, along part of the length of the vessel, to prevent rolling when at sea (called rolling chokes).

There still remains a few inches of depth of keel along the centre, but the greater part runs along the bottom on the inside, chiefly to strengthen the structure, and called the keelson.

These vessels have two bottoms, the second being about $4\frac{1}{2}$ feet to 5 feet above the lower, or what is called the "skin" of the ship.

The space between is divided up into tanks like the cellular ones described. They are always limited by the holds and the transverse water-tight bulkheads. Any of these bottom tanks, except the fore and after-peaks, may be divided by an imperforate partition running along the keelson, so as to make double or port and starboard tanks in one or more of the holds.

The tanks ending in the bow and stern, called the fore and after peaks, necessarily take the shape of the vessel, and whereas the bottom tanks are square and have a uniform depth of about $4\frac{1}{2}$ feet, those of the fore and after-peak are single, deep, and narrow at the bottom. The depth might be 16 feet to 18 feet, according to the size of the vessel.

The reason for describing these tanks, and the "bilges" which also form part of the double-bottom space, is that the tanks are being used on large vessels to carry reserves of water for domestic uses, and that the bilges, now about to be described, lie close against them—indeed share one partition wall between them, and so form a possible source of contamination to the reserve water.

Bilges.—In sailing and in all older vessels the bilge space is in the centre, but in the newer, "flat-bottoms," except in a few which have unusually fine lines fore and aft, the spaces are at the sides. They are of a V shape, and formed by the outer walls of the port and starboard tanks and the sides or skin of the ship, which curves a little outwards and upwards before rising perpendicularly.

These bilge spaces or wells are divided off by the holds or water-tight bulkheads, as are the water-ballast tanks.

Each "well" is provided with a pump, the bilge end of which is hook-shaped, and has a sort of watering-pan rose end to it. This arrangement leaves the rough sediment behind for periodical special cleanings. The deck ends, to which the suction pumps are fitted when the pumps are not in action, are always plugged with round brass plugs marked "bilge." These openings are also used as "sounding wells," i.e., for measuring the amount of water in the bilge or wells.

The bilge spaces are divided by manhole partitions similar to those of the cellular tanks, and they are more or less about 18 inches or so in depth. They are not covered on the top except by the flooring of the hold, and consequently can be reached only in "light" ships.

METHOD V. is a combination of certain of the aforementioned varieties of domestic tank variously situated, and connected with an overflow distribution tank placed on the highest possible site, viz., the bridge deck, for the distribution of the water over the ship by gravitation. Added to these there is a stock of fresh water stored in certain of the "bottom" or "water ballast" tanks, and connected by steam-pumping power through the emptying pipes already mentioned.

Reserve Water.—I. When used for drinking purposes, the reserve may be pumped directly into the domestic tank, and thence by hand or steam pump up to the "distribution" tank on the bridge deck, or it may be pumped directly into the "distribution" tank, and from there turned by cock into the domestic tanks for special uses, as well as over the ship through pipes for other special purposes, e.g. lavatory basins, baths, the galley, pantries, etc.

II. The cattle water is always stored in the ballast tanks apart from the "drinking" water circulation. It is pumped up either into an overflow distribution tank of its own, and carried along the decks in pipes provided with cocks from which the cattle water barrels are filled, or it is pumped up as in the ordinary emptying process, and carried along the decks to the cattle water barrels by means of connected lengths of hose.

III. In large vessels a special reserve and circulation is sometimes kept for cooking, washing, and such domestic purposes, so as to save the store in the domestic tanks for drinking water alone. In such large combined passenger and cattle ships as the s.s. "Ionian" and s.s. "Sicilian" (Allan Line) there are three classes of water reserves and circulations, viz., that for drinking water, that for cooking and washing water, and that for the cattle water.

Condensed Water and Boiled Water.—The methods of storage and distribution of water on board ship would be incomplete without mention being made of the occasional use of condensed water and of boiled water, special apparatus for the production of one or other of which is frequently carried by vessels as a provision against shortage or contamination of the regular supply.

A *Drinking Water Condenser* is an apparatus connected with the engine cold water circulating pump, and so arranged as to cool and condense steam from the boiler. The condensed steam runs into a tank on a lower level, from which it is withdrawn through a cock placed as already described. Condensers are usually situated in or over the engine-room conveniently to the circulating pumps mentioned.

Distilled or even boiled water is not over pleasant to the palate, but certainly better than brackish or contaminated water.

An *Apparatus for Boiling Water* is a sort of reversed condenser; in the latter the cold water condenses the steam, and in the former the steam boils the cold water. The source of the water to be boiled is, of course, different; it is pumped by hand from the domestic tank into the boiling apparatus, and there rapidly boiled by steam from the boiler, after which it is passed into a special tank, from which it is withdrawn through an ordinary tap cock.

This method of boiling water in bulk is not frequently met with; in fact, it has been noted at the Tail of the Bank on one vessel only, viz., the s.s. "Harald," a Norwegian cargo ship.

On account of this boiling of the water, the captain thought it unnecessary to clean his

domestic tanks more than once a year. The boiled water reservoir, however, was cleaned and cement-washed every voyage.

Overflow and Distributing Tanks.—This tank is simply a small circular boiler placed on the highest available site, viz., the bridge deck. It may rest horizontally or perpendicularly, and is met with of two different patterns.

As already stated, the pumping or filling power, although usually by steam, may be by hand.

The pattern most frequently met with is filled from the engine-room, and pumping is continuous, as all the water which reaches the level of the overflow pipe returns to the reservoir or ballast tank. The pressure within is thus constant while the pumping is in progress.

The second pattern requires intermittent pumping, and is better adapted to hand work. Its overflow pipe rises from the highest level of the tank, and usually ends swan-necked and open, so that the tank is known to be full when the water spouts from this open end. This overflow pipe varies in diameter, and height, sometimes being carried half way up the ship's funnel when greater pressure is required.

Sanitary Tanks.—Sanitary tanks are similar to those just described, and also occupy the bridge deck. They are, however, directly connected with the circulating engine pumping apparatus, and are constantly kept filled with sea water, which is carried through the ship by means of pipes to cisterns for flushing water-closet pans, filling sea-water baths, etc.

For the crew's and steerage latrines, the constant closet flushing is generally carried out through pipes laid directly from the said engine circulating pumps to the closets, and there regulated over the troughs or pans by means of a wrench tap.

In certain tramp steamers this flushing of closets is done by means of a hose, which is also used for deck cleaning, etc. It has its source in the above-mentioned salt-water circulating system.

SPITTING IN A RAILWAY CARRIAGE.—At Marylebone, William Nash, living at Clyde-road, South Tottenham, was summoned for unlawfully spitting upon the floor of a carriage on the Charing-cross, Euston, and Hampstead Railway, contrary to the bye-laws and regulations of the company. Mr. B. O. Bircham, barrister, represented the company, and said that the defendant was seen to spit three times. This was the first prosecution. The defendant admitted the offence. Mr. Paul Taylor remarked that he was glad to see these proceedings taken on sanitary grounds. He ordered the defendant to pay 5s.

CREMATION IN BRITAIN.—At the annual meeting of the Manchester Crematorium Society on November 19th, the chairman gave the following figures of the number of bodies cremated at the various crematoria named during the year:—At Golders Green, 315 bodies were cremated; at Woking, 108; Manchester, 109; Hull, 32; Liverpool, 28; Glasgow, 23; Birmingham, 22; Leeds, 21; City of London, 13; Leicester, 12; Sheffield, 8; Darlington, 6; Bradford, 5.

AN OUTBREAK OF CHOLERA FOLLOWING A HINDU FESTIVAL.*

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AS cholera is the chief danger of all great festivals, I give here a short account of the "Ardhodoya Jog" of 2nd February, 1908.

This great Hindu festival, which only occurs at long intervals, fell on 2nd February, 1908, the previous ones having taken place on 8th February, 1891, and 7th February, 1864. Its date seems to be determined by astronomical celebrations, viz.: "when the moon is in conjunction with the sun in the constellation of Capricorn between its 10th and 23rd degrees (Shravana Nakhshatra). This conjunction must take place on a Sunday and during the day time in the month of Paus or Magha (15th December to 15th February). Pious Hindus on such an occasion consider it a highly important duty to bathe in the sacred waters of the Ganges and worship in some famous temple on its banks. There is consequently a general movement towards the Ganges and its tributaries, and the river Hooghly with the temple of Kalighat are selected for this particular occasion by vast numbers of the Hindu population, both in Calcutta itself and from a wide area around. Old men and women, but also women of all ages prepare for and attend this festival in large numbers.

Great preparations were made for the pilgrimage of 1908, as it was anticipated that an enormous number of pilgrims would come to Calcutta. The attendance of visitors in 1891 was roughly estimated at 1,500,000, but it was freely asserted that at least 5,000,000 might be expected this year.

The forecast in this respect has proved incorrect, as the returns from the railway, and steamboat companies indicate that the number of pilgrims certainly did not exceed and probably was less than that of 1891.

The sanitary and medical arrangements were made by the health department, but special preparations on a large scale were made by the railway authorities for the arrival and departure of the pilgrims and by the police with regard to the regulation of the traffic.

From previous records a cholera outbreak was expected, and the sanitary arrangements were chiefly based on the probability of this occurrence. Cholera is always more or less in Calcutta, and the district of Kalighat has an unenviable notoriety with regard to this disease. In October and November of 1907, there had been a sharp though not an extensive outbreak, but during December and January (1908) Calcutta was comparatively free.

The preparations made consisted chiefly—

1. In the erection of filtered water posts at every 100 feet along all the principal roads leading to Kalighat temple in order that there should be

* Annual Report, 1907.