

cubic feet of space was completely changed ten times in every hour. On the contrary it was not changed once during the nine hours I remained in my room.

Even if the perforations in the top of the partition had not been closed up, I could not have obtained the minimum amount of ventilation necessary for health, for we have no reason to suppose that such a heavy gas as cold carbonic acid could perform such a miraculous feat as to climb to the top of the partition and crawl through those little holes.

On the contrary, under the most favorable circumstances with natural ventilation, it is admitted that the air in a room cannot be changed oftener than three times in an hour. How utterly impossible, therefore, with similar means, to change ten times in an hour the atmosphere of a room so especially unfavorably situated for ventilation as a stateroom *below* or even *between* the decks of a ship.

What would have been the result if there had been, as the room was intended to contain, three occupants instead of one? I dread to think of it. Perhaps our fate would have been that of the seventy persons who were found dead next morning out of the one hundred and fifty passengers who were shut up in the cabin of the Irish steamer "Loudonderry," during a stormy night in 1848. What must be the feeling of the emigrant, who according to the regulations of the British Board of Trade is allowed seventy-two cubic feet of space? Is the air in the "steerage" changed forty-three times in an hour, which it should be in order that each occupant of the above seventy-two cubic feet of space should receive the necessary three thousand cubic feet of fresh air? Manifestly not, since by natural means the air in a room can only be changed three times in an hour. If there are twelve hundred passengers below deck, as there frequently are, all night, they would require at last three million six hundred thousand cubic feet of air per hour, while ten funnels or ventilators one foot square, into which the wind is blowing at the rates of thirty miles an hour, would only deliver one million five hundred and eighty-four thousand feet, or nearly two million feet per hour, short of the requirements of health.

Professor de Chaumont says: "Air is the prime necessity of life. Food or water may be abstained from for a considerable length of time,

and we may thus have an opportunity of replacing either should we doubt its purity or healthfulness, but the atmosphere around us we must breathe or die. Hence the paramount necessity of having it pure. But, he continues, though this is apparently so obvious, attention to its importance has been very generally omitted. I may add, that while defective ventilation has caused thousands of deaths on shore, the above remarks are especially true when applied to ships. For it is a well known and generally admitted fact that ship fever was due to the emigrants being compelled to breathe over and over again an atmosphere charged with organic matter in a state of decomposition; while only the thin walls of the vessel stood between them and an unlimited supply of the purest of pure air."

Although the Merchant Shipping Act of 1855, by forbidding the carrying of passengers in the hold, and by limiting the number to be carried on deck to one for every seventy-two cubic feet of space, put an end to such wholesale slaughter, still I think it is evident from what I have said, that with the present system of ventilation, that amount of space is only barely enough to sustain life, without even mentioning comfort or health.

But whether the ocean traveller gets even this small amount of space or not, is left very much to the discretion of the emigration officer at the port of embarkation, who may or may not understand the importance of a sufficient supply of air.

Should anyone doubt the exactness of the scientific experiments and calculations of the most eminent authorities, such as Richardson Parkes, de Chaumont, Hammond and others, on whose authority I have made the above statements, let him go down into the steerage or even staterooms of an ocean steamer, just arriving from sea, and his nostrils will testify to the truth of these assertions.

Dr. Heber Smith, in the United States Marine Hospital report for 1871, says: The sickness rate among seamen is probably greatly augmented by the want of light and air, and by the presence of dampness and filth so often observed in the forecables of even the largest and best equipped sailing and steam vessels. Many of the forecables which he examined illustrated the bottle form of ventilation, for where the hatches were closed, as they generally are in rough weather, the bottle was complete, even to the cork.