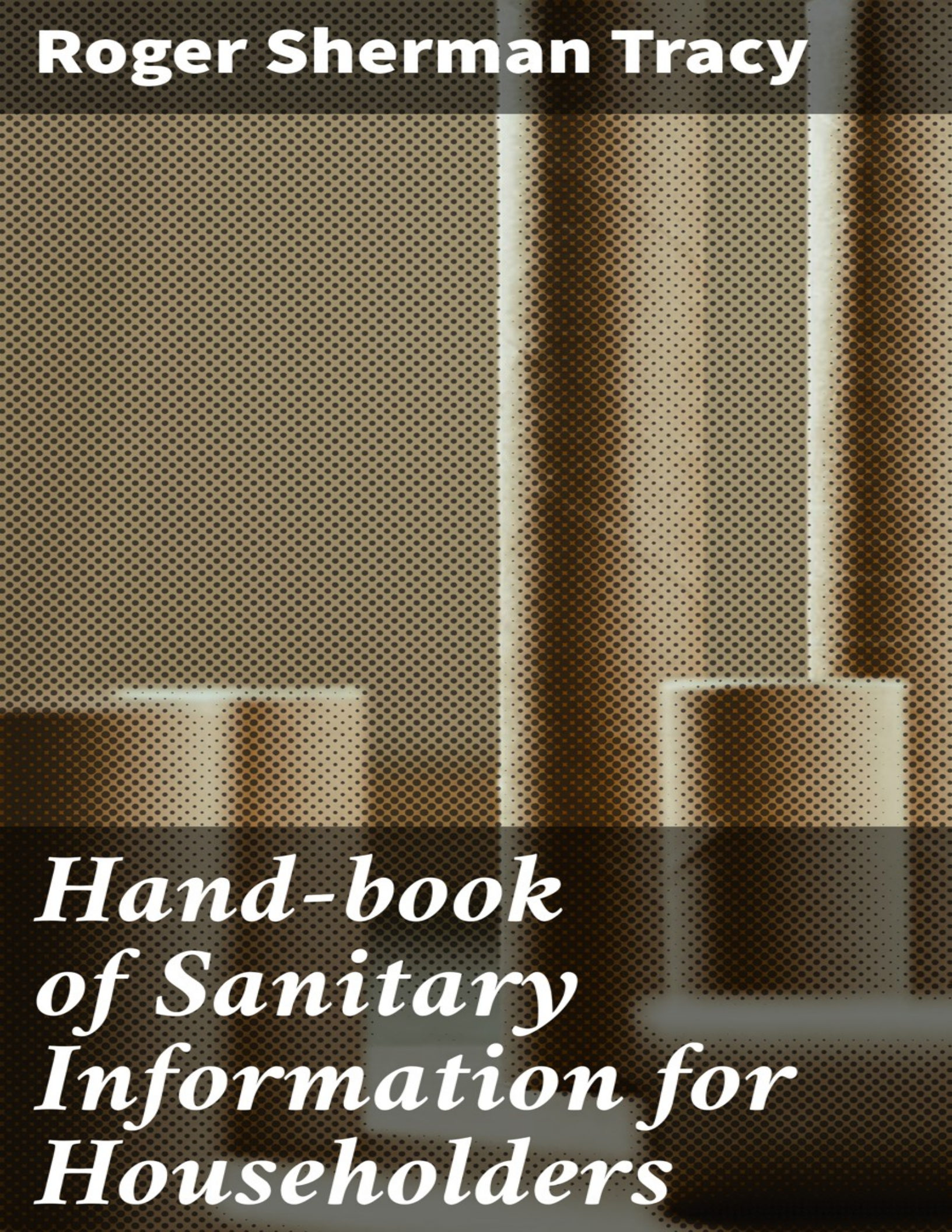

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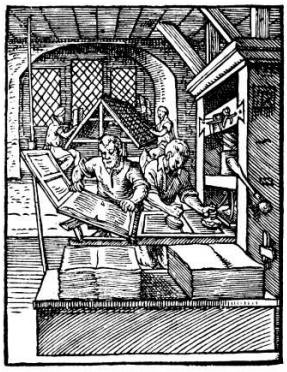

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PREFACE.

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The preparation of this hand-book was suggested by persistent questioning about the matters it contains. Its purpose is to furnish householders with information which has been so scattered, or buried so deep in technical discussions, that it has not been easy for them to find it for themselves. It is, of course, mainly a compilation, and the only difficulties met with have been those incident to the arrangement and condensation of a large mass of material. I have intended to give credit, where credit seemed to be due, for everything borrowed, and, if I have failed to do so in any case, it is not my fault, but my misfortune.

R. S. T.

HAND-BOOK
OF
SANITARY INFORMATION.

Necessary to continued good health are GOOD AIR, GOOD FOOD, and GOOD WATER. It is the object of Sanitary Science to secure these.

CHAPTER I.
AIR.

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Normal air contains 79 per cent of nitrogen, 20.96 per cent of oxygen, and .04 per cent (4 parts in 10,000) of carbonic acid.

Oxygen supports animal life; carbonic acid, vegetable life; and the use of the nitrogen, otherwise than as a diluent, is not known.

Very pure air contains 78.98 per cent of nitrogen, 20.99 per cent of oxygen, and .03 per cent of carbonic acid.

Air begins to be very bad when the oxygen is reduced to 20.60 parts in 100. In mines, where candles go out, oxygen is reduced to 18.50 parts in 100, and, in the worst specimen yet examined by Angus Smith, to 18.27. Air in which the percentage of oxygen has been reduced to 17.20 is very difficult to remain in for many minutes.

Aside from impurities due to local causes, the purest air is found from six to forty feet above the ground, and the most impure from seventy to ninety feet, where the air from chimneys is poured forth.

Air is contaminated by the products of respiration and the bodily emanations of healthy persons, and by the products of combustion.

An adult man, in ordinary work, gives off in twenty-four hours from twelve to eighteen cubic feet of carbonic acid, according to his size; women, children, and old persons less.

Edward Smith found that an adult asleep exhaled about nineteen grains of carbonic acid per hour, and, when he

walked three miles an hour, the amount was increased to 100.6 grains.

W. R. Nichols, of Boston, found in passenger-cars 23.2 parts of carbonic acid to 10,000 parts of air, and in the Berkeley Street sewer 10.4 parts per 10,000. Wilson found in Portsmouth Prison, in cells containing six hundred and fourteen cubic feet of air, always occupied, 7.20 parts per 10,000, and in cells containing two hundred and ten cubic feet, occupied only at night, 10.44 per 10,000.

Besides the carbonic acid, there is exhaled from the lungs a small amount of organic matter, of unknown composition. It forms a glutinous coating on the furniture, walls, and windows of closed rooms, decomposes rapidly, imparts a peculiarly offensive odor to the air of a badly-ventilated room, and poisons those who inhale it. Its quantity is so small that it has so far defied analysis. In a room contaminated by respiration alone, the odor of this substance begins to be perceived when the carbonic acid has increased to about 7 parts in 10,000, and 10 parts in 10,000 may be considered the maximum amount of carbonic acid allowable in dwellings.

The following table shows how much carbonic acid artificial lights produce per hour:

Petroleum, slit-burner,	10	candle-light,	1.98	cubic feet,
Petroleum, round-burner,	7.6	”	2.15	”
Oil-lamp,	4	”	1.09	”
Candle,	1	”	.39	”

Coal-gas, slit-burner,	7.8	”	3.25	”
Coal-gas, flat-burner,	10	”	3	”

A five-foot gas-burner produces as much carbonic acid per hour as five men.

As the most poisonous element of the breath can not readily be detected by analysis, the amount of carbonic acid is taken as a measure of the impurity of air contaminated by respiration.

Test for carbonic acid in air (Pettenkofer’s method):

Shake up a definite volume of the air in a closed vessel with a definite amount of lime-water. The carbonic acid unites with the lime, forming carbonate of lime. This compound, being insoluble in water, renders it turbid. The degree of turbidity may be judged of by looking through the water at a cross marked in lead-pencil on the inside of a piece of paper pasted on the opposite side of the bottle, and a standard may be fixed by shaking up ordinary external air in a sixteen-ounce bottle, as described below, which will show the degree of turbidity produced by 4 parts of carbonic acid in 10,000. Lime-water can be bought of a druggist, or made by shaking distilled water with slaked lime, allowing it to settle, and pouring off the clear liquid. With a common hand-ball syringe, the end of the rubber tube resting on the bottom of the bottle, pump in air, until the bottle is filled with the air to be tested. Put in half an ounce of lime-water, cork the bottle, and shake it up well. Let it stand for five minutes, and if the water becomes turbid, as if a little milk

had been dropped into it, the presence of carbonic acid in the air will be indicated in the following proportions.

Size of bottle. ounces	Amount of lime-water.	Parts in 10,000.
16	1-2 ounce	A little less than 4
12	”	A little more than 5
10	”	A little more than 6
8	”	8
6	”	A little more than 10
4	”	A little more than 15

Dangers of such Contamination.

Air contaminated by the products of respiration and by bodily emanations (perspiration, etc.) contains substances which have been ejected from human bodies as useless or injurious. What all systems reject can not be healthy for any, and it is found that long-continued exposure in an atmosphere laden with these impurities produces anæmia, general debility, and poor nutrition, conditions likely to result in the development of scrofula and consumption. It is believed, too, that typhus fever may originate in this manner, while when such poisons are inhaled in a more concentrated form, as in the famous Black Hole of Calcutta, nausea, vertigo, convulsions, and even death are produced.

The air is at certain times and places contaminated by the products of respiration and the bodily emanations of diseased persons.

In certain diseases, commonly known as **contagious**, organic matters are thrown off by the lungs and skin of the sick, which tend to reproduce these diseases in the bodies of other persons. The exact nature of these poisons is in most cases unknown, but they are generally believed to be living microscopic organisms (bacteria, bacilli, micrococci, etc.), which multiply their kind in the blood of the person who has inhaled them.

Of such diseases, the dangerous ones are small-pox, measles, scarlet fever, typhus fever, and diphtheria, and their contagious quality is marked very nearly in the order in which they are here mentioned.

The less harmful of these diseases are whooping-cough, chicken-pox, mumps, and German measles.

There is strong evidence that consumption is contagious, though not as markedly so as the diseases above enumerated.

The air may be contaminated by the products of the decomposition of the excreta of healthy persons.

The contents of cesspools, privy-vaults, and sewers, are generally composed of discharges from the bowels and kidneys, various matters washed off from the bodies of animals and from culinary and household utensils, and dissolved soap, constituting a mixture which rapidly decomposes and affords a fine soil for the nourishment and propagation of microscopic organisms.