Market woman careful
Of the precious casket,
Knowing eggs are eggs,
Tightly holds her basket;
Feeling that a smash,
If it came, would surely,
Send her eggs to pot
Rather prematurely!
Singing through the forests,
Rattling over ridges,
Shooting under arches,
Rumbling over bridges,
Whizzing through the mountains,
Buzzing o'er the vale;
Bless me! this is pleasant,
Riding on the Rail!

DOMESTIC MANIPULATION.

ON THE OPERATIONS AFFECTING WATER.

THE subject of the Water supply to the Metropolis and other large towns is one of the highest importance to the well-being of the community at large, in whatever point of view it may be regarded—whether as affecting the comfort, the health, or the pocket of the consumer, its influence can scarcely be overrated. To enter, however, into this matter, affecting, as it does, so many varied and conflicting interests, would be to pass beyond the limits set to this series of papers: what remains for us to do is to avail ourselves of the vast amount of scientific knowledge which has been recently brought to bear upon the question, and to cull from it such portions as bear directly upon *Domestic manipulation.*

The quality of water for domestic purposes depends mainly upon its degree of hardness or softness; and this in its turn depends almost entirely upon the quantity of lime dissolved in some form or other in the water. In speaking of the quality of water, the term "degree of hardness" is much used; thus we say that the water of the Thames is of 14 degrees of hardness, that of the Hampstead springs about 10 degrees, &c. &c. In these and most other cases the hardness is owing to a certain amount of chalk, carbonate of lime, dissolved, and the degrees of hardness correspond with the number of grains contained in a gallon of water. The Thames water, of 14 degrees of hardness, has in each gallon 14 grains of chalk, and the Hampstead 10 grains. It is found, upon experiment, that one gallon (weighing 70,000 grains) of *pure* water will not dissolve more than two grains of chalk, and so acquire two degrees of hardness; and that whenever more is contained in water, the excess is always owing to the presence of carbonic acid gas, which enables it to dissolve a much larger quantity. The practical part of our subject depends upon this fact; for if by any means we can get rid of carbonic acid, the dissolving chalk is necessarily precipitated, and the hard water, unfit for culinary and domestic purposes, becomes soft, and well adapted to both these uses. Carbonic acid is in part expelled from water by heating it to the boiling point; a still larger quantity is got rid of after boiling for some few minutes, and nearly every trace disappears at the end of half an hour; and just in proportion as the carbonic acid gas is expelled, so does the chalk fall, rendering the water in the first instance turbid, and becoming deposited on the interior surface of kettles, and where it forms the well-known rock or *fur.*

It has been found that water of 14 degrees of hardness lost two degrees when merely made to boil; boiling for five minutes reduced the hardness to six degrees; and for a quarter of an hour, to little more than four degrees. The practical application of this knowledge needs scarcely to be pointed out. Whenever a soft water is required, boil for several minutes before using. In making tea, for instance, the economy and general superiority of a soft water is well known. Those, however, who use Thames water just made to boil, employ a water of upwards of 14 degrees of hardness; those who boil for five minutes, diminish the hardness of the water by nearly one-half; and by boiling for a quarter of an hour, it can be lessened to one-third. This circumstance is one of those that prove how great a substratum of truth there is at the bottom of most popular notions. How many a young gentleman, with a smattering of science just enough to inform him that water gets no hotter however long or violently it is boiled, has laughed at his grandmother's antiquated notions, because she requested that the water might be made to boil *thoroughly before the tea was made*; the old lady could give no very satisfactory explanation of her prejudice, yet it was not the less a correct one.

Before going further in this matter, it may be stated that there are some waters in which the lime is dissolved in the form of gypsum (sulphate of lime); in these, which fortunately are rare, the hardness is of a permanent character, and cannot be lessened by boiling. Tea made under such circumstances may be improved, either by the addition of a very small quantity of carbonate of soda, or the tea should be kept soaking for half an hour under such circumstances as will retain the heat. This latter is the plan followed in Greenwich Hospital, where they use a well water of 19 degrees of permanent hardness.

In washing, the use of hard water is, as is well known, extremely prejudicial. The explanation is exceedingly simple: every degree of hardness *in a gallon of water destroys ten grains of soap*, and by following out the calculation, it will be found that 100 gallons of unboiled Thames water wastes exactly two pounds of soap before any approach to a lather can be made. Now what is the remedy for this evil? Simply to boil the water some time before use; one quarter of an *hour's boiling will reduce the waste of soap* from two pounds to ten ounces; and half an hour's boiling will still further lessen it to six ounces, but no amount of boiling will make Thames water equal to rain water, which is without hardness.

There is one practical matter of great importance to which we wish to draw the attention of all concerned: it is the effect of boiling linen in hard water. If clothes are put into cold water and then boiled, the precipitation of chalk (which