

All waters known as hard, result from some of the acids or their salts being held in solution. The most common are the carbonic acid and the carbonates, and sulphurous and chloric acids and their combinations. All the waters containing carbonic acid gas, and sulphurated hydrogen (the material that makes the sulphur springs of the country), uncombined with the earths, are rendered soft by simple boiling, as the gases are expanded by heat and thrown off, and no deposit is left; but when united with lime, alumina (clay) or the metals, boiling deposits a portion by releasing the solvent, in the form of a hard, stony concretion.

The process used by washing-women to cleanse the hard water, by adding lye, ashes, or potash, is a strictly correct chemical process. Acids and alkalis are antagonistical principles; one destroys or neutralizes the other, and renders both inert and harmless. The sulphurated waters are more difficult to cleanse, or purify, than any other class, except the muriates (acid of common salt, now called chlorates), as they adhere to their combinations with greater tenacity.

The effect produced on hard water in washing, where soap is used, is very simple when investigated. Soap is a compound of an alkali and animal fat, or vegetable oils and resins, and when added to water containing any acid, or acidulated substance, the acid, by its chemical affinities, seizes and neutralizes the alkali of the soap, disengaging the fatty substance in the same shape it was originally, and in the worst possible for cleansing the person or clothing.

There is a vulgar error prevailing among the people generally, that it is dangerous to add lime to wells and cisterns, on account of its rendering the water *hard*. There is no greater fallacy among our traditional beliefs. Lime is strictly an alkaline substance, and as such, is a neutralizer of all the acids which water contains, and may be freely used when in a *quick* or unslacked state; old and airslacked is hurtful, as it has become a sub-carbonate. One ounce of fresh quick lime, dissolved in water, will soften two barrels of ordinary hard water, and render it fit for washing purposes. It is also advantageously used to sweeten cistern water when it becomes stagnant, and of bad color, and the cheapest and most ready deodorizer of all unpleasant, unhealthy effluvia.—*Rural New-Yorker*.

#### MOTION OF SAP IN TREES.

What a curious hallucination is that which supposes the sap of trees to fall or settle in the winter into the roots! One would have thought that the notorious difficulty of cramming a quart of water into a pint measure might have suggested the improbability of such a phenomenon. For it certainly does require a very large amount of credulity to believe that the fluids of the trunk and head of a tree, can, by any natural force of compression, be compelled to enter so narrow a lodging at the roots.

We shall assume the word sap to signify the fluids, of whatever nature, which are contained in the interior of a tree. In the spring the sap runs out of the trunk when it is wounded; in the

summer, autumn and winter, it does not, unless exceptionally make its appearance. But in truth the sap is always in motion at all seasons and under all circumstances, except in the presence of intense cold. The difference is that there is a great deal of it in spring and much less at other seasons.

When a tree falls to rest at the approach of winter, its leaves have carried so much more fluid than the roots have been able to supply, that the whole of the interior is in a state of comparative dryness, and a large portion of that sap which once was fluid, has become solid in consequence of the various chemical changes it has undergone. Between simple evaporation, on the one hand, and chemical solidification on the other, the sap is, in the autumn, so much diminished in quantity as to be no longer discoverable by mere incisions. The power that a plant may possess of resisting cold, is in proportion to the completeness of this drying process.

When the leaves have fallen off, the tree is no longer subject to much loss of fluid by perspiration, nor to extensive changes by assimilation. But the absorbing power of the roots is not arrested; they, on the contrary, go on sucking fluid from the soil, and driving it upward through the system. The effect of this is, that after some months of such an action, that loss of fluid which the tree has sustained in autumn by its leaves is made good, and the whole plant is distended with watery particles. This is a most wise provision, in order to insure abundance of sap for the new born leaves and branches, when spring and sunshine stimulate them into growth.

During all the winter period the sap seems to be at rest, for the re-filling process is a gradual one. But M. Biot many years ago, proved by an ingenious apparatus, that the rate of motion of the sap, may be measured at all seasons, and he ascertained it to be in a state of inactivity in mid-winter. Among other things he found that frost had considerable influence upon the direction in which the sap moves. In mild weather the sap was constantly rising, but when frost was experienced the sap flowed back again—a phenomenon which he referred to the contracting power of cold on the vessels of the trunk and branches, the effect of which was to force the sap downward into the roots, lying in a warmer medium; then, again, when the frost reached the roots themselves and began acting on them, the sap was forced back into the trunk, but as soon as the thaw came and the ground recovered its heat, the roots out of which a part of the sap had been forced upwards, were again filled by the fluids above them, and the sap was forced to fall. A large poplar tree in the latter state, having been cut across at the ground line, the surface of the stump was found to be dry, but the trunk itself dripped with sap. Sap, then, is always in motion, and if it ever settles to the root in a visible manner, that is owing to temporary causes, the removal of which causes its instant re-ascent.

As to the idea that the bleeding of a tree begins first at the root, and in connection with this supposition, that what is called the rise of the sap is the cause of the expansion of buds and leaves and branches, nothing can well be more destitute of