# Chemistry, Physics, Technology.

## ON TANNING,

One of the most important industries of the civilized world is of course the tanning of hides for the preparation of leather. The immense capital invested, the solid profits of these investments, the great number of workmen whose livelihood depends on this trade, and the usefulness of the product, all this contributes to draw attention to it, especially in New York. This city, since 1638, when one of the four brothers Evertsen, owned the first tannery on Manhattan Island, has taken the lead in the business and is still holding the most conspicuous place in the leather manufacture and trade of the world.

As might be expected, the progress in science, especially chemistry, has during the present century had great influence upon the manufacturing details of this business. The first of the improvements were several mechanical appliances for softening, fulling, rolling, and splitting skins and hides, and for grinding tan bark, some of which devices were introduced long ago. Other methods followed for washing, glazing and finishing leather. Then came the application of water-power and especially of steam in many of the operations, and of hot water in others; finally the extraction of tannin in concentrated solutions, and its application under great pressure, together with instruments and chemical devices for determining the amount of the tannic acid, and consequently the tanning power of various liquors, with greater subdivision of labor in large establishments, resulting in more skillful manipulation in the processes of tanning, currying and finishing leather. To this must be added the sweating and other operations, whereby the gelatine and muscular fibre is more completely exposed to the tannic acid and the density or weight of the leather increased. These improvements have greatly influenced the art of preparing leather in an economical manner.

Two important problems have attracted the special attention of chemists, the first, the invention of devices for shortening the time necessary for the proper penetration of hides by the tanning principle, which as done in the old style requires some eighteen months for its proper accomplishment, and which involved of course, so much loss of interest upon the capital invested, and the saving of which enables the manufacturer to increase his business without increasing his capital, in the same ratio that he shortens the time to transform hides into leather. The second problem which has presented itself, is the substitution of other substances having tanning properties, in place of the oak bark, which has been becoming more and more scarce, for the reason that the trees have continually diminished, while on the other hand, the consumption and demand for leather has steadily increased.

The first stimulus given towards the invention of a rapid tanning process was by the government of the first French Republic in 1752, to Armaud Seguin, when shoes and belts were suddenly required for the increased army, called out for the national defence against Royalist Invasion; Seguin succeeded in tanning hides in twenty-five days, and thus the victorious but barefoot soldiers were properly shod. American statistics show, that we exported that year very near three thousand hogsheads of ground oak bark, which caused a rise in its value from eight to twelve or thirteen dollars per cord. The consequence was a request from the tanners for an increase in the import duties on leather.

It had become known that there were other barks and woods which, as well as oak bark, contained the active principle needed for tanning, and which was called tannin or tannic acid; there were several varieties of oak in the United States, unknown to the Old World, which were very well adapted and used for the same purpose, but the greatest impulse was given by the discovery that hemlock bark, with which the forests of New England and of New York abound, also produced a reddish colored, but very good leather, and was successfully used in New England for tanning. On this basis the "New York Tannery," was organized in 1817, and a colossal establishment founded in the midst of the hemlock forests in the Catskill mountains, at Hunter, 1,200 acres of this land being secured for a beginning. This was a movement in the right direction, in regard to economy, because in place of bringing the bulky tanbark to the hides near the city, where land is dear, the hides were brought to the tanbark forests, where land is cheap, by which at the time the expense of removing the exhausted bark was done away with, as it was simply left on the ground. The tannery was moved when the hemlock trees around had been stripped. We saw, in 1849, such a tannery in full operation in the clove of the Catskill mountains above Palenville; a few years later we found it abandoned and in ruins, and now not a trace is left, except heaps of exhausted bark.

Zadoc Pratt erected, in 1824, a mammoth tannery in the heart of Greene county, 500 feet long, containing more than 300 vats, consuming per year 6,000 cords of hemlock bark for the tanning of 6,000 sides of sole leather, of which he sent in 1842 the first hemlock tanned leather to Europe. In twenty years he tanned more than a million hides. We mention these figures in order to show the enormous quantity of bark consumed, and wish the reader to notice that it takes on an average a whole cord of bark to tan a single hide of sole leather, so that attempts to reduce this bulk are not to be wondered at.

An important move in this direction was made by Joseph Gilef of Nermont, who patented the use of a liquid extract or essence of oak and hemlock bark, so concentrated that one hogshead contained the tannin of four cords of bark. He claimed to tan with it calf skin in forty-eight hours.

In 1846 and 1847 some inventions were introduced to hasten the process by mechanical means, such as rollers, between which the hides were squeezed while in the vat; paddle wheels for stirring the stock in the vats; devices to enable two men to work in and out the vats 150 hides per day. Further improvements were made also in tanning liquids by the addition of chemical sails, such as sulphate of potash, sulphate of iron, etc. While in 1865, Towers, of Boston, patented a process by which he claimed to tan sheep and goat skins in thirty minutes, calf skins in five days and the heaviest sole leather in thirty days, also claiming a better product than the old method. The main ingredient by which he caused the rapid penetration of the tanning liquor was alcohol.

But a new era is dawning upon this business by chemical methods, which however, appear not to have developed themselves sufficiently for practical introduction, on a large manufacturing scale; it is the act of dispensing with the vegetable tannin altogether, and in place of it using some mineral astringent substance of similar property. The first step in this direction was proposed in 1850, by Knapp, in his chemical technology; it was an astringent salt of iron, such as the sulphate or chloride of iron, which latter produces a pure yellow leather, while the sulphate makes a yellow red leather; adding soda or potash gives a dark brown leather. Leathers thus obtained are similar to those made with alum, which is used for white leathers, but the iron salts cause shrinking in drying. Knapp mentions also, that the chromium compound possesses excellent qualities as substitutes for tannin.

In Wagner's Jahresbericht for 1858, is a method described for improving the action of the chromium compound, such as the chloride, by the addition of as much soda as can be added without precipitating it. It is claimed that rapidity of action, and good flexible leather is thereby obtained. Finally we find that in 1860, Clark obtained an English patent for a new tanning process, which consists in placing the hides, after the usual preparation, in a solution of bichromate of potash. He leaves them there for six to twelve hours, after which they will absorb the tannin in the ordinary vat in as many days as other hides require months.

The first inventor of the use of chromium compound for tanning, we find to be Warrington.

There are several other substances which have been experimentally used, with more or less success, either to supersede tannin entirely, or to prepare the hides for a more rapid absorbtion of the same. It has been found that the greater the affinity of these substances for the tannin the quicker will be its absorption, and shorter the time needed, which in some cases, has been so far reduced as that less than a single hour, was sufficient to perform a perfect tanning.

We will for the benefit of those, who wish to give practical attention to this important subject, give a list of some of the substances used in place of tannin, or for preparing the leather for a quick tanning operation.

1. Common alum, this as a substitute for tan bark, gives a peculiar leather, and is in use.
2. Sulphate of alumina.
3. Chloride of aluminum.
4. Acetate of alumina.
5. Common salt and acetate of alumina.
6. Chloride of iron.
7. Sulphate of iron.
8. Stearic acid.
9. Margaric acid.