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SCIENCE AS APPLIED TO TANNING.

Considering the immensity of the trade, modern science has done but little for the tanning industry. Except in the perfecting of a comparatively few simple mechanical devices for the saving of labor, the work of tanning heavy leather is now very nearly the same as it was a hundred years ago. The time required for tanning has been shortened by the use of stronger bark solutions, and more frequent handling of the hide or skin in such liquors, but the principle is the same; a greater variety of tanning agents is employed, but the astringent principle, similar to that found in oak bark, and which exists in greater or less proportion in almost every plant, must be sufficient to combine with the gelatine of the hide, which alone makes tanned or tawed leather.

Yet there has been no lack of endeavor in this field, for a substantial, or even a partial success, in the making of something which would compete with an article so universally used as leather, or in perfecting a cheaper mode of producing it, would be sure to bring the discoverer or inventor large rewards. German chemists have been especially active in this direction. One of them has claimed that tanning is not, as it has always heretofore been considered, a chemical operation, but that it is simply mechanical, and that the tannin only surrounds, but does not actually combine with, the particles of gelatine. This theory has not met with general acceptance, but it is, nevertheless, certain that leather tanned with some descriptions of tanning material, such as valonia, gambier, and divi-divi, can be again so far brought back to the raw hide condition as to be suitable for use in the making of glue. The most noteworthy result of the recent efforts of German chemists has been, however, in the perfection of a method of making leather without the use of bark at all, by what is called a mineral tanning, with a solution principally of iron, making what is called an iron tanned leather. Some very fair samples of both upper and sole leather have been produced by this process, and it is claimed that leather can be made thereby in much less time than it takes by the old method, and with a material saving in the cost. It is to be remarked, however, that the sole leather so made is very hard and brittle, so that it is difficult to make up and finish in a boot or shoe, and is liable to chip out and wear away rapidly except in wet weather. It seems, however, to have sufficient toughness, when wet, to resist a good amount of wear, and its water-resisting qualities are about equal to those of many kinds of bark tanned leather. That it will, as at present made, come into competition with our leather, does not appear at all likely, but the fact that hides and skins are now chemically treated so as to make an article nearly resembling bark tanned leather, and which will make serviceable boots and shoes, marks a step forward in the progress of an industry which, though one of the oldest in the world, has probably shown less change than any other.

The German process above alluded to has been covered by two patents in this country, but no leather of such manufacture has yet been made here. In fact the process can hardly be said to have met with any decided favor in Germany, where, from the high price of tanning material, and the generally inferior quality of the sole leather manufactured, it would seem to have most chance of being adopted. The patents cover the process, and a new chemical compound, as a mineral reagent, in the place of a vegetable tanning material. The process includes the making of a peculiarly prepared basic sulphate of iron, which forms the tanning material, into which the hides or skins are placed for two, or at most four days, without any handling or changing liquors. It is this part of the process of making leather in the ordinary way which requires so much time and labor, heavy hides being kept in the bark liquors from four to six or seven months, and in some cases considerably longer. The preparation of the hide for the liquor or compound, so far as the removal of the hair, flesh, etc., are concerned, is supposed to be the same for the new process as by the old method of tanning, as are also the currying and finishing operations.

We can now make very cheap leather in this country, because bark is so abundant, and the iron-tanned leather has not yet been brought to such a standard of excellence that it can compete with the means of furnishing; but it requires no long look into the future to see that these conditions may, at no very distant day, be reversed. Our woods are being rapidly destroyed, so that available bark for tanning is found, year by year, only at greater distances, and this will afford additional incentives to a spirit of investigation and research which may, in time, find us a substitute for bark in the manufacture of leather.

THE GREAT CHANOINE DAM AT PITTSBURG.

The general government is at present engaged in constructing near Pittsburg an experimental lock and dam, which when completed will be among the largest works of the kind in the world. The dam will be the largest "movable" one yet built in this country, being designed after the Chanoine system in use in the Seine and other European streams. The object of the work is mainly to test the applicability of the Chanoine system to the improvement of the Ohio and similar streams. The success or failure of this costly experiment will have a most important bearing upon the future of the entire Ohio valley from Pittsburg to Cairo, Ill., and more particularly upon the coal trade of the first named city.

The site selected for the work is located five miles below the junction of the Allegheny and Monongahela Rivers, and near the northwestern city limits of Pittsburg. The Ohio at this point has a width between banks of 1,300 feet, and the stream itself varies in width from that distance down to 700 feet, according to the stage of water. Operations were begun August 19, 1878, and with the exception of two months' cessation last winter have continued ever since. The force employed has varied from 50 to 450 men. Col. W. E. Merrill, whose headquarters are at Cincinnati, is chief engineer, but the work is under the immediate supervision of Lieut. F. A. Mahan, resident engineer. No great engineering difficulties have been met with, and the season of extraordinary low water during the past summer and fall has greatly facilitated the laying of the foundations for the river wall of the lock. The latter is located at the northern end of the proposed dam. Bed-rock was readily found for the shore wall, which is completed to the coping. The dimensions of this lock are as follows: Length, 600 feet; width, 110 feet; depth (of water), 12 feet, of wall, 17 feet.

The lock gates are unlike those in general use in every particular. They are immense affairs. In operation they will run directly across the lock at right angles to either wall. To enable them to be so operated immense recesses lead from the shore wall, each recess being 120 feet deep (long) and 15 feet wide. Into these the gates slide when the lock is opened. Each gate measures 118 feet in length, 10½ feet in thickness, and 14 feet in height; and these affairs will resemble, in place, a truss bridge on edge. Their material will be wood or iron. If of the former they will weigh 80 tons each. An offset in the masonry of the river wall serves as bearings for the outer end of each gate. The operating device for these ponderous gates will be turbine wheels, actuating upright and lateral shafting, so arranged in connection with suitable gearing, endless screw, reversing device, etc., as to draw the gate in and out of its recess upon seven pairs of iron rollers running upon rails. The latter are laid on the masonry at the bottom of each recess and across either end of the lock. Connecting the bottom of the upper recess with the bottom of the shore side of the lock is an immense arched tunnel termed the "filling culvert." Into it the water pours from seven circular inlets, 4½ feet in diameter, and fitted with balanced wing valves or gates, and is led to the lock, which is filled through ten openings, 3 by 3½ feet, and 17 feet below the coping. By this means the lock can be filled or emptied in four minutes.

So much for the lock. The dam will be 1,200 feet long, subdivided into three "passes" of 400 feet each. The channel pass, or that nearest the lock, will be that across which the movable or Chanoine dam will be placed. A solid sill of masonry and timber must first be laid across the bed of the river. To the timber is hinged a series of wickets of stout oaken planks, each 13 feet in length by 3 feet 8 inches in width. A space of 4 inches separates each wicket, and a hinged prop or arm forms part of the wicket, the whole being so arranged that when the wicket is drawn to a position almost perpendicular, its prop, as to its free end, slides into a metal "step." This operation repeated constitutes raising the dam, inasmuch as every wicket is a duplicate of its neighbor. Lowering the wickets is instantaneously accomplished by means of a "tripping bar" extending along the series and resting upon the dam sill. By its agency each prop is disengaged from its "step," the water presses wicket and prop prone upon the bottom, and the channel is virtually clear of obstructions. The spaces mentioned as existing between each wicket are thus provided for: Over each interval a plank is laid, kept in place mainly by the pressure of water upon its upper surface. These planks are connected by links at their upper ends only, in such a way that when the dam is "tripped," the chain of planks, being connected, and the whole series being permanently fast at one end only, swings away with the current—a sort of floating chain, ready for service again when the dam is raised.

Such, in brief, are the devices constituting the main features of the Chanoine dam, which will rise and fall—according to the stage of water—across the channel of the Ohio at the point in question. When the river falls to less than a six foot stage the wickets will be raised by gangs of men in boats working simultaneously toward the center of the pass. When up the crest of the dam will be 12 feet above the sill, and the "back water" will extend into the mouths of both the Allegheny and Monongahela rivers. This, of course, means navigable water about the wharves of Pittsburg and her sister city, Allegheny. At present local towage is only possible during a portion of the year.

The engineers in charge have as yet not definitely agreed upon the style of wicket for use in the two remaining sections of the dam, but that they will be movable is certain. Up to the present time 6,000 cubic yards of cut stone have been laid in this work, all in the shore wall. The river wall will require 4,000 yards, laid upon a foundation of concrete, the latter starting at a level 15 feet below the bed of the river, upon hard firm gravel. The concrete is composed of 5 parts sand and gravel as found in the river, 3 parts broken stone, and 1½ barrels Rosendale cement. Of the latter nearly 30,000 barrels will be incorporated in the walls and foundations. The sum of $200,000 has been expended, and the probable amount required for completion is placed by the resident engineer at $750,000. The most massive strength is noticeable in the work, and in all portions subjected to possible strain a factor of safety of 10 is preserved.

It might be added here, that the most intense opposition to the building of this dam was evinced by the river coal trade of Pittsburg, whose members held that the success of