Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

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NEW YORK, SATURDAY, DECEMBER 20, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 207.

For the Week ending December 20, 1879.

Price 10 cents. For sale by all newsdealers.

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 product which our native forests supply us 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 the work and the resultant and possible multiplication of Chanoine dams along the Ohio would inevitably destroy the coal trade of Pittsburg, as far as river shipments were concerned. Within the past few months, however, this opposition has given way in marked degree. The change of feeling is mainly attributable to causes novel and unlooked for. Owing to almost unprecedented and long-continued drought laden coal craft, containing 20.000,000 bushels (760,000 tons) had up to the middle of November, 1879, accumulated at Pittsburg, when the article was bringing famine prices in Cincinnati. At the date mentioned timely rains permitted a third of the accumulation to pass down the Ohio. But the argument for an artificially improved river was potent in the extreme, and to-day even the river coal trade of Pittsburg advocates the "Davis Island Dam."

THE ANGAMAR STEAM PASSENGER CAR.

For ninety consecutive days during the past season the Angamar steam passenger car "Lillie" has been running upon the Third Avenue surface railway, part of the time hauling an extra car. The experiment continued long enough to make it clear that a proper steam passenger car can be used safely and successfully in summer time, even in crowded thoroughfares. There is probably no street railroad in the world on which cars are run at briefer intervals, or where the necessary stoppings and startings are more frequent than on our Third Avenue road; nor one where the necessity is greater for quickness of action and entire regularity in running. If the Angamar motor can meet the severe requirements of winter traffic with corresponding success, the car horse may look for a change of occupation, and the community be relieved of the growing nuisance of his presence in our cities.

Superior economy is claimed for this motor, as compared with other steam locomotives, on the following grounds: 1. The water is heated in a stationary boiler, thus making a great saving of fuel in comparison with locomotive boilers. 2. There is no water level to watch, no injectors to take care of, and no fire to attend to during a trip. Hence the motor does not require a high-priced skilled engineer to run it, any average man of the class of car drivers being able to do the work. 3. All the working parts are protected from dust and dirt by close-fitting boxes, thus reducing the wear to the minimum. There is a further advantage in the circumstance that the machinery is so arranged upon the truck that the ordinary cars in use can be easily converted into self-propelling cars.

The Angamar motor runs without any noise of escaping steam, is easily handled, and does not frighten horses. The boiler is supplied with hot water under pressure at the central supply station, where the furnace is filled with red-hot coal in quantity sufficient to keep up the initial pressure in the boiler during the trip. The amount of coal required for this purpose and for heating the water in the stationary furnace was, during the ninety days' test, one third of a ton of egg coal a day. The volume of water in the boiler is so large and the fire in the furnace so small that all risk of explosion is avoided.

A NEW PLAN FOR HEATING HORSE CARS.

The Third Avenue Company, of this city, have introduced a novel plan of heating their cars. Metal pipes about 4 inches in diameter are laid under the seats and filled with salt water. At one end of the car the pipes unite in a sort of box surrounding a chamber called the oven, about 12 inches long, 5 inches wide, and 4 inches high. The door to this oven is through the end of the car, just above the platform, and consists of a box of non-conducting material nearly filling the oven. The water is heated at the stables by means of a block of highly heated iron thrust into the oven, nearly filling it. When the car leaves the stable the iron is removed and the oven closed, the heated water in the pipes sufficing to keep the car warm throughout the trip. Salt water is used to lessen the risk of bursting the pipes by frost, should the car be kept overlong on the road. So far the plan contains nothing objectionable. To economize heat, however, the company have had the car windows fitted with extra casings, permanently closing them, trusting to the opening of the doors, in the admission and discharge of passengers, for the supply for fresh air. Unless the ventilators in the roof are kept well open this plan is liable to add a new terror to horse car traveling. The atmosphere of crowded horse cars is bad enough at best; if its renewal is to be left to chance they will be little better than pest holes.

A HOT WATER RIVER.

The projector of the Sutro Tunnel is of the opinion that the hot water which is so troublesome in the Comstock mines comes from a depth of ten or fifteen thousand feet, where the rocks are at a high temperature; also that there must be some connection between the water of the Comstock lode and that of the boiling springs at Steamboat, six or seven miles distant.

One of the great advantages of the tunnel is the means it affords for draining the mines. The tunnel discharges about twelve thousand tons of water every twenty-four hours. To lift this water to the surface would cost not less than $3,000 a day. Some of the water has a temperature of 165° where all the water mingles; four miles from the mouth of the tunnel the temperature ranges from 130° to 135°. If left to flow through the open tunnel this water would so fill the air with steam as to make the tunnel impassable. In flowing the four miles through a tight flume made of 3 in. yellow pine, the water loses but 7° of heat. At the mouth of the tunnel the water is conducted sixty feet down a shaft to a water wheel in the machine shop, whence it is carried off by a tunnel eleven hundred feet in length, which serves as a tail race. From this tunnel the water flows a mile and a half to the Carson River.

This large flow of warm water is now used for many purposes, the first to utilize it having been boys who made small ponds to swim in—pioneers, it may be, in establishing a system of warm baths, which may ultimately become a great sanitary resort. The water can also be turned to account in heating hot houses and for irrigation. The tunnel company have a farm of over a thousand acres which, when properly watered, is very fertile. In course of time there will probably be many acres of fruit and vegetables under glass at this point, all warmed and watered by the tunnel water.

NEW YORK ACADEMY OF SCIENCES.

At a meeting of the Academy, held December 1, President Newberry exhibited some very fine quartz crystals from Herkimer county, N. Y., and also two slabs of perfectly preserved fossil fishes from the extensive Eocene formation of Wyoming Territory. This formation, which is about 7,000 feet thick, shows evidences of three successive deposits, and is exceedingly rich, not only in the remains of fishes, but of birds and mammals. The abundance of fish remains is accounted for by the supposition that the fish were over taken by some sudden disaster, by which great numbers perished at the same time; that they floated for a while on top of the great lakes they inhabited, and eventually sank to the bottom. The occasional great mortality of fish in the Gulf of Mexico, where the decaying remains sometimes cover a very large area, to the great annoyance of travelers, furnishes an analogy to these prehistoric catastrophes, and suggests the explanation that they were caused by the evolution of poisonous gases from the bottom during volcanic eruptions. In Oregon, where fish remains similar to those of Wyoming are found, there is also evidence of volcanic eruption.

Captain Blake stated that during the great eruption of Mauna Loa, in 1841, the surface of the water was covered with dead fish for miles. Dr. Martin suggested that numbers of small fish frequently perish near the shore by being cut off in lagoons left by the receding tide. As the water evaporates, the fish are brought more and more closely together, until, finally, there is not sufficient water left to keep them alive. The paper announced for the evening on

THE PROBOSCIS OF THE HOUSE FLY,

by Dr. George Macloskie, of Princeton College, was one of unusual interest to the comparative anatomist, as it embodied the results of orginal work in investigating and in terpreting the organs of the house fly (*Musca domestica*).

The general structure of the proboscis is very similar in the house fly and in the other kinds of flies with which we are familiar. Indeed the analogies it is proposed to point out will apply with greater or less exactness to the whole order of diptera. The stomaxys, or piercing fly, which is sometimes very common in our houses, may be distinguished from the domestica by its brown, ringed proboscis, suggesting an elephant's trunk. It is only partially retractile, but able to pierce our skin, an offense which the domestica is incapable of committing. Another misdeed of the stomaxys, for which the house fly has been unjustly blamed, was found during these investigations. The piercing fly was often observed to have her head and proboscis crowded with eggs. That these were not her own eggs was evident from their different shape, and then they were in the wrong end of the insect. Further observation showed that these eggs developed into anguillula worms, resembling paste eels. Here then we have one of the ways in which the fly defiles articles of food, etc.

Dr. Macloskie then referred to large diagrams to show the structural resemblances of the cray fish, the cockroach, and the fly, calling especial attention to the number of segments in the body, the maxillæ, the mandibles, and the calcareous tendons attached to the latter. In all the diptera the mouth parts are modified into organs of suction with or without piercing apparatus. The house fly alone has a retractile proboscis that folds up like a letter Z, and is drawn into the head when not used. It is traversed by channels connecting with the trachea, and is protruded, not by muscular action, but by the inflation of its chitinous membranes. The anterior end of the proboscis consists of a knob, and contains the lips and a series of forked half rings, by means of which the fly rasps the surface from which it gathers its food. The teeth of the house fly have three cusps, and form a single row of five or six on each side, while the blow fly and others have as many as thirty teeth, or three rows on each side, each tooth having only two cusps.

No difficulty was experienced in explaining the analogy of these and the other numerous parts of the fly's mouth apparatus to those of the crustaceæ, until the largest of them was reached, the organ to which the tendons, corresponding to the mandible tendons of the lobster, are attached. An opportune katydid, that flew into the room of the investigator at the critical moment, solved the difficulty, as a dissection of its head revealed the presence of an interior skull or endo-skeleton, a part not possessed by the diptera. The explanation laid before the Academy was that the organ in question represented a rudimentary internal skull in the head of the house fly. C. F. K.

Sorghum in the West.

The first annual convention of the Mississippi Valley Cane Growers' Association met in St. Louis, December 3. The secretary reported that since the organization of the society last spring he had been in correspondence with persons in 35 States and Territories in regard to the culture of sorghum, and that a very great interest is manifested in regard to the matter everywhere, especially in the North. Colorado is particularly well adapted to cane growing, and Texas might raise two, perhaps three, crops a year. In the discussion of seeds and their culture several members gave their experience.

Mr. C. H. Miller, of Minnesota, thought the Minnesota-grown seed preferable for that climate, the cane from it being earlier than from seed raised in more southern regions. Southern-grown seed produced larger cane and more sirup, but the cane did not, as a rule, mature early enough for the extreme Northern climate. The weight of testimony seemed to be in favor of the early amber variety, but Honduras early, and orange Siberian, and one or two other varieties, were well spoken of. There is much enthusiasm among cane growers, and some of them believe that in five years this country will not only have stopped importing sugar, but will export large quantities.

Advance in Leather Belting.

A meeting of manufacturers of leather belting, at which were representatives of fully 75 per cent of the capital invested in this business, was held at the Astor House, New York, on the 4th inst. It was determined to advance prices ten per cent over those now ruling, such increase to take effect immediately. This is the third advance in prices which has been made since the 24th of July, the aggregate increase amounting to 40 per cent. By the new scale of prices, the charge for pure oak belting will be 33 cents per foot for 3 inch, 69 cents per foot for 6 inch, $1.05 per foot for 9 inch; $1.41 per foot for 12 inch, and $3.22 per foot for 24 inch, with 100 per cent more right through for double belting; but with discounts ranging from 30 to 37½ per cent with the different firms. The belt manufacturers, although they do not form a close combination, have for a long time past made a common scale of prices, which it is generally understood they will all adhere to, except in such particular exigencies as may seem to call for variations in order that a house may protect its own trade or its customers as against outside competition.

One More Number.

The next issue will close another volume of this paper, and with it several thousand subscriptions will expire.

It being an inflexible rule of the publishers to stop sending the paper when the time is up for which subscriptions are prepaid, present subscribers will oblige us by remitting for a renewal without delay, and if they can induce one or more persons to join them in subscribing for the paper, they will largely increase our obligation.

By heeding the above request to renew immediately, it will save the removal of thousands of names from our subscription books, and insure a continuance of the paper without interruption.

Kitchen's Horse Detacher.

In the illustrated description given in our last issue of the novel horse detacher recently patented by Mr. W. R. Kitchen, the address of the inventor was omitted. Persons desiring information concerning this much needed invention should address, Mr. Kitchen, at Willard, Carter Co., Ky.

A Ten Years' Average of Amercan Crops.

The annual averages of the below-mentioned crops include the period from 1868 to close of 1877. The estimates are from the statistics of the Treasury Department:

	Annual average product'n bushels.	Annual average total value.	Average value per bu. cents.	Average yield per acre. bu.	Av. value of yield per acre.
Oats	291,036,670	$116,810,592	40·1	28·	$11·22
Rye	18,016,030	15,091,207	83·7	13·7	11·51
Corn	1 068,959,550	525,211,602	49·1	26·4	12 97
Wheat	273,583,174	301,481,541	110·2	12·12	13·40
Buckwheat	10,938,070	9,204,801	84·1	17·2	14·51
Barley	30,606,609	25,385,450	82·9	22·2	18·41
Potatoes	126,259,470	75,011,668	59·4	90·9	54·04
	Tons.		per ton.	tons.	
Hay	26,272,810	331,261,659	$12.60	1·21	15·25

Temperature of the Sun.

Newton, Waterston, Ericsson, and Senchi have asserted that the sun's temperature cannot be less than from 1,000,000° to 2,000,000° (1,800,000° to 3,600,000° Fah.); Pouillet, Vicaire, Violle, and many others maintain that the temperature cannot exceed from 1,500° to 2,500° (2,700° to 4,500° Fah.). The French Academy, in 1876, offered a "Bordin Prize" for the solution of the question, which resulted in a reward to Violle, certificates of "honorable mention" to Vicaire and Crova, and a withdrawal of the prize, in consequence of the difficulty and uncertainty involved in the question. Senchi obtained more than 2,000,000° by Newton's formula, while Violle obtained only 1,500° by the formula of Dulong and Petit from the same set of observations. F. Rosetti, in a memoir crowned by the Royal Academia dei Lincei, discusses experiments and methods of his own, from which he concludes that the temperature cannot be much less than 10,000° (18,000° Fah.), or much more than 20,000° (36,000° Fah.).—*Ann. de Chim. et de Phys.*