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Improvement in Apparatus for Tanning Leather.

It is a well-ascertained fact that the thorough rousing of the liquor in tan vats, during the progress of tanning, greatly accelerates the process and secures uniformity in the product proportionably to the thoroughness with which this detail is attended to. The old method of doing this, technically called "handling," is the most laborious of all the work done in a tannery, and when performed in the best manner possible, often leaves much to be desired in the quality of the leather.

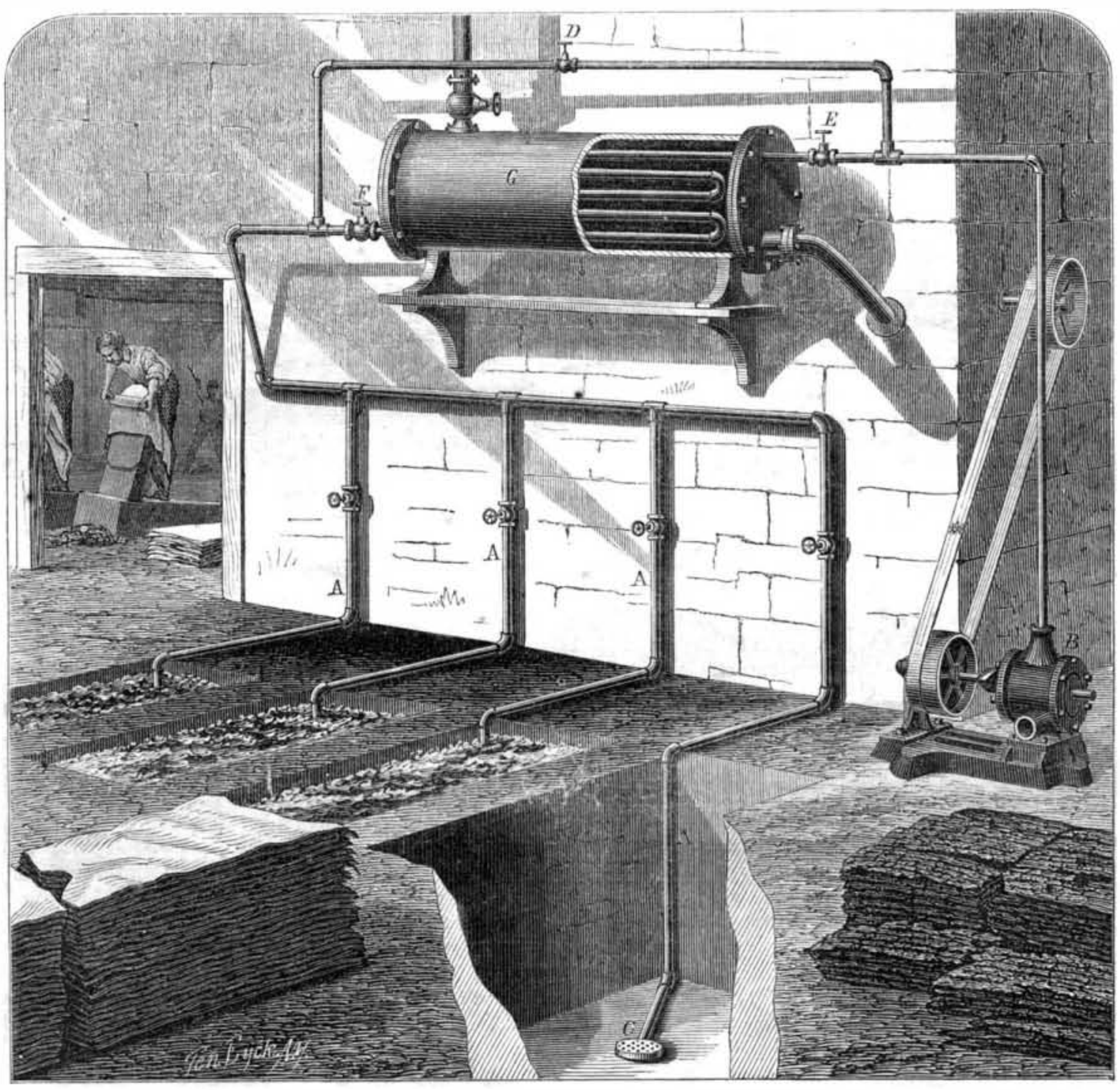
For tanning small hides revolving perforated drums have been employed, rotating in vats containing the tan liquor, and this method, although expensive of power, has answered in the manufacture of inferior qualities of leather from sheepskins, etc., for bookbinding, trunk-making, and other purposes where the best leather is not always required.

The improvement herewith illustrated will not only do the same thing more effectually with a far less expenditure of power, but is of such a nature that it can be advantageously applied to the tanning of any kind of hides, large or small.

The advantages claimed for this invention are, that it will save at least one fourth of the heaviest labor in tanning; that it will produce a more uniform and better quality of leather than any process hitherto employed; that it is equally adapted to liming hides, leaching tan, and other similar processes; and is very effective and economical in all these operations.

The hides are hung on slats, as close together as usual, in the vats containing the tanning liquors. Then the air is forced into the bottoms of the vats through a series of pipes, A, leading from an air pump, B, and there discharged through a distributor, C. Then escaping through the supernatant liquors, it causes therein violent currents and ebullition. This insures a regular tannage of the hides.

The inventor informs us that no spots or traces can be found throughout hides tanned by this method that have not received equal tannage, and that the surfaces of the skins, when the operation is performed, present a perfect, smooth, and unbroken grain hitherto unknown among tanners.



KAUFFELT'S IMPROVED ATMOSPHERIC TANNING APPARATUS.

In winter the air can be warmed by closing the cock, D, and opening the cocks, E and F. The air will then pass through a series of pipes inclosed in the steam cylinder, G, and heated to the temperature required—a process which will greatly accelerate the tanning, while it is totally free from the objections attending the use of hot liquors. In summer the cocks, E and F, being closed, and D being opened, the air does not pass through the heater, G, but enters the vat at the atmospheric temperature.

It will be seen that this adjustment, simple and cheap as it is, insures two very important requisites to speedy and efficient tanning; viz., the regulation of the temperature of the liquor to a nicety, and the thorough rousing of the contents of the vat; and we shall be greatly mistaken if it does not meet with a favorable reception from that very intelligent and enterprising class of men, American leather manufacturers.

Patented through the Scientific American Agency, July 13, 1869, by John E. Kauffelt, Shrewsbury, Pa., to whom communications may be addressed.

Surmounting Inclines.

If the inclines on railways could be so arranged that every ascending gradient should be preceded by a descending one, in other words, that the two should meet at the lower level, the impetus acquired in the descent would materially assist the subsequent ascent. There are, undoubtedly, some instances where this desirable result obtains, but they are, in all probability, occasioned more by accident or necessity, than by design. The steeper the incline, the greater must be the adhesion of the wheels on the rails. Hence the innumerable patents and inventions for accomplishing this purpose, which climaxed in the introduction of the middle rail and extra wheels. In one sense, weight and adhesion are synonymous terms, but to gain the necessary amount of adhesion by simply increasing the weight, would be to employ a remedy worse than the evil, as the difficulty is to get the weight itself up the hill. The experiments at Mont Cenis have quite thrown into the shade anything that has been done at home in the way of surmounting inclines, although we have, in latter days, distinguished ourselves in the art of making steep railway gradients to a degree that would have appalled our predecessors in that particular branch of engineering. A trial is to be made on the French side of Mont Cenis of the system of an Italian engineer, M. Agudio, for working sharp inclines on mountain summits. This principle has been employed for some years upon the Turin and Gênes Railway, and the experience gained during its application there has enabled the inventor to remedy the imperfections, correct the errors, and introduce those modifications and improvements which are indispensable to the success of every newly-tried mechanical invention.

Steep gradients are essential to the system of M. Agudio. He reconciles the differences of level by inclines of 1 in 10, and presses into his service the resources that nature has placed at his disposal, instead of employing means wholly artificial for accomplishing his purpose. The natural forces or motive power to be found in mountainous districts is utilized by hydraulic machines placed one at the summit, and the other at the bottom of the incline. From these the power is transmitted by the agency of steel telodynamical cables, working at a high velocity, to a locomotive, or, rather, locomotor, which is placed at the head of the train. As no boiler is required, the weight is very small in comparison with that of an ordinary locomotive, being restricted solely to that necessary to provide for the moving parts. At the same time, a certain amount of adhesion is absolutely indispensable, especially on inclines of the steepness already mentioned. In order to effect this, there is, first of all, the weight of the engine. Secondly, this weight is rendered more serviceable by being carried on eight wheels; and, thirdly, there are six horizontal wheels introduced, which, by means of springs, are caused to press against a central rail, similarly to the well-known Fell system. Powerful brakes are supplied to guard against contingencies in descending the inclines. A grant has been made by the Imperial Government of nearly £10,000 for carrying out this principle at Mont Cenis, and a similar subvention of the same amount has been given by the Italian Government. The particular section of the Mont Cenis Railway, to which this system is to be applied, commences at Lanslebourg, a station on the Fell road, crosses the river Arcq, and ascends the sides of the hill by nearly the same route as that occupied by the lines of telegraph. A succession of sharp curves from 450ft. to 900ft. radii, and an equal number of heavy gradients, bring the new section to the summit, where it rejoins the line of Fell. This route has been adopted by M. Agudio in order to demonstrate the great advantage of his system over others in use in similar arduous localities. The total difference of level between the starting point and the summit level is 2,296ft., and this is accomplished in a distance of 2·2 miles, whereas 7·5 miles is the distance required by Mr. Fell to rise the same hight. The length of line, and, *cæteris paribus*, the cost is, therefore, in the latter instance, about three and a half times that in the former. One of Fontaine's turbines constitutes the prime motor. It is fed by the waters of the Arcq, which are collected and stored in a reservoir containing 900,000 gallons of that fluid, the whole of which is capable of being run off and replenished six times a day, thus affording six ascents and six descents in the twenty-four hours. Each ascent will occupy about a quarter of an hour, and will of course be made without any interruption *en route*. The load taken up, will, in round numbers, equal sixty tuns. It is stated that the Fell locomotive requires an hour to perform the same journey, that is, so far as the difference of level is concerned, and conveys only one fourth of the load between the same termini. M. Agudio calculates that the ordinary passenger trains, which will weigh considerably less than sixty tuns, will "do" the journey in ten minutes. At the present day, when engineers have exchanged the old principle of adapting the road to the locomotive for the more modern practice of suiting the locomotive to the road, any proposed improvement in that direction is deserving of careful and impartial consideration.

THE LATEST ACHIEVEMENTS OF ENGINEERING SCIENCE.

Extract from the address of C. W. Siemens, F.R.S., before the British Association.

In viewing the latest achievements in engineering science, two works strike the imagination chiefly by their exceeding magnitude, and by the influence they are likely to exercise upon the traffic of the world. The first of these is the great Pacific Railway, which, in passing through vast regions hitherto inaccessible to civilized man, and over formidable mountain chains, joins California with the Atlantic States of the great American republic. The second is the Suez ship-ping canal, which, notwithstanding adverse prognostications and serious difficulties, will be opened very shortly to the commerce of the world. These works must greatly extend the range of commercial enterprise in the North Pacific and the Indian seas. The new waterway to India will, owing to the difficult navigation of the Red Sea, be in effect only available for ships propelled by steam, and will give a stimulus to that branch of engineering.

Telegraph communication with America has been rendered more secure against interruption by the successful submersion of the French Transatlantic cable. On the other hand, telegraphic communication with India still remains in a very unsatisfactory condition, owing to imperfect lines and divided administration. To supply a remedy for this public evil the Indo-European Telegraph Company will shortly open its special lines for Indian correspondence. In northern Russia the construction of a land line is far advanced to connect St. Petersburg with the mouth of the Amoor river, on completion of which only a submarine link between the Amoor and San Francisco will be wanting to complete the telegraphic girdle round the earth.

With these great highways of speech once established, a network of submarine and aerial wires will soon follow to bind all inhabited portions of our globe together into a closer community of interests, which if followed up by steam communication by land and by sea, will open out a great and meritorious field for the activity of the civil and mechanical engineer.

But while great works have to be carried out in distant parts, still more remains to be accomplished nearer home. The railway of to-day has not only taken the place of high roads and canals for the transmission of goods and passengers between our great centers of industry and population, but is superseding by-roads leading to places of inferior importance; it competes with the mule in carrying minerals over mountain passes, and with the omnibuses in our great cities. If a river cannot be spanned by a bridge without hindering navigation, a tunnel is forthwith in contemplation, or, if that should not be practicable, the transit of trains is yet accomplished by the establishment of a large steam ferry.

It is one of the questions of the day to decide by which plan the British Channel should be crossed, to relieve the unfortunate traveler to the Continent of the exceeding discomfort and delay inseparable from the existing most imperfect arrangements. Considering that this question has now been taken up by some of our leading engineers, and is also entertained by the two interested governments, we may look forward to its speedy and satisfactory solution.

So long as the attention of railway engineers was confined to the construction of main lines, it was necessary for them to provide for heavy traffic and high speeds, and these desiderata are best met by a level permanent way, by easy curves and heavy rails of the strongest possible materials, namely, cast steel; but, in extending the system to the corners of the earth, cheapness of construction and maintenance, for a moderate speed and a moderate amount of traffic, become a matter of necessity.

Instead of plunging through hill and mountain, and of crossing and recrossing rivers by a series of monumental works, the modern railway passes in zigzag up the steep incline, and conforms to the windings of the narrow gorge; it can only be worked by light rolling stock of flexible construction, furnished with increased power of adhesion and great brake power. Yet by the aid of the electric telegraph, in regulating the progress of each train, the number of trains may be so increased as to produce, nevertheless, a large aggregate of traffic; and it is held by some that our trunk lines even would be worked more advantageously by light rolling stock.

The brake power on several of the French and Spanish railways has been greatly increased by an ingenious arrangement conceived by M. Lechatelier, of applying what has been termed "Contre vapor" to the engine, converting it for the time being into a pump, forcing steam and water into the boiler.

While the extension of communication occupies the attention of, perhaps, the greater number of our engineers, others are engaged upon weapons of offensive and defensive warfare. We have scarcely recovered our wonder at the terrific destruction dealt by the Armstrong gun, the Whitworth bolt, or the steel barrel consolidated under Krupp's gigantic steam hammer, when we hear of a shield of such solidity and toughness as to bid defiance to them all. A larger gun or a hard bolt by Palliser or Grüson is the successful answer to this challenge; when again defensive plating, of greater tenacity to absorb the power residing in the shot, or of such imposing weight and hardness combined as to resist the projectile absolutely (causing it to be broken up by the force residing within itself) is brought forward.

The ram of war, with heavy iron sides, which a few years since was thought the most formidable, as it certainly was the most costly weapon ever devised, is already being superseded by vessels of the Captain type, as designed by Captain Coles, and ably carried out by Laird Brothers, with turrets (armed with guns of gigantic power) that resist the heaviest firing, both on account of their extraordinary thickness, and of the angular direction in which the shot is likely to strike.

By an ingenious device, Captain Moncrieff lowers his gun upon its rocking carriage after firing, and thereby does away with embrasures (the weak places in protecting works), while at the same time he gains the advantage of re-loading his gun in comparative safety.

It is presumed that in thus raising formidable engines of offensive and defensive warfare the civilized nations of the earth will pause before putting them into earnest operation, but if they should do so it is consolatory to think that they could not work them for long without effecting the total exhaustion of their treasuries, already drained to the utmost in their construction.

While science and mechanical skill combine to produce these wondrous results, the germs of further and still greater achievements are matured in our mechanical workshops, in our forges, and in our metallurgical smelting works; it is there that the materials of construction are prepared, refined, and put into such forms as to render greater and still greater ends attainable. Here a great revolution of our constructive art has been prepared by the production, in large quantities and at moderate cost, of a material of more than twice the strength of iron, which, instead of being fibrous, has its full strength in every direction, and which can be modulated to every degree of ductility, approaching the hardness of the diamond on the one hand and the proverbial toughness of leather on the other. To call this material cast steel seems to attribute to it brittleness and uncertainty of temper, which, however, are by no means its necessary characteristics. This new material, as prepared for constructive purposes, may indeed be both hard and tough, as is illustrated by the hard steel rope that has so materially contributed to the practical success of steam plowing.

Machinery-steel has gradually come into use since about 1850, when Krupp, of Essen, commenced to supply large ingots that were shaped into railway tires, axles, cannon, etc., by melting steel in halls containing hundreds of melting crucibles.

The Bessemer process, in dispensing with the process of puddling, and in utilizing the carbon contained in the pig iron to effect the fusion of the final metal, has given a vast extension to the application of cast steel for railway bars, tires, boiler plates, etc.

This process is limited, however, in its application to superior brands of pig iron, containing much carbon and no sulphur or phosphorus, which latter impurities are so destructive to the quality of steel. The puddling process has still, unless the process of decarburization of Mr. Heaton takes its place, to be resorted to, to purify these inferior pig irons, which constitute the bulk of our productions; and the puddled iron cannot be brought to the condition of cast steel except through the process of fusion. This is accomplished successfully in masses of from three to five tuns on the open bed of a regenerative gas furnace at the Landore Siemens Steel Works, and at other places. At the same works cast steel is also produced, to a limited extent as yet, from iron ore, which, being operated upon in large masses, is reduced to the metallic state and liquefied by the aid of a certain proportion of pig metal. The regenerative gas furnace – the application of which to glass houses, to forges, etc., has made considerable progress—is unquestionably well suited for this operation, because it combines an intensity of heat, limited only by the point of fusion of the most refractory material, with extreme mildness of draft and chemical neutrality of flame.

These and other processes of recent origin tend toward the production, at a comparatively cheap rate, of a very high class material that must shortly supersede iron for all structural purposes. As yet engineers hesitate, and very properly so, to construct their bridges, their vessels, and their rolling stock of the material produced by these processes, because no exhaustive experiments have been published as yet fixing the limit to which they may safely be loaded in extension, in compression, and in torsion, and because as yet no sufficient information has been obtained regarding the tests by which their quality can best be ascertained. This great want is in a fair way of being supplied by the experimental researches that have been carried on for some time at her Majesty's dockyards at Woolwich, under a committee appointed for that purpose by the Institution of Civil Engineers. I have also pleasure to announce an elaborate report by Mr. William Fairbairn on this subject. In the meantime excellent service has been rendered by Mr. Kirkaldy in giving us, in a perfectly reliable manner, the resisting power and ductility of any sample of material which we wish to submit to his tests. The results of Mr. Whitworth's experiments tending to render the hammer and the rolls obsolete by forcing cast steel, while in a semi-fluid state, into strong iron molds by hydraulic pressure are looked upon with great interest. But, assuming that the new building material has been reduced to the utmost degree of uniformity and cheapness, and that its limits of strength are fully ascertained, there remains still the task for the civil and mechanical engineer to prepare designs suitable for the development of its peculiar qualities. If, in constructing a girder, for example, a design were to be adopted that had been worked out for iron, and if all the scantlings were simply reduced in the inverse proportion of the absolute and relative strength of the new material, as compared with iron, such a girder would assuredly collapse when the test weight was applied, for the simple reason that the reduced sectional area of each part, in proportion to its length, would be insufficient to give stiffness. You might as well almost take a design for a wooden structure, and carry it out in iron by simply reducing the section of each part. The advantages of using the stronger material become most apparent if applied, for instance, to large bridges where the principal strain upon each part is produced by the weight of the structure itself, for, supposing that the new material can be safely weighted to double the bearing strain of iron, and that the weight of the structure were reduced by one half accordingly, there would still remain a large excess of available strength in consequence of the reduced total weight, and this would justify a further reduction of the amount of the material employed. In constructing works in foreign parts the reduced cost of carriage furnishes also a powerful argument in favor of the stronger material, although its first cost per tun might largely exceed that of iron.

Cider and the Cider Manufacture.

The season for the manufacture of cider is at hand. As it is an important product, and many a good crop of apples is wasted in making an inferior quality, simply from want of a little practical knowledge, the following hints from the *Working Farmer* will be found seasonable and sound:

"In general, we may say that the same principles that govern the manufacture of wine hold good in making cider; for cider is merely wine made from apples instead of grapes, and deserves the name of wine certainly as much as the fermented juice of currants, raspberries, and other fruits that we dignify with this name. To be more particular, no good cider can be made from unripe fruit. We should laugh at the man who should undertake to make wine from green grapes. It is just as foolish to make cider from green apples. Sugar is essential in all fermentation. As fruit matures, the starch is converted into sugar; and only when mature is the fruit fit for eating and conversion into wine. Providence has made all unripe fruit unpalatable, so that neither man nor beast should be tempted to eat it in its green state. In unpropitious seasons the vine grower adds sugar to the expressed juice of his grapes in order to supply the deficiency of saccharine matter and perfect the fermentation; and few if any of the grapes of New England contain enough sugar to make good wine without this addition. Cane sugar, however, never gives a flavor equal to that naturally produced in the fruit. The nearer to perfect ripeness, therefore, we can bring our apples, the better will be our cider. We have tried adding sugar to the juice of apples, and find that it improves the quality of the cider as much as it does wine. If sugar is added to the juice of any fruit, it should be of the purest kind. It is a common mistake to suppose that the flavor of Muscovado sugar will work off during the vinous fermentation; it is continued even into the acetous fermentation, and deteriorates the quality of the vinegar.

"As a second rule, no rotten apples, nor bitter leaves, nor stems, nor filth of any kind, should be ground for cider. The winemaker who seeks a reputation for a superior article looks well to the condition of his grapes before he allows the juice to be expressed. We do not like to eat rotten apples; and they are no better for drink than for food. No wonder that a prejudice should exist against cider in the minds of those who have seen the careless way in which it is sometimes made. We have heard it called, and not inaptly, the expressed juice of worms and rotten apples. Perhaps, if we could see the process of manufacturing cheap wines, our prejudices against them would be equally strong. There is no economy in such carelessness. If cider is worth making, it is worth making well; and then with a good conscience we can ask a good price, and be sure of getting it too; for a good article is always in better demand than a poor one.

"Much cider is injured by being pressed with musty straw. In this respect, the little hand mills have the advantage, for they require no straw; and there is little straw so bright and and clean as to be totally free from dust and an unpleasant odor. We very much question whether straw is of any advantage in the large power mills. It doubtless aids in conducting the juice, but it also absorbs not a little; and the danger of a bad flavor from it is so great that we should discard it altogether. The press can be made small, and of birch or some other hard timber, that will not contaminate the cider. Two presses are really necessary for each mill, so that the pomace can be exposed to the air in the one while it is being pressed in the other, and thus acquire a deeper color

"Perhaps the most essential requisite for good cider is the cask in which it is to be preserved. Few old cider barrels can be cleansed so as to be fit for use again. We have seen them soaked in running water for days, and still retain the seeds of putrefaction. Fresh slacked lime we have found one of the best disinfectants; but we prefer a new oak barrel or one in which whisky or alcohol has been kept. We have heard linseed-oil barrels recommended, as the oil will rise to the surface and prevent rapid fermentation. They are good for those who like them. We prefer to shut off the air at the right time with a good tight bung.

"If it is desired to keep the cider in a state of must it can easily be effected by boiling it a little, and then bunging up the cask tightly. This is the canning principle; and if the cask is tight, the cider will be found as sweet at the end of the year as when first put up. We doubt whether the medicinal effect of such cider is as good as when it is allowed to ferment for a few days, and a little alcohol, and not a little carbonic acid, are generated. Whenever the cider arrives at the proper stage of fermentation—and the time for this will vary from a week to a fortnight, as the temperature of the weather may vary—the cask should be closed tightly, and all air excluded. Some say that a pound of mustard seed or a pint of horse-radish should be added to each barrel when the bung is driven, and claim that this prevents further fermentation. They may add a little pungency to the cider, but we do not see how they act to prevent fermentation; nor do we know how fermentation can proceed without air. Prof. Horsford, a few years since, suggested sulphate of lime to keep cider sweet. It certainly has this effect, but, at the same time, neutralizes the peculiar acid, on which much of the good effect of the cider depends. If, at the proper time, the cask is made air tight, or the cider is securely bottled, we much doubt whether any of these artificial ingredients are an improvement. If more color and richer body are desired, a quart or two of boiled cider added to each barrel will impart them.

"Cider, like every other blessing, must be used with moderation. As the sweetest things can become the sourest, so our greatest blessings can be perverted into great curses. We feel bound to speak well of a bridge over which we have crossed safely; and cider has bridged us over a severe attack of jaundice, and we find it an excellent aid to digestion. If the experience of others differs from ours, we shall not quarrel with them, but only agree to differ."

MANUFACTURE OF SUGAR.—It is stated that experiments are now in progress in some French colonies to try, on a large scale, Messrs. Rousseau and Bonneterre's plan of converting the saccharine juice of cane or beet-root into a peculiar saccharate of lime, and to transport that salt, instead of raw sugar, for the purpose of refining. It is said that this compound is as hard as sand, and can be transported without the risk of damage and injury sugar is subject to, and be kept for any length of time