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ON THE PRESERVATION OF WOOD.

The use of wood as a constructive material for dwelling houses, mills, bridges, railway sleepers, and even roads, is of almost universal application in Canada. The constant exposure of this perishable substance to atmospheric changes, and the rapid decay to which it is liable, renders a cheap and durable preservative a great desideratum.

Much attention has been devoted to this subject in England and on the European continent, where wood is comparatively dear. Numerous processes have been patented from time to time to effect the object in view, but all of these are either too expensive, or otherwise unsuitable for general adoption in Canada.

In considering the causes which lead to the decay of wood, it is essential to know something about its composition, and the nature of the substances it contains, which are most liable to decomposition. It is well known that the durability of different kinds of wood depends upon the compactness, the state of induration, and the quantity of such stable substances, as resin and tannin, which they contain. The liability to decay is produced by the presence of an albuminous substance which acts as a ferment, when wood is exposed to heat, air and moisture; in some countries the attacks of insects are very prejudicial, and in all countries the growth of fungi contribute materially to the decomposition and final destruction of wood. Alternations of temperature with damp, are also sufficient to produce decay, even if the albuminous substance is rendered neutral. The question which at once suggests itself is this—How may the substance which acts as a ferment and induces decomposition be rendered inert, or the texture of the wood be made proof against the decay it induces. The processes hitherto adopted have consisted in simply imbuing the substance of the wood with certain salts, oxides of metals, tar and oils; the compounds which are recommended are alum, pyrolignite of iron, corrosive sublimate, blue vitriol, chloride of zinc, &c., which possess the property of coagulating albumen and combining with the substance of the wood, and thus rendering the action of the ferment incapable of communicating its destructive powers to the fibre of the wood. This has been usually effected by causing a solution to permeate the pores of the material so as to act upon its internal portions as well as to protect it externally. A difficulty has always arisen in causing the antiseptic liquid to find its way to the heart of large pieces of timber—a necessary result—otherwise decay would commence internally, and gradually be propagated outwards, following the reverse course of ordinary decomposition. There is no difficulty in effecting the thorough permeation of even large timbers, by placing them in an exhausting chamber, containing the solution with which it is intended they should be impregnated, and, removing the air contained in the pores of the wood, allow the fluid to take its place. Wood is generally about one-half as heavy as water: that is to say, its specific gravity is about 1.5, but it usually floats on water, in consequence of the air contained within its pores. When this interstitial air is removed by the exhaustion process, above described, the solution easily finds its way to the interior, upon exposure to ordinary atmospheric pressure. It is evident that this process is too costly to be employed on a large scale in Canada.

Another mode, which has been practiced in France, is to take advantage of the natural functions of the leaves of a tree. If a tree, for instance, in full leaf, be cut down, and its extremity immersed in a solution of blue vitriol, or any other metallic solution, the natural function of the leaves will, by exhalation, cause it to be carried upwards, and diffused through every part of the tree, even to the extremities of the smallest branches. Liquids can also be absorbed by boring a hole into the trunk of a tree, and establishing a connection with a supply of prepared fluid, contained in an appropriate vessel. Various colours have been introduced into trees by this process, and different kinds of wood have been not only tinted with any desirable colour, but even perfumed with essential oils. A solution of soluble glass, similar to that used for the purpose of lining petroleum vats, has been introduced by these means, and found available not only as a preservative against decay, but also as a protection from fire.

Mr. Bethell's process is much employed in England: it consists in impregnating wood throughout with tar oil, or any solution containing creosote, and particularly with a solution of pyrolignite of iron and tar oil, which holds more creosote, in a dissolved state, than water. The wood is put into a close iron tank; the air is then exhausted, and tar oil and pyrolignite of iron forced in by means of hydrostatic pressure, equal to 150 pounds to the square inch. The wood becomes very much heavier, and thoroughly impregnated with the material forced into its pores. The effect is first to coagulate the albuminous matter in the wood, and thus retard its putrefaction; and secondly, to protect the fibre of the wood from air and moisture. The bituminous substance introduced into the pores, binds the fibres together, so that a piece of pine or fir is not only rendered more durable, but acquires great additional strength, and is proof against the attacks of insects, alternations of temperature, and exposure to wet and dry, and permits iron bolts or nails to remain in its substance for any length of time, unaffected by rust. For railway sleepers, Mr. Bethell's process is considered invaluable, as it enables the common woods to be used for the purpose, and gives them a durability which defies the ordinary attacks of atmospheric influences, extended over a very long period of time. The tanks which are used for this purpose on the Bristol and Exeter Railway, can prepare 20 loads of wood per day by this process.

Other substances besides pyrolignite of iron may be successfully used for coagulating the albumen, such as chloride of zinc, which was extensively employed by Burnet some years since, and is used, to a considerable extent, in the United States, for preserving cordage made from unrotted hemp. Chloride of zinc is extremly soluble, and may be used in a state of great dilution. It is now considered better than corrosive sublimate—the material employed by Mr. Kyan—from whose name the process, termed Kyanizing, derived its appellation.

Perhaps, the cheapest and the best mode of preserving wood in Canada will be found to be the following:—Let the timbers be placed in a drying chamber for a few hours, where they would be exposed to a temperature of about 200 degrees, so as to drive out all moisture, and by heat coagulate the albuminous substance, which is so productive of decay. Immediately upon being taken out of the drying chamber, they should be thrown into a tank containing crude petroleum. As the wood cools the air in the pores will contract, and the petroleum occupy the place it filled. Such is the extraordinary attraction shown by this substance for dry surfaces, that by the process, called capillary attraction, it would gradually find its way into the interior of the largest masses of timber, and effectually coat the walls of the cells and interstitial spaces. During the lapse of time, the petroleum would absorb oxygen, and become inspissated, and finally converted into a bituminous substance, which would effectually shield the wood from destruction by the ordinary processes of decay. The process commends itself on account of its cheapness. A drying chamber might easily be constructed of sheet iron, properly strengthened, and petroleum is more abundant and accessible, and enduring than any other preservative which can be named.

Immediately after the pieces of timber have been taken out of the petroleum vat they should be sprinkled with wood ashes, in order that a coating of this substance may adhere to the surface, and carbonate of potash be absorbed to a small depth. The object of this is to render the surface incombustible, as it is well known that wood soaked in crude petroleum alone would become eminently combustible. Dusting with wood ashes until quite dry will destroy this property to a great extent.

The quantity of sap in a tree during different periods of the year was well shewn by Duhamel more than a century since.

It was found that pieces of oak of equal size cut from trees of the same diameter growing in similar soil, weighed as follows:—

340 lbs.	in	December.
340	"	January.
328	"	February.
331	"	March.
311	"	April.
319	"	May.
297	"	June.
297	"	July.
314	"	August.
306	"	September.
328	"	October.
331	"	November.

From which it appears that the quantity of sap in the oak is greatest in the winter months of December and January, and least in the summer months. Recent experiments upon other trees show that, generally, wood contains the greatest amount of moisture in winter and the least in summer.

Hard woods, by drying, lose about one-third of their weight; light woods from one-third to one-half, according to the nature of the soil on which they grow. Air dried wood looses about 20 per cent of its weight.

The condition of wood is greatly dependant upon the time when it is felled. The results of a series of experiments made in Germany show that December cut wood allows no water to pass through it longitudinally; January wood passed in forty-eight hours a few drops; February wood let two quarts of water through its insterstitial spaces in 48 hours; March wood permitted the same to filter through in two hours and a half. Hence the reason why barrels made from wood cut in March and April are so leaky.

It has been remarked with reference to the principal cause of fermentation in wood—"always the forerunner of decay in timber—is the presence of an atmosphere of warm, damp, and stagnant air. On one of these three conditions being removed, the durability of timber would be immediately prolonged. Thus it is that we cannot contemplate without a feeling of admiration the woodwork of the oldest mansions or churches. The joists of the houses built by our ancestors last almost for ever, because they are in contact with air which is continually changing. Now, on the contrary, we foolishly enclose them between a ceiling of plaster (always very damp to begin with) and a floor; they rapidly decay, and sometimes cause the most serious disasters, of which it is impossible to be forwarned. The timbers of our ships, placed as they are between the outside planking and the inside ceiling, are in the same predicament; the stagnant air of the channels is heated by the vicinity of the hold, and at the same time is charged with moisture, as much from the constant emission of aqueous vapour from the wood as from the leakage of water through the seams, which, during rough weather, always open a little. Thus it is the timbers decay with frightful rapidity, endangering either the ship or the health of her crew."

MR. WALTON'S SLATE QUARRIES.

To gain a medal of honour is a distinction in any country, but to win so high a mark of excellence in any art, science, or manufacture, where the world is the field, and the competitors are among the most advanced of mankind, is an additional source of congratulation. It is one thing to be able to point out the fitness of any particular material for specific purposes, but it is another, and far more difficult operation to bring into actual use, for the purposes of every-day life, the crude products of a country. Mr. Walton has succeeded, beyond the best expectations of himself and his friends, in bringing under public notice the roofing slates of Lower Canada, and for his discovery of these slates, and the unwearying zeal with which he has directed public attention to them, he was awarded an International Exhibition Medal at London, 1862. It is not only valuable to Mr. Walton, but it is a subject of great interest to Canadians, that such an important material as roofing slates of superior excellence, should exist in Canada in comparative abundance, and easy of access.

Mr. Walton's quarry is situated at Melbourne, Lower Canada. Sir William Logan thus speaks of these slates in the Descriptive Catalogue of the Minerals of Canada:—

"This band of slate is in immediate contact with the summit of the serpentine. It has a breadth of one-third of a mile, and dips about S. E. $< 80°$. Mr. Walton commenced opening a quarry upon it in 1860, and found it necessary, in order to gain access to the slate, to make a tunnel through a part of the serpentine. To complete this, and to expose a sufficient face in the slate to pursue profitable working, has required two years of time, and $30,000 of expenditure. The face now exposed has a height of seventy-five feet; but the band of slate crosses the St. Francis, and the fall from the position where the quarry is now worked, to the level of the stream, is upwards of 400 feet, the distance being one and a half miles, so that by commencing an open cutting on the slate, at the level of the stream, a much greater exposure can be ultimately attained. Up to a comparatively recent period, the usual coverings of houses in Canada have been wooden shingles, galvanized iron or tin plate, but so many destructive fires have occurred from the use of the first of these, that they are now interdicted in all large towns. Slate, as a covering, costs about one-third more than shingles, but one-half less than tin, and one-third less than galvanized iron.

"The quarry has now been in operation since the spring of 1861; 2000 squares have been sold, and some of the slates have been sent to a distance of 550 miles from the quarry; a quantity of them having been purchased for Sarnia on the River St. Clair. To show that slate, as a covering, is well adapted to resist the influences of a Canadian climate, it may be here stated that slates from Angers in France, have been exposed on the roof of the Seminary building on the corner of Notre Dame and St. Francois Xavier Streets, in Montreal, for upwards of 100 years, without any perceptible deterioration."

The quarry has been examined and reported on by Mr. Robb, of Montreal, Mining Engineer, and as these slates have won for Canada and Mr. Walton a medal from the Commissioners of the International Exhibition, we have pleasure in introducing an abstract of Mr. Robb's professional report upon the quarries:—

Situation and General Description.

"This property is situated on the west bank of the river St. Francis, in the Township of Melbourne, Canada East; about three miles from the flourishing village of the same name, and also from the Richmond station of the Grand Trunk Railway, which passes about one and a half mile from the present quarry, but on the opposite side of the river; and is provided with a siding, platform, &c., for the special convenience of loading the slates on the cars. The villages of Richmond and Melbourne form the centre of a populous and thriving district; and are distant from Montreal 73 miles; from Quebec 96 miles, and from Portland 220 miles.

"The direction of the vein or band of workable slate rock, is at right angles to the river, from which the hill rises to an elevation of 450 feet at the present quarry, which is about the summit. There is a good road running parallel with the north-western outcrop of the slate rock, from the quarry to the river, where the carts or sledges conveying the slates to the railway are ferried across by a scow in the summer, and driven on the ice during winter. The entire road, from the quarry to the railroad, including the depot lot, is on land comprised in this property.

"The property consists of a *freehold* of nearly 1200 acres, comprising the following lots, which are indicated on the plan by the green tint, viz.:—

Lots 21, 22, 23, and 24, in the	6th	Range,	(200 acres	each)	800	Ac.
Lot 21, and half of lot 22,	" 7th	"	"	"	300	"
One-quarter of lot 22,	" 5th	"	"	"	50	"
Part of lot 22,	" 7th	"	"	"	26	"
Also, the shipping or depot lot on other side of river,......					4	"
Total number of acres					1,180	

Geological Features.

"The geological horizon of the rocks underlying this property is in what is styled by Sir William Logan the Quebec group of the Lower Silurian System, equivalent to the Taconic series of Professor Emmons; and is the same as that in which the far-famed roofing slates of Wales, Cornwall, and the West of Scotland, as well as those of Maine and Vermont, are found. In the present case, the argillacious slate rock occurs in contact with a band of serpentine, accompanied with soapstone, chromic iron ore, and asbestos; the direction of cleavage is N. 60° E., and the dip within a few degrees from the perpendicular.

"The slate rock, the outcropping of which has been thoroughly traced, occupies an area of about one hundred acres, and has a breadth of one-third of a mile over a great part of its area. Judging from surface exposures, and from experience in similar circumstances at other places, it is highly probable that the quality of the rock will be uniform throughout the whole area.

"The land comprised in this property is, for the most part, under wood, consisting, chiefly, of spruce, maple, birch, beech, and ash, yielding abundance of timber for all purposes required in carrying on the works. There are, however, about 60 acres cleared, and the land is, in many places, well adapted for agricultural purposes.

Present and Prospective Workings.

"The present quarry, which was commenced in 1860, and has been in successful and profitable operation for a considerable period, is situated on lot 22, in the 6th range of the township, about a mile and a half from the railway. The present working level is seventy feet from the summit of the rock, and the amount of excavation hitherto made in the slate rock, at this point, is about 2540 cubic fathoms; besides a tunnel or adit cut through a part of the serpentine, which it has been necessary to excavate at a cost of nearly $30,000, in order to obtain the above-mentioned depth of face, as well as to drain the quarry. A good iron railway is laid through this adit, from the quarry to the dressing sheds and spoil bank—a distance of 600 feet—and is provided with suitable trucks and waggons. There are two good substantial boarding houses adjacent to the quarry, capable of accommodating 35 boarders—besides blacksmith's shop, stables, and a large house for the superintendent, partly completed. There are, also, connected with the works one span of horses, with waggons and carts; also, a good supply of working tools, railroad iron, ferry scow, derricks, &c.

"This property, as will be perceived, has been developed only to a very limited extent; in fact, the work hitherto done may be regarded as only preliminary and tentative; but, nevertheless, the present proprietor has manufactured and sol upwards of four thousand squares of excellent slates, at highly remunerative rates; and the demand for them, within the Province, is already greater than he can supply. From estimates which have been submitted to me, and which I have carefully studied, I am satisfied that when the works are extended, as proposed to be done, by driving another adit at a level forty feet below the present one, and by opening up the quarry so as to admit of economical working, the profits will be not less than two dollars per square, or upwards of (100) one hundred per cent. upon the cost of production and delivering on the cars.

"With the facilities thus obtained, the quarry will produce 20,000 squares in a year, and if a still greater production were desired it can be attained to an almost unlimited extent, and with greatly increased economy, by driving an adit in connection with a bridge across the river, from the base of the hill, and which would cut the slate rock at a depth of between 300 and 400 feet from the present level of the quarry. This tunnel would have sufficient size and inclination to admit of a double line of rails, so that the full cars, in descending, would draw up the empty cars, and thus save all cartage, as well as drain the quarries most effectually.

"The average price of the slates, shipped on the cars at Richmond, is $3 75 per square; and the rate of freight to Portland, 89c., making the total cost, delivered in Portland, $4 64 per square. I understand that the market price for such slates in Boston and New York varies from $8 to $10 per square, which will afford a very handsome profit over the cost of transportation from Portland to these parts; and this profit will be in addition to that which will accrue as stated upon the delivery of the slates at Richmond.

Quality and Quantity.

"As regards the excellent quality of the Melbourne slates, I can speak with the utmost confidence; and the specimens which will accompany this Report, together with the analysis by Mr. Hunt contained in Sir William Logan's Descriptive Catalogue (page 41), and certificate of an experienced slate merchant in this city, will establish the accuracy of my statements.

"The quarry, as already remarked, has only been worked to the depth of seventy feet, while some of the Welsh slate quarries are worked (as this is also capable of being) to the depth of 400 feet from the surface. It is well known that the slate always improves in hardness, toughness, uniformity of color, and all other desirable qualities the deeper it is wrought; but even at the moderate depth hitherto attained, the Melbourne slates leave little further to be desired in these respects, and are not inferior to any in the world. They are remarkably uniform in the color, perfectly smooth and even in the cleavage, they split with great facility when first taken from the quarry, but rapidly harden and acquire great strength and toughness. Their color is unaffected by acids; they are perfectly non-absorbant of water, and consequently unaffected by frost; and when struck with a hard body, emit the metallic ring so much prized by slaters. The rock is remarkably free from joints, spar-veins, and other impurities affecting its uniform quality; even at the moderate depth at which it is now worked, the quarry would yield slabs of upwards of six feet square free from flaws.

"With regard to quantity, it will be obvious from the extent of the slate rock on the property as already stated, and its probable uniformity of character, that these quarries may be regarded as practically inexhaustible. From their position as regards drainage, &c., no machinery for pumping or hoisting would probably ever be required. The perpendicular cleavage of the rock gives great facilities for working the quarry to advantage which are not enjoyed by many others.

Markets for Slates.

"The advantages possessed by these slate quarries in point of position, as well as the excellence of the material produced, will enable the proprietors readily to command the trade of the whole Province of Canada, in which slate is rapidly superseding all other material for roofing purposes. The facilities for water conveyance by the St. Lawrence and the lakes will enable them also to compete successfully for the supply of the western cities of the Union; and as I have already shown, there will be a large margin for profits in the New York and Boston markets, even after allowing for railway transportation to Portland. There is a good market for slates in the West Indies which could be readily supplied from this source; and even in England the demand for slates has recently become as greatly in excess of the supply, that it is highly probable the Melbourne slates could be shipped to a profit from Portland to Liverpool. (See *London Mining Journal* for April, 1863, p. 252.)

"It should be remarked, that although many attempts have been made to establish slate quarries in Canada, they have all failed from want of the peculiar excellence of quality and natural facilities for working possessed by the Melbourne quarries; therefore there is little ground for apprehension on the score of competition in this country. In addition to its use for roofing purposes, this slate is admirably adapted for the production of slabs of all sorts, which are now extensively in use for many purposes, and which, by the introduction of simple and inexpensive machinery, could be manufactured to any extent on the property."

WEIGHTS AND MEASURES.

The importance of a uniform system of weights and measures has long been recognised in the United Kingdom. By common consent an approach to this desideratum has gradually taken place in the United States and Canada. Yet we are still far behind the French, and those nations who have adopted the French system in this important matter. While the country is yet young, it would appear advisable to adopt some general plan of action, which shall ultimately convert all our weights and measures into decimal parts of one standard. It is proposed in the British parliament to effect this object in a greater or less degree by adopting parts of the French system; and the only objection to the proposed system appears to be that it does not embrace the French system as a whole. The *Chemical News* contains a short article on this important subject, which is deserving of consideration, as if the recommendation of the bill before the British Parliament is adopted, it will have a considerable effect upon the mixed system in vogue with us.

By the adoption of the Canadian shilling as the fifth part of a dollar, we have virtually recognised the decimal system for our currency; in estimating, also, the ton at 2000 lbs., and the cwt. at 100 lbs., we have made a further advance in the right direction. And it is clear, that if the British bill becomes law, we must either adopt the standards which form the basis of their system of weights and measures, or improve upon it in such a way as to avoid many of the objections to which it is liable. In new scientific works, claiming to come up to the standard of modern requirements, the French weights and measures are generally adopted; and we do not see any valid reason why a modification of that admirable system should not find favour with our legislators.

In order that our readers may form some conception of the difficulty of this question in England, we introduce the following notice of British weights and measures from the report of the Select Committee of the House of Commons.

"Omitting many specific anomalies, we have no less than ten different systems of weights and measures, most of them established by law:—1. Grain, computed decimally, used for scientific purposes; 2. Troy weight, under 5 Geo. 4, c. 74, and 18 & 19 Vict., c. 72; 3. Troy ounce, with decimal multiples and divisions, called bullion weights, under 16 & 17 Vict., c. 29; 4. Bankers' weights, to weigh 10, 20, 30, 50, 100, and 200 sovereigns; 5. Apothecaries' weight; 6. Diamond weights and pearl weights, including carats; 7. Avoirdupois weight, under 5 Geo. 4, c. 74, and 18 & 19 Vict., c. 72; 8. Weights for hay and straw; 9. Wool weight, using as factors, 2, 3, 7, 13, and their multiples; 10. Coal weights, decimal under 1 & 2 Will. 4, c. 76, and 8 & 9 Vict., c. 101, Nos. 1, 5, ·2, ·1, ·05, ·025. We have also, in occasional scientific use, the weights of the metric system. For measures of length, we have the ordinary inch, foot, and yard. We have, in cloth measure, yards, nails and ells. There are four different sorts of ells. For nautical purposes, we have fathoms, knots, leagues, and geographical miles differing from the common mile. The fathom of a man-of-war is 6 feet; of a merchant vessel, 5½ feet; of a fishing-smack, 5 feet. We have also the Scotch and Irish mile, and the Scotch and Irish acre. There are several sorts of acres in the United Kingdom, and there are a great variety of roods. We have, in almost every trade, measures of length especially used in those trades; for the measurement of horses we have the hand; shoemakers use sizes; and we are compelled to adopt gauges where the French use the *millimétre*. These gauges are entirely arbitrary. The custom of the trade is the only thing which would decide the question, in case of dispute. For measures of capacity, we have twenty different bushels; we can scarcely tell what the hogshead means; for ale, it is 54 gallons; for wine, 63. Pipes of wine vary in many ways; each sort of wine seems to claim the privilege of a different sort of pipe. For measures of weight, we have about ten different stones: a stone of wool at Darlington is 18 lb.; a stone of flax at Downpatrick is 24 lb.; a stone of flax at Belfast is only 16¾ lb.; but it is also at Belfast 24½ lb., having in one place two values. The hundredweight may mean 100 lb., 112 lb., or 120 lb. If you buy an ounce or pound of anything, you must inquire if it belongs to Dutch, Troy, or avoirdupois weight." The *Chemical News* says:—

"The intrinsic excellence of the system of weights and measures established in France is almost universally recognised, and its superiority to the system, or rather the confusion of systems prevailing in this country, has long been felt. In scientific pursuits the French decimal system has been very largely adopted, with convenience in some respects, but with disadvantages resulting from the absence of any relation between it and the legitimate weights and measures used in commercial transactions.

"The Parliamentary Committee that have lately been inquiring into this subject have come to the conclusion that there would be a great advantage in the general adoption of a system of weights and measures which should be uniform, in itself, and with the system now established in France. The bill now before Parliament proposes therefore to substitute the French decimal weights and measures for those hitherto used in this country. This proposal certainly combines very great difficulties with, perhaps, equally great advantages, and it will doubtless be the subject of considerable difference of opinion. The inconveniences resulting from its adoption cannot but be very great, though they may be only temporary, and the great point to be determined is, whether the advantages ultimately resulting from the adoption of a system of weights and measures uniform with that of other countries, would be so considerable in themselves, and so much more important than the inconveniences of the change, as to justify its adoption.

"In France the introduction of the metrical system was effected at a period peculiarly favourable for a change of the kind, but still its practical recognition was a work of considerable time and difficulty. It may even be said to be scarcely complete at the present. The introduction of the metrical system, as the legitimate one, in this country, would probably be far from being generally followed by its actual adoption, just in the same way that the present legitimate weights and measures are not universally used. Local custom is so much more influential than sound principle, that even now transactions are carried on in many parts with weights and measures that are not the legitimate ones, and it is equally probable that if the metrical system were legitimately established, the actual use of the weights and measures now familiarly known, would be discontinued but very gradually. It would almost seem as if such a progressive change were contemplated by the framers of the bill as inevitable, since it provides that "For the more convenient subdivision of weights and measures, it shall be lawful to use the double and the half of all the said units, and their principal decimal divisions and multiples, *as well as any other* subordinate divisions which the Committee of the Privy Council for Trade may deem expedient." Thus it is proposed that the new pound should not be identical with the kilogramme, which is equal to 2·2046 pounds avoirdupois, but that it shall be equal to the half of a kilogramme, or 1·1023 pounds. This proposal seems somewhat inconsistent with the adoption of the decimal system. If it be admissible to use half the standard unit of weight =1·1023 pound avoirdupois, should it not be equally admissible to use weights that would be respectively equal to 0·45359 parts of a kilogramme, and to 50·8024 kilogrammes and which would be equal to the pound and hundred weight now in use? If the kilogramme be substituted for the present legitimate standard unit of weight, with the view of introducing the decimal system, it would seem that there could be no reasonable objection to the use of *any* fraction or multiple of that standard unit in commercial transactions, any more than there is to the use of fractions or multiples of the present unit of weight, such as half, or a quarter, or a sixteenth of a pound, and 112 or 2,240 pounds. In this way it might be possible to introduce eventually the metrical system without the present inconvenience of altering the actual value of the weights and measures now in use, by merely altering the mode of expressing those values as regards the legitimate standard. It is conceivable that such a plan would open the way to the practical recognition of the new system more easily and more effectually than would otherwise be possible, and that it would remove much of the opposition which the contemplated change is likely to meet with. It would render that change practically but a change of standard units, leaving the customary weights and measures to become gradually obsolete perhaps, in the same way that the guinea has come to be in reality obselete, and to exist only in name. To facilitate the eventual change, and to afford opportunity for the new system becoming familiar, customs and excise duties might be charged according to the legalised standard units, instead of the fractions, or multiples of them, used in ordinary commercial transactions. In any case, if the proposed alteration be made, some expedient will be necessary to lessen the inconveniences consequent upon it.

It appears to be a remarkable omission in the bill now before Parliament, that no provisions are made for the conditions under which the proposed new standard units of measure and weight are to be determined. This is more especially the case since, in clause 9 of the bill it is stated, that "all and every the provisions and provision which are by law in force with respect to the inspection, verification, &c., of the present imperial standard weights and measures, shall apply to and be in force with regard to the metric weights and measures in every respect as if the standard metric weights and measures were comprised in and designated by the imperial weights and measures in the Acts relating to such inspection, verification, &c." The unit of weight is to be the weight of a new quart of distilled water, or the tenth of the French cubic metre; but if this weight is to be estimated at 62° F. it will not be a kilogramme, since the kilogramme is the weight of a cubic decimeter of water at a temperature of 39·1°F., and under a barometric pressure of 29·922 inches.

"The unit of linear measure is made referable to the present inch, and not to the natural basis upon which the French measure is founded, though it is implied that the inch is to be abolished, and the several standards of weight and measure are to be verified by comparison with the standards in Paris, though it does not appear why their accuracy should be made dependent on that of the French standards."

THE VICTORIAN GOVERNMENT.*

The Victorian Exhibition of 1861 was held preliminary to the International Exhibition in London, 1862, and in order to disseminate correct and ample information respecting the colony of Victoria, the Government of that thriving province have issued a catalogue of the Victoria Exhibition, with prefatory essays, indicating the progress, resources, and physical characteristics of the colony.

Not content with giving this able work a widespread circulation in the United Kingdom and America, the Government of Victoria have caused it to be translated into the German and French languages, and distributed wherever those languages are spoken.

The Parliament of Victoria has done more than this: during 1861, it voted—

1st. Towards defraying the expense of introducing, from the United Kingdom, persons nominated by friends or relatives in the colony, £65,000 stg.

2nd. For sending out single females, and persons nominated in the United Kingdom, the sum of £40,000 stg.

3rd. For the introduction from Italy, Spain, and the South of France, of persons, with their families, who are skilled in the production of wine and oil, and in the drying and preservation of fruit, £8,000 stg.

Total for emigration purposes, £113,000 stg.

The vast riches of Victoria enable the Government of that country to take extraordinary steps to publish, in Europe, the advantages they can offer to emigrants, and the assistance they are disposed to give in drawing the human tide towards their shores. Canada has also many and great advantages, not least among which are the nearness of the country to Europe; its healthy climate, and the certain prospect of adequate remuneration, and ultimate independence it offers to industry. Victoria, with its glittering gold fields, possesses many outward attractions; but where great and sudden extremes of wealth are possible, it is also probable that there will be great and appalling extremes of vice and wretchedness. The quiet and healthy industry of Canada is better, far, than the feverish excitement and doubtful close of the gold miner's life, notwithstanding the seductive inducements offered by the Victorian Government.

* "Catalogue of the Victorian Exhibition."
"The Victorian Government Prize Essays."
"The Statistical Register of Victoria."

NOTES ON THE PRESENT CONDITION OF THE OIL WELLS OF ENNISKILLEN.*

BY SANDFORD FLEMING, ESQ., C. E.

During a recent visit to the village of Oil-Springs, in the Township of Enniskillen, I made the following notes on the present condition of the oil wells in that quarter.

The first flowing well discovered, was that known as the "Shaw Well," on Lot 13 in the Second Concession. The Oil was "struck" in the early part of last year, and continued to flow spontaneously for about ten months. This well was formed by digging about fifty feet though clay to the rock surface, and then by boring one hundred and fifty-eight feet though the latter. The flow from this well has now entirely ceased, after discharging a total estimated quantity of 35,000 barrels.

During the past summer, or at least since the first discovery of the Shaw well, there have been found in all about thirty flowing wells of more or less value in this section. The yield of all these wells, as I was informed, was at one time as much as 12,000 barrels per day. They are all situated within an area of one square mile, and chiefly on the south bank of the Black Creek; only one having been discovered to the north of it. The number of flowing wells is now reduced to two, an old and a new one recently opened. These two wells are within a hundred feet of each other, and yield, it is said, over one hundred barrels per day each. Many of the old surface wells are now brought into requisition; and such of the old flowing wells as yet afford oil by pumping, are worked by hand. The total yield from the flowing wells and all other sources, at the present time, is said to be about four hundred barrels per day.

There is one remarkable peculiarity connected with the stoppage of the natural discharge of oil from the wells which might here be mentioned. The deepest wells invariable have been those which first ceased to flow: and the two shallowest of all the thirty wells, are those only which now yield a natural discharge of oil.

I ascertained the depth of nine separate flowing wells, at points scattered over the whole oil-producing area, to be as follows:

The deepest well.. ..	G	is 230	feet in the rock.	
" next deepest......	I	is 208	"	"
" "	B	is 200	"	"
" "	C	is 182	"	"
" "	H	is 180	"	"
" "	D	is 162	"	"
" "	A	is 158	"	"
The shallowest wells	E......	is 109	At present flowing	
	F......	is 109		

It ought to be borne in mind, that I give the depths under the rock surface, not under the surface of the ground; the former being nearly level while the latter is very uneven. Over the surface of the rock, the thickness of clay ranges from forty feet in the flats of the creek to eighty feet on the banks.

The deepest well (G) was the first to fail; in fact this one only discharged 4,000 barrels in all. The next on the list (I), the "Feroe" well, failed. Then the wells (B and C) at opposite extremities of the oil-producing area gave way, Then well H, in the centre, and close by the gum beds, ceased flowing. Then various intermediate wells failed; until now the only old well flowing is F, with a depth of one hundred and nine feet under the rock surface; and its companion (E), recently made, within thirty or forty yards of it, and to the same depth in the rock, yields a copious supply.

In ceasing to give a discharge of oil, these wells seem to give no previous indications of a coming change. The iron pipe which conveys the fluid from the bore in the rock to a convenient height above the surface of the ground, continues to yield a discharge; but this discharge is suddenly changed, in most instances from petroleum to salt water, and the water flows on in a continuous stream, as did the former substance.

The mention of some apparent anomalies may be of interest to those who desire to form satisfactory theories regarding the various phenomena connected with the mineral oils.

1. In the immediate neighbourhood of all the flowing wells, and on the next lot to what is termed the gum-beds, the rock was bored to a depth of three hundred feet—seventy feet lower than the lowest well—without finding the slightest trace of oil.

2. About twenty yards from the flowing well marked I, a second bore was made in the rock to a greater depth by seven feet than the first well, without finding oil.

3. In another case, the rock was bored about fifty feet from a good flowing well, and twenty-five feet deeper, without success.

4. But perhaps the most singular case is the following:—Some time after the "Shaw" well flowed so successfully, a second party bored the rock to the same depth about 100 yards from it, and found a copious discharge of oil, but this second well had the immediate effect of reducing very materially the flow from the "Shaw" well. When either was plugged up, the other yielded a full discharge; but when both were allowed to flow, each yielded only a partial supply. A third party owning a small oil lot between the two wells, commenced boring on a line drawn from the one to the other at the distance of about thirty yards from the "Shaw" well; he naturally expected to rob both wells, whilst their owners (who by this time had formed a co-partnership) had every reason to fear his certain success. All parties however were doomed to disappointment, as the third well proved an utter failure, although the rock was bored to a much greater depth than the other two wells.

I may mention that although traces of petroleum have been found at several places beyond the immediate neighbourhood of the village of Oil Springs, viz., at Bothwell, at Tilsonburgh, and at other points within a circle of perhaps ten or fifteen miles; yet with one exception, I believe no flowing well has been struck beyond the limited area shewn on the sketch. The exception referred to is at Petrolea, on lot 14 in 18th concession, Enniskillen, and about six miles from Oil Springs village. The rock is here bored to a depth of three hundred feet—five hundred and sixty-three feet under the surface of the ground—and a con-

* Read before the Canadian Institute, February 29, 1863.

stant stream of salt water and oil is discharged, equal to it is estimated, 1,200 barrels per day; and of this yield, about one per cent., or 12 barrels per day, is found to be petroleum.

There are at the present time a great number of refineries in the neighbourhood of the springs; I had no means of ascertaining the exact number, but I was told that, reckoning large and small they could not number much fewer than one hundred. The capacity of these refineries is estimated to be equal to 1,500 barrels of crude oil per day, whilst the total yield of the springs is said to be not much more than four hundred barrels.

The "oil-men," although discouraged, are not without hope; they think that, as in Pennsylvania, an increased supply of Petroleum will be found, by sinking wells to a greater depth; and accordingly, they are making arrangements, if they have not already commenced, to sink a test well, to the great depth of one thousand feet under the surface.

I was informed, that although only about 150,000 barrels of Petroleum have been shipped, a total quantity of 300,000 barrels must have been discharged, up to this date, from all the wells; about half of the total yield having been allowed to run to waste. To give some idea of the capacity of the hidden reservoirs in which the Petroleum has been stored, I may mention that 300,000 barrels are equal to nearly 2,000,000 cubic feet; and that if brought into one place, the crude oil discharged from the wells of Enniskillen would be sufficient to cover an area of five acres of land to a depth of ten feet!—*From the Canadian Journal.*

ON MAIZE PAPER.*

"Where shall we in future get our paper from?" is at the present time a stereotype question among paper-makers. And they have indeed reason to ask the question, for it is a well known fact that the consumption of paper is enormously increasing in all civilised States. The explanation of this is not only the increased productive activity of literature in general, and the periodical press especially, but also the quicker pulsation of public and private commercial life, caused by the freer institutions of States, the stimulus of competition, increased communication, &c. A great quantity of paper is also now used for other purposes than for printing and writing on, such as for paper hangings, cartridge, packing paper, &c.

The consequences of this enormous paper consumption are felt more and more, because the paper manufacturers meet every day with greater difficulties in procuring a sufficient supply of the raw material necessary for the working of their factories. The rags which are mostly used for the paper pulp cannot be produced at will, like other raw material; the supply is, as well in regard to quality as quantity, to a certain limit influenced by the activity of the rag gatherers.

It is therefore evident, that the moment must come, sooner or later, when it will be absolutely impossible for the paper manufacturers to keep pace with the paper consumption—if they should not succeed in discovering a suitable substitute for rags. To this end their exertions have been directed for years, and experiments tried with different degrees of success have proved the existence of many substances containing fibre which might serve as a substitute for rags. Few, however, are adapted for manufacturing purposes, either because they are too costly, or because they cannot be obtained in sufficient quantity. Culture or food plants are those which are produced in the greatest quantity, and of these the maize plant seems one of the best adapted for paper-making. This fact was ascertained long ago, and hence it has been tried on several occasions. According to Dr. Schaeffers "Sammutliche Papierversuche" (Reginsburg, 1772), two maize straw paper factories existed in Italy in the last century. But the process in use by the makers seems to have been lost with the decay of the paper mills. A certain Montz Diamant from Bohemia, recently again drew attention to the maize plant as a substitute for linen rags, and indicated a process for the transformation of maize fibre into paper pulp. He submitted in 1856 to Baron Bruck, the Austrian Minister of Finance, a project with regard to it. The Imperial paper manufactory at Schlogelmuhle, near Gloggnitz, was consequently authorised to make, under Diamant's direction, paper out of a certain quantity of maize straw. The paper so produced was not satisfactory in regard to quality, and the cost of making it also proved to be much higher than that of rag paper. The Minister of Finance therefore gave orders to stop further experiments.

In consequence of a recommendation from experienced men whose opinions had been taken, Baron Bruck consented to have a second trial made in the Imperial paper mill, under Diamant's direction. The mill was at that time under my superintendence, and I interested myself very warmly in the experiments. Different kinds of paper, writing and printing, were manufactured, which were not entirely satisfactory as far as quality was concerned. The cost of producing the paper was still, in spite of all exertions to reduce the manufacturing expenses, considerably higher than that of rag paper, consequently the director of the Imperial paper mill could not recommend the manufacture of maize paper on a large scale.

As the bulk of the expenditure arose from the great distance of transport of the raw material, it was proposed to undertake the manufacture in a locality where maize was raised in sufficient quantity to have the straw at hand available. It was further resolved to erect an experimental factory for reducing it into half stuff; so that instead of the bulky straw only the compressed substance adapted for manufacturing paper should be delivered at the paper mills.

The half stuff factory was erected at Roman Szt-Mitaaly, near Temesvar, where the maize cultivation is extensive, and on the 6th March, 1860, it commenced to work under Diamant's provisional direction. The restricted time for experiments was one year. Diamant promised to manufacture in that period 4,500 cwt. of half stuff out of maize straw, but not the seventh part of this quantity was reached.

The half stuff made was also so poor that further experiments, and the working of the factory were

* By Dr. Alois Ritter Auer Von Welbash, Imperial Royal Aulic Counsellor, Chief Director of the Imperial State Printing Establishment in Vienna, and of the Imperial Paper Mill, at Schlogelmuhle, Member of the Imperial Academy of Sciences.

suspended at Diamant's own suggestion before the stipulated time had expired. Diamant was then released from his position, absented himself, and left the question unsettled. The experiments cost more than 30,000 florins, which had been advanced by the Imperial paper mill, according to orders from the late Baron Bruck. With this, the past operations of maize straw paper were closed as far as the experiments were conducted under Diamant's direction. Diamant did not participate in subsequent experiments.

The Imperial paper mill had now to rely on itself. The exertions of the direction under whose superintendence the experiments were continued, aimed principally at two things; first to reduce the cost of production by improvements in the mode of manufacture—secondly to ascertain what the expenses would be, if, instead of the whole straw, only the envelop of the grain cob (the sheathing leaves enclosing the corn head), containing fibres of the best and finest quality were used for making paper.

If these industriously continued experiments did not lead directly to the desired result, that of making paper as cheap out of maize straw as out of rags, they led at least indirectly to improvements and what is of greater weight, to a very important result—the discovery of a new fibre capable of being spun and woven, and the waste of which fibre furnishes a cheap paper.

The origin of this discovery was somewhat as follows:—

It was known that the basis of all paper is vegetable fibre. The rags are but the fibres, produced out of the flax, hemp, or cotton plants, and used up by wearing, If those fibres were used for making paper before they were converted into textures, the paper would be certainly better, but at the same time more costly.

Paper of maize straw is paper of unworn plant fibres. After the idea had once run in this direction, the question arose—cannot the fibres of the maize plant before they are delivered to the paper machine, just as well be worn as the fibres of flax and hemp are first reduced by wear and tear? In other words, cannot the maize fibre be spun and woven. All that was necessary was a trial. It was made, and succeeded. It was found that the maize fibre could be extracted from the plant in a form like flax, by a process very simple, and at the same time requiring but little apparatus and auxiliary means; that it could be spun like flax, and woven like flax thread. The process which I have invented and brought into use, is protected by patents in all the great European States, so as to secure for Austria the priority of the invention.

That the spinning and weaving of the maize fibre is not yet so far advanced as to make paper out of it, is not to be wondered at, for it must be borne in mind that the last-named process has been tried for several years, while the invention of spinning and weaving it has only recently been experimented on, and is consequently yet in its infancy. The textiles of maize flax will look very different in a short time, when practical men have taken it in hand, and the spinning and weaving machinery have been adapted to the maize fibre. No invention has come out of the brain of its author thoroughly complete, all require time to bring them to perfection, so has it been with this. But this much can be stated with confidence, that the adaptability of maize fibre for spinning and weaving is of the greatest consequence in a commercial point of view, for the cultivation of this plant constitutes one of the most profitable branches of agriculture known, especially in America and parts of Europe. Without taking the corn into consideration which already pays for its cultivation, the various parts of the plants can be utilised in many ways.

By the process employed for producing the maize fibre, the components of the plant are separated into three different parts—fibre, flour-dough, and gluten. The fibres are spun and woven, the nutritive substance (flour-dough) which has the peculiarity of remaining fresh for months in the open air, and, unlike other organic substances, resisting putrefaction gives a pleasant tasting, nutritive, healthy flour dough.

All the fibre and gluten wastes of the maize plant which are precipitated during the process of extracting the fibres, are used for manufacturing paper. The catalogues of the Austrian collection at the London International Exhibition in 1862 in German, French and English, were printed either wholly on maize paper, or on paper made partly of maize fibre and of linen or cotton rags.

The ear and the maize stuff extract furnish food for man. The fibres are woven into clothing, and the shorter fibre and gluten stuff is converted into beautiful paper. After the fibre has served for clothing, it is recovered as rags and manufactured into paper. What plant can boast of such general qualities as maize.

The entire maize plant can be brought into use. The most remarkable thing in regard to the process is its simplicity. The humblest laborer can adopt it when once instructed, and is enabled to produce the above-named article in the field itself without the slightest expense. Where wood is scarce, the lower part of the stalk will supply him with fuel; owners of large farms or manufacturers can produce hundreds of cwt. per day in steam boilers, The material may be bought for cash from the smallest farmer or the largest planter, and brought into the markets of the world.

Austria will endeavour first to acquire enough to supply its own consumption, and then realise a large foreign export. The other countries where maize is grown will follow in the train of this useful application, and the whole world will derive millions of profit by this new branch of industry.

I may close with the following summary: 160 pounds of rags, valued here at about 16 florins, are required for the production of 100 lbs. of foolscap, which paper sells for about 33 florins. Four florins have been paid up to this time at Schlogelmuhle for one hundred weight of the maize paper material. From 3 to 3½ cwts. of lischen (head leaves), yield 100 lbs. of paper.

According to official accounts there are in the Austrian dominions more than 2,800,000 yokes (1½ English acres=1 yoke) of ground planted with maize. The produce of lischen or head leaves (grain sheath) may therefore be estimated at 2½ cwt. of lischen at the lowest computation. We may thus take it for granted that 1,200,000 cwt. of rags can be substituted by maize leaves.

One cwt. of head leaves yields, on an average, one-third substance for spinning, one-third for paper and one-third for food, there is therefore, scarcely an atom of waste.

If the whole of the fibrous substances were worked up into paper there would be produced about 1,500,000 cwts. of paper from the lischen collected in the Austrian monarchy. There is no doubt whatever that paper made from pure maize substance far surpasses the best rag paper in strength, toughness, durability, and power of bearing. Experiments made in my own room and before my own eyes, showed that one sheet of bleached maize paper chosen from the portfolio, sustained a weight of 460 Vienna pounds.

If the substance is ground short, on which the transparency depends, maize paper can probably be used as an excellent substitute for glass, owing partly to its natural transparency. It may further be remarked that factories for the extraction of fibre and substance for bread, require no expensive machinery, and but little additional material.—*From the Technologist.*

[The remaining portion of this article, as it appears in the Londor *Technologist* for March, 1863, is copied word for word from the January No. of this Journal without the slightest acknowledgment.]

BRITISH PUBLICATIONS FOR MAY.

Allen (C.) Young Mechanic's Instructor; or, Workman's Guide, roy. 12mo	0	2	6	*Elliott.*
Bank's Staircasing and Handrailing, 3 vols., revised by Jos. Galpin, 4to each	0	14	0	*Whittaker.*
Barker (T. H.) On Malaria and Miasmata, and their influence, 8vo.	0	8	0	*Davies.*
Beeton's Dictionary of Universal Biography, post 8vo	0	7	6	*Beeton.*
Besant (W. H.) Elementary Hydrostatics, fcap. 8vo	0	4	0	*Bell & Daldy.*
Binn's (W. S.) Course of Geometrical Drawing, Part 2, cr. 8vo	0	6	0	*Weale.*
Black's Guide to London and its Environs, new edit., fcap. 8vo	0	3	6	*Black.*
Clarke (L. Lane) Objects for the Microscope, 2nd edit., sm. post 8vo	0	3	6	*Groombridge.*
Crabbe (George) Dictionary of General Knowledge, by H. Davis, cr. 8vo., red to.	0	3	6	*Tegg.*
Hann (James) Short Treatise on the Steam Engine, edited by T. Baker, 2nd ed., crown 8vo	0	3	6	*Houlston.*
Hart (A. S.) Elementary Treatise on Hydrostatics and Hydronamics, 8vo., re. to	0	4	0	*McGlashan & G.*
Hunter (Rev. J.) Examination Questions in Bookkeeping by Double Entry, 12mo	0	1	0	*Longman.*
——— with Answers, 12mo.	0	2	0	*Longman.*
Lankester (Edwin) Half-hours with the Microscope, new edit, fcap. 8vo., plain, 2s. 6d., colored	0	4	0	*Hardwicke.*
Lillywhite's Guide to Cricketers, Spring Edition, 1863, fcap. 8vo.	0	1	6	*Lillywhite.*
Lund (Thomas) Short and Easy Course of Algebra, 6th edit., fcap. 8vo.	0	2	6	*Longman.*
Lupton (W. M.) Chemical Tables, for Separation of one Acid and one Base, Pt. 1, royal 8vo	0	2	6	*Bean.*
Matheson (Henry) Practical Advice to Amateur Photographers, cr. 8vo.	0	1	0	*J. How.*
Miller (W. H.) Tract on Chrystallography, 8vo	0	5	0	*Bell & Daldy.*
Molesworth (G. L.) Pocket-Book of Useful Formulæ and Memoranda, 2nd edit., oblong 32mo	0	4	6	*Spon.*
Noad (Hen. M.) Manual of Chemical Analysis, Part 1, Qualitative, cr. 8vo	0	6	0	*L. Reeve.*
Parkes (Samuel) Chatechism of Chemistry, by Wm. Barker, 12mo., red. to	0	2	0	*E. Law.*
Reynolds (John S.) Hints on School Building, fcap. 8vo	0	2	6	*H. & Col. Sch.*

Patent Laws and Inventions.

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

2645. H. Ellis. *Improvements in the manufacture of compounds of silica, and in the application of certain compounds of silica to mineralize woven fabrics, paper, and paper pulp, to harden and preserve stone and cement in the production of artificial stone and paint, and in the production and glazing of porcelain and such like manufactures.* Dated September 29, 1862.

To manufacture compound silicates, the patentee first precipitates the compound silicates out of solutions of silicate of soda, or of potash, by means of solutions of any of the salts of the metals, or of the earths. He then strains and washes the silicates so obtained; and while recently formed, or in the gelatinous state, he redissolves them in as much as may be sufficient of a solution of silicate of soda, or of potash or of both. If the silicates have been allowed to get dry he heats the mixture up to the boiling point to facilitate their solution. All gelatinous silicates, however obtained, may be made soluble in the above manner, and by addition of carbonates of soda or of potash. Solutions of the boro-silicates, phospho-silicates, and chromo-silicates he obtains by mixing saturated solutions of borate of soda, or chromate of potash, with an equal quantity by measure of solutions of silicates of soda, or potash, or of both, of about 1·2 specific gravity, and then precipitating by means of solutions of the metallic or earthy salts, and washing and redissolving the recent precipitates so obtained in the manner described. All the above compound soluble silicates may be reduced by evaporation into a gelatinous state, and preserved for use in that state in air-tight vessels.

2654. A. Prince. *Improvements in the manufacture of varnish, printing ink, paint, and printing colours.* (A communication.) Dated September 30, 1862.

This invention consists in the use and application of petroleum, or the products thereof (instead of linseed oil hitherto in use), to the manufacture of varnish, printing ink, paint, and printing colours, and oil colours of every kind. Instead of natural petroleum, coal and schist oil, prepared in an artificial way, may likewise be applied.

2982. P. W. Reuter. *Improvements in dyeing.* (A communication.) Dated November 4, 1862.

In carrying out this invention, the inventor takes slacked lime in the proportion of 1 lb. to every 100 gallons of water, or thereabouts, and after the same has been well mixed, he takes the clear solution of lime and adds thereto powdered oxide of lead, litharge, minium or massicot, or other salt or compound of lead, in the proportion of about 2 oz. to every lb.

of wool or woollen fabric to be dyed. He then adds carbonate of soda in the proportion of about 1 oz. to every lb. of wool or woollen fabric to be operated upon. Having thus formed the bath or mixture intended for the dyeing or colouring of wool or woven fabrics thereof, he proceeds as follows:—The mixture or bath being contained in a suitable vessel, he places therein the wool or fabric to be dyed, and he gradually raises the temperature of the mixture or bath to 150 deg. Fahrenheit, and after the wool or other material or fabric to be dyed has attained the desired intensity of colour or tint, he removes it from the dye bath. It may then be removed and dried, but generally it is preferred to subject it to what is known as a "soap bath," and afterwards to a bath containing water acidulated with hydrochloric or other suitable acid; and, finally, to several washings in cold water, as is well understood. By this means, any lime or other substance which may become attached to the wool in the process of dyeing is removed.

Selected Articles.

GRAIN ELEVATORS

The processes of thrashing, cleaning, and elevating grain, simple as they may seem, involve operations of such nicety that the whole subject deserves to rank as a separate science. We find on examination, that corn, like air, water, electricity, &c., requires the observance of certain fixed and determinate rules in every thing connected with its management, to a degree which the uninitiated in such matters little imagine. The belief obtains that all the varying processes through which it goes from the time it leaves the farmer's stack, until it is pronounced fit for the miller, can be performed by comparatively rude appliances, which are easily constructed, and exercise no great demand on the inventive abilities of the agricultural engineer. Never was there a greater error; and we do not hesitate to say that the construction of a good thrashing machine involves more difficulties, and requires more accurate knowledge of certain principles, than that of many other machines which are regarded as models of scientific skill properly applied; and we cannot but regard it as strange that the young engineer has not one text-book at his command which can afford him sound or theoretical or practical information on this very important subject. The preparation of corn for the market is not so easy a matter now as it formerly was; farmers are no longer satisfied to send their produce to the purchaser in a partially prepared state which involved a considerable amount of expensive labour on the part of the miller before it could be pronounced fit for the process of grinding; and the growing tendency is not only to bring samples to the highest possible state of perfection, but also to perform all the necessary operations at one time, and in a single machine. When we consider the different descriptions of grain dealt with and the varying states in which it is submitted to the action of this apparatus, we shall be better able to form an opinion of the difficulties involved. It is not our intention at present to enter on the question of the construction of thrashing machinery, but to glance at one of its appurtenances, the Elevator, which bids fair to play an important part in the future of these machines.

From the time that the first mill was built three stories high, it is more than probable that the want of a suitable means of raising corn from the lower to the upper stories made itself felt. The sturdy backs of the miller and his men supplied the want for years in a very effectual manner, we feel little doubt; but growing intelligence after a time pointed out far better means of attaining the same end, and various descriptions of sack-hoist, may still be found in mills of a good old age. The inventors of these ingenious and useful applications of power have all sunk into oblivion, and nothing remains of them but their works. Now, although the hoisting of grain in mass, or by the sack at a time, was found suitable enough to the wants of the miller, it did not by any means supply the demands of the brewer or distiller who generally keep their corn stored in large receptacles or granaries, from which it requires to be elevated to the upper stories of the building periodically in very considerable quantities, quite precluding a resort to the operation of sacking.

The machine designed to fulfil this purpose bears the name of "Jacob's Ladder," and for any evidence we have to the contrary might as well have been invented by the patriarch whose name it bears as any one else. It consists of a broad endless leather belt, running over small wheels—one in the highest story of the building; the other in the lowest is fixed in a kind of box, which can easily be placed in communication with a hopper into which corn is delivered in a continuous stream from the granaries on the ground floor. On the surface of the belt are fixed a number of tin buckets by means of rivets. Power being applied to the upper pulley, by its revolution it causes the ascent of one side of the belt and the descent of the other, when the little tin cups, dipping into the corn in the receptable at the bottom, become partially filled with the grain, which they carry to the top and discharge into a suitable spout on being upset in passing over the upper pulley. The machine is simple, and in such situations, where it has only clean corn to deal with works admirably; once the speed and the feed are regulated, it will without attention and with unvarying regularity, continue to carry up corn so long as it remains in motion. As a consequence, it has met with almost universal application and continues to enjoy high favour. Still it is quite incapable of meeting an emergency when more than the normal quantity of grain requires to be raised in a given time. If run above a certain speed the corn is tossed out of the cups, which ascend only partially filled; and although this is a matter of little importance in the regular work of a mill or brewery, in other situations it has become a defect which promises to lead to its supersedal by very different mechanism.

In the first thrashing machines introduced into this country, the inventor satisfied himself with merely extracting the grain from its straw, leaving the subsequent operation of cleaning and dressing to be accomplished by hand in other machines; but the inconvenience of this mode of proceeding soon becoming evident, led to the combination of the dressing, with the thrashing machinery; and as this last always delivers the corn near the ground in the first instance, owing to its working conditions it became necessary to elevate the thrashed grain to the top of the machine, in order that it might find its way through the dressing apparatus to the sack. The Jacob's Ladder offered the readiest means of attaining this end, and was immediately employed; but it soon proved itself sadly deficient in supplying the demands of the farmer, who could ill brook the frequent stoppage of the machine—a result which constantly took place in consequence of the admixture of considerable quantities of short straw with the corn, which choked up the buckets, got wound on the pulley shafts and filled up the wooden case in which the elevator generally worked. Worst of all it was frequently found incapable of raising the extra quantities of grain, thrashed from peculiarly productive samples, nevertheless, it remained in general use until three or four years ago, when another elevator was brought into notice by Messrs. Bruckshaw and Underhill.

One of the most necessary processes which barley, &c., undergoes in its preparation for market, is the removal of the beard or awn. This has hitherto been performed by a machine called a "hummeler" which is simply a horizontal iron tube about 9 in. in diameter and 5 or 6 feet long, containing a spindle set round with a great number of small blunt knives, which being arranged spirally, force the corn poured in at one end by the elevator towards the other end, from which it falls on the dressing seives, the spindles revolving at three or four hundred revolutions per minute. The knives effectually remove the beard or awn, and brighten and improve the general appearance of any corn, bearded or not, which passes through the apparatus.

Mr. Underhill accomplishes both the hummeling and elevating of the grain in one operation, by the following means:—

In any convenient situation at the bottom of the thrashing machine he arranges a fan, very similar to those employed in blowing cupolas and smithy fires. It is usually about 30 in. in diameter fitted with straight vanes, made of stout sheet-iron with the sides turned up about ½ in. These vanes are about 8 in. long and 4 in. wide, and are riveted to stout wrought-iron arms forged with the centre boss in one piece. The fan-case is of cast and wrought iron, only just wide enough to permit the fan to revolve within, without touching it; from the circumference of the case above the centre proceeds a tangential inclined wind-trunk, about 8 in. wide by 4 in. deep. The upper end of this trunk opens into a box of peculiar but simple construction, which permits the escape of air but not of grain. The fan being caused to make about 700 revolutions per minute, sends a powerful current of air up the trunk, while the thrashed corn poured into the bottom of the fan case by a suitable spout is, by the combined stroke of the fan-blades and the powerful current of air, carried in almost any quantity to the top of the machine, or indeed much higher; the patentees stating that it will elevate 30 ft. with ease.

The action of the fan effectually removes every particle of awn from the corn; indeed it occasionally does much more, breaking the grain in a very objectionable manner—a result always due to improper fitting and arangements, easily avoided by those conversant with the peculiarities of the apparatus. Thus we have known it to break corn at 700 revolutions, while it did not injure it in the slighest degree at 1,200 revolutions per minute—a result we attribute to the fact of the corn being elevated rather by the current of air, than the stroke of the fan. In some cases a difficulty is found in finding a suitable place for it on machines not specially intended for its application—a difficulty often got over by taking the wind trunk from some part of the circumference of the fan-case below, instead of above the centre, which permits the revolutions of the fan in an opposite direction. The powerful blast aids materially in carrying off the chaff and dirt, and the machine has hitherto proved itself extremely efficient and satisfactory.

Messrs. Smith and Higgs have introduced an Elevator, whose action depends on nearly the same principles as those which regulate the ascent of water in a pump. Although it has not yet received much attention, being of very recent invention, we believe it may yet be capable of supplying all the requirements which may entitle it to be called a very excellent machine. A fan something similar to that last described, but having peculiarly curved vanes, is mounted on the drum shaft of the thrashing machine. A flat trunk, the opening through which is about 15 in. long and 2 in. wide, proceeds from the centre of the closed fan-case to the lower part of the machine, where it ends in a kind of mouth-piece just over a shallow iron tray, into which the thrashed corn is delivered. The fan runs about 900 revolutions per minute. The word "suck" is neither elegant nor scientifically accurate, yet we can find nothing which better expresses our meaning, for the corn is actually "sucked" up from the tray through the trunk into the fan, from which it is propelled through a second trunk fixed horizontally, or nearly so, above the dressing machinery, while the air, leaving the corn to make its way through this apparatus, passes down a large tube, and acts the part of first winnower to the rough grain.

The elevating of grain in quantity by this machine depends on many of those nice points of scientific detail, which we have already stated to be largely involved in the construction of thrashing and dressing machinery. The exact curve of the fan blades, the shape of the elevating trunk, the curve by which it communicates with the interior of the fan-case—all exert a powerful influence on its action. There seems to be little limit to the height to which it will elevate corn; we believe it equal to Underhill's in this respect, and with suitable arrangements it will dress the corn equally well. Curiously enough, three different individuals each without the knowledge of the others, applied for provisional protection for this invention within a fortnight—a remarkable instance of a similar want giving rise to a similar train of ideas in distinct individuals at the same time.

Messrs. Hornsby, preferring to retain the old-fashioned Jacob's Ladder, yet fully alive to all its defects, have succeeded in so far remodelling it as to construct a very efficient Elevator. Removing the buckets, they have replaced them with flat iron plates, standing at right angles to the surface of the belt, which runs at the upper end on a pulley on the chain shaft, and below on a second palley, situated within the case, which resembles that usually employed, except that it is lined with roughened iron plates. The corn is delivered into the case at the bottom, and is scraped so to speak, up the case by the exceedingly rapid motion of the ascending plates on the belt, effectually hummeling it during the process. The belt certainly seems exposed to a considerable amount of wear, but this need not be excessive, provided the pulleys are of fair diameter; and it must be remembered that Underhill's Elevator requires a belt running at a very high speed to drive it; besides both it and Smith's Elevator require considerable power to drive the fans, in addition to that employed in raising the corn, so that the advantages and disadvantages are pretty well divided amongst them.

The four machines which we have now slightly described, play an important though indirect part in the preparation of our breadstuffs; and two of them at least, involve nice questions in dynamics, which make them well worthy of the attention of those interested in such matters. There is still room for considerable improvement, especially in the reduction of the power required to work them. As to their comparative merits, we may say that although the general principles of construction are the same in all thrashing machines, yet the means of applying them to the object in view are so various that the different forms of this class of machinery are almost endless, and of course the best result can only be obtained by selecting that description of elevator which is most suitable to the form of the machine to which it is to be applied. Not only is there often a practical difficulty in getting the grain to the elevator, but also in getting it away again, and that which might suit one form of machine admirably, might be just as unfitted for another.—*Mechanics' Magazine.*

THE INFLUENCE OF THE BLAST IN THE QUALITY OF IRON.

When we consider the immense interests involved in the iron manufacture, it seems strange that the precise influence of the different applications of the blast on the quality of the iron produced in the blast furnace has not been investigated with the care demanded by the importance of the subject. The most eminent men of science are at variance when attempting to explain the principal phenomena resulting from the action of the tuyeres at the hearth.

If we remember that a weight of nearly 14 tons of air is consumed in an hour in some of the large furnaces—an amount of nearly three times as great as that of the solid materials; the ore, flux, and fuel—it must be evident that the volume, the density, the hygroscopic state, the chemical constituents, and lastly, the temperature of the air employed must exercise a powerful influence for good or for evil upon the products of the furnace. The action of the air will evidently not merely confine itself to the "yield" or quantity, but will also exercise an influence on the "make" or quality of the pig.

The density of the blast employed has a considerable influence on the smelting operations, and it is principally determined by the dimensions of the furnace and the kind of fuel employed. The season of the year also requires some variation in the pressure of the air; and when its density is diminished by the heat of summer, the blowing engine has to make up the deficiency by increased speed, in order that the furnace be supplied with the requisite amount of oxygen. Before the introduction of blowing engines worked by steam great difficulties were encountered in the use of coke and coal in the furnace. About 2 lb. to the square inch is the minimum pressure of air now employed, and this density is generally increased with the density of the fuel until in some cases it reaches 3½ lb. to the sq. inch. Considerable difference of opinion still exists as to the precise shape of the tuyeres and the exact number to be employed. Mr. Truran patented in 1855 (No. 1730), "a mode of constructing nozzle pipes so that they could deliver through one tuyere two or more jets of blast, hot or cold, of like or different densities. The nozzle pipes may be divided by partitions or be double, one being within the other, so that the outer one delivers an annular jet, and the two jets may be supplied from different pipes, and be of different densities or temperatures." We do not know whether this plan has ever been tried. The blast is generally applied by means of three tuyeres, but as many as ten nozzels are sometimes used. The small tuyer system is especially adopted in Scotland. It is to be regretted that exact data do not exist as to the relative values of the two systems.

The hydroscopic state of the air, or the amount of moisture contained in the atmosphere, is another potent element of success or failure. It is estimated by Mr. Truran that about 25 tons of air are consumed per ton of metal, say dark grey pig iron, and thus, with a make of 120 tons per week, the amount of blast consumed would be 3,000 tons. According to Dalton, the air in England contains about 1·42 per cent. of moisture, in dry weather, and more than double that amount in wet weather so that we have a quantity of from nearly 50 to 100 tons of water discharged weekly into the furnace. This is, no doubt, the explanation that there is less fuel consumed and a better quality of metal produced in winter than in summer. The increase of make is, in fact, estimated to be from 4 to 5 per cent greater during the winter months. The chemical constituents of atmospheric air being invariably the same, it could only be by artificial means that any action on the furnace could be sought for by changing the chemical composition of the blast. Various attempts in this direction will be found recorded in her Majesty's Patent office. Thus we find one invention (Patent No. 6,948, Old Law), proposing to inject "pure hydrogen gas" into the blast furnace. Apart from the risk of explosion, the great expense in procuring the gas would of itself form an insuperable bar to the practical introduction of this process.

The precise effect of raising the temperature of the ejected air to about 610 deg., or the use of the hot blast, is still a debatable point with those concerned in iron-making. The question may be briefly divided into three separate heads; the first being the influence of the hot blast on the economy of fuel, the second its action on the quality of the iron produced, the third being the commercial or trade value of the hot blast.

There is no doubt that the consumption of furnace coal is reduced by the hot blast. The saving effected varies greatly with different kinds of coal and ore. Taking the coal used in the stoves for heating the blast into account, the saving effected has been estimated at 3 cwts. of coal per ton of pig iron in Wales, and from 6 to 7 cwts. in Scotland. Various reasons have been given to account for this economy of fuel. By some it has been ascribed to an annulling of the cooling effects of the cold blast on the combustion of the furnace; by others that a hot blast supports combustion better than a cold blast; the relative proportions of the oxygen and hydrogen on the air are, however, unaltered by the addition of heat. Mr. Truran ascribes the economy effected by the hot blast to a reduction in the quantity of coal required in the furnace from the extraneous heat thrown in by the blast, as a reduced proportion of coal to ore is always succeeded by an increased quantity of iron produced. The amount of coal required in the furnace being thus lessened, there is a less volume of blast required, the additional result being a diminished consumption of fuel in the upper parts of the furnace. Briefly stated, the economy of fuel effected may be ascribed to two causes; the reducing power of the heated blast ejected at the bottom of the furnace, and the lesser proportion of carbon in the furnace to the volume of the blast.

With regard to the influence of the hot blast on the quality of the pig, we are still somewhat in the dark. There is no doubt, however, that the use of such a powerful means of acting on the furnace may, in unskilful hands lead to bad results. Mr. Robert Mallet, in his work "On the Physical Conditions Involved in the Construction of Artillery," ascribes the "much discussed and unquestionable (?) inferiority of hot-blast iron over cold" to unnecessary heat of fusion, caused by an unskilful use of the hot blast. "Unnecessary heat of fusion injures the quality of the metal, as unnecessary heat of 'pouring' injures the quality of the casting. It does this in two ways—by the introduction of foreign earthy and alkaline bases, which greatly reduce the cohesion, and far more by the great increase of surface, produced by extreme elevation of temperature, in the disseminated plates of graphite. These scattered through the mass, like mica or hornblende in granite, present at their innumerable planes of cleavage almost no cohesion; but these planes are, in accordance with the general law of arrangement, in planes of least pressure, found mainly to coincide in parallelism with those of the crystals of the iron itself (*i. e.*, the carburet of iron, which constitutes the metal of cast iron chiefly), so that the total deterioration of strength is very great; and this is, in fact, the secret of the much discussed and unquestionable inferiority of hot-blast iron over cold; nothing more than the elevated temperature introduced in the blast furnace," Fully admitting that the injudicious use of the hot-blast may produce the injurious effects ascribed to it by Mr. Mallet, we nevertheless differ from him in his sweeping condemnation of the process. To corroborate our opinion, we will further quote the following:—Mr. Hodgkinson, in his report on the experiments on hot and cold blast iron, made by Mr. Hodgkinson and Mr. Fairbairn for the British Association, says; "It is rendered exceedingly probable that the introduction of a heated blast in the manufacture of cast iron has injured the softer irons, whilst it has frequently molified and improved those of a harder nature, and considering the small deterioration that the irons of quality No. 2 have sustained, and the apparent benefit to those of No. 3, together with the great saving effected by the heated blast, there seems good reason for the process becoming so general as it has done." Respecting the specific gravity of hot blast iron, we may state that some years ago, Dr. Thomoson carefully analyzed the chemical constituents of hot-blast iron, and he found, as a general result, that the specific gravity of hot blast iron is greater than that of cold blast, and an average of several experiments showed that the hot blast increases the specific gravity of cast iron by about 1.22nd part. Dr. Thompson also found that hot blast iron contained a smaller proportion of carbon, silica, and aluminum than cold blast iron.

We now come to what we have termed the commercial or trade influence of the hot blast on the quality of iron.

The best English ironstone is the argilaceous or clay ironstone, and it requires the cold blast to work it in quantities. The iron produced is neither "red short" nor "cold short" and is thus never brittle, whether hot or cold. What is called "cinder" is the refuse of the puddling surface. It contains a large percentage of iron, combined with impurities that have been expelled by the puddler from the good iron or "mine." The power given by the hot blast in extracting the iron from amongst these impurities has greatly increased the production; but the produce is rendered very inferior by an admixture of this material. It is called "cinder iron." We do not assert that the hot blast injures the quality of the iron. As we mentioned before, its precise effect has not been ascertained with any precision. But we have seen that the hot blast may be used to extract iron from any material from the best to the worst. The cold blast can only be applied to the best ore and fuel, it cannot be used to make "cinder iron;" and thus the very name of "cold blast iron" is to some extent a guarantee as to its quality. The introduction of the hot blast has thus been a great benefit as regards *quantity* of produce, but as regards *quality*, it has offered facilities for "scamping" the work, of which unfortunately, but too many have availed themselves. The hot blast has also been the means of permitting the ironmasters to use raw or uncoked coal, instead of the desulphurized coke. It is evident that more impurities are liable to be worked up with the iron when raw coal is employed. The Scotch coals are generally so unfit for coking that they often lose 55 per cent, in the proprocess, and the introduction of the hot blast, by greatly economizing the coals there employed, has raised the iron manufacture of Scotland to its present importance. Within twenty years the make of iron in England has been trebled; in 1840 the total produce was a little less than 1,400,000 tons; in 1860 it was more than 4,150,000 tons. This progress however, is more of a striking than solid character. Of the 1,400,000 tons of iron produced in 1840, 770,000 tons of this quantity was cold blast iron; of the treble quantity in 1860, only 150,000 tons were produced by the cold blast. Figures, however do not give a true account of the produce of the iron manufacture. Mere quantity is a very rough estimate; quantity and quality combined ought to be taken into account. Double the resisting powers of the iron produced, and for many applications less than half of the quantity is required.

The value of raising the temperature of the blast is thus another point upon which much difference of opinion still exists. As we have seen some say that hot-blast metal is greatly inferior to cold-blast, in contradiction to others who assert the contrary opinion. The exact amount of economy of fuel effected by the use of this process is another subject of dispute. No definite data exists that would warrant our drawing conclusions as to its precise influence on the molecular structure and chemical constituents of iron. We consider that this great uncertainty is a disgrace to the iron manufacturers as a body; and without overlooking the fact that a strict inquiry into the matter would involve great expense and difficulty, we nevertheless consider it very extraordinary that the exact value of a process employed for the last 35 years, is still involved in obscurity. The fact seems to be that the manufacturers, on the one side, ignore the deductions of theoretical science; while on the other, laboratory chemists refuse to consider the practical requirements of manufacturing on a large scale. The only means of arriving at the truth would be by the labours of a scientific commission, meeting the iron makers on their own ground. The usual way adopted in England in encountering these questions, is to summon a host of witnesses before a Parliamentary Committee of Inquiry, and the culminating result of this expensive precedure is a voluminous blue-book, which is read by nobody. The evidence given is, no doubt, often very valuable in its way; but who is to separate the grains of wheat from the mass of chaff? This separation could only be effected by the light of science; not by orators from parliamentary benches, but by chosen men, taken from the forge, the laboratory, and the workshop.

There are many phenomena in the manufacture and use of iron, verified by the practical experience of manufacturers and engineers, which are as yet, unexplained by science. On the other hand, many of the later important discoveries in science have not been utilized by the manufacturer. Let the ethereal spirit of science incorporate itself in the flesh and blood of practice, and the union would result in a "mens sana in corpore sano."

The questions involved in the quality of iron are no longer private questions of profit and loss and of each man's safety and comfort; by the recent alterations in ship building, the national honour and security, are made to depend upon an abundant supply of good iron. In case a naval battle should ever be fought within reach of our shores, the command of the Channel would fall to the power capable of repairing and refitting iron ships with the greatest celerity. We have seen, by the recent conflict at Charleston, how damaging a naval action is likely to be to the ships engaged; and we must not forget that the French are still in advance of us in their arrangements for docking large vessels of war. The safety and honour of England depend upon her navy; but that navy must not be dependent upon the chances of trade and the "scamping" of contractors and manufacturers. It thus becomes a question which English iron-manufacturers would do well to consider, whether the Government will not have to manufacture a portion at least of the iron required for the national defences. While wood only was used for vessels of war, the Admiralty found themselves obliged to have complete command over the supply of that material; iron now takes the place of wood, and a similar result with regard to its supply may ensue. We do not advocate that the Goverment should manufacture all the iron it requires; we only wish that the Government should be raised above the accidents and frauds of trade.

We often hear it vaguely stated that French iron is superior to our own, but we have no sufficient data from which we could draw a conclusion. There were certainly some very fine samples of iron from France, Germany, Belgium, and Sweden in the late exhibition. In the Swedish Department there was a very remarkable sample of iron from that country. It consisted of the keel of an iron paddle steamer, 200 ft. long, and built at the Mortala Works. The vessel struck on a rock while steaming at a speed of eight or nine miles per hour; and although the plates bent into a most extraordinary shape, they show no fracture, and the ship arrived safely at Stockholm. A medal was obtained for this exhibit: and we remember that the question was facetiously discussed in the Exhibition as to the person who really deserved to bear away the honours. Should the medal be given to the maker of the iron, or to the builder of the ship, or rather to the pilot who tested the iron by steering it on to the rock? Seriously, however, this specimen of iron from Sweden shows what might be done with iron to ensure safety at sea; and it affords a lamentable contrast to the late disaster with the "Anglo-Saxon," which has involved the loss of upwards 200 lives, and about £100,000 in money. —*Mech. Mag.*

HIGH PRESSURE BOILERS.

Could the shade of the illustrious Watt make a little tour through our manufacturing districts, the timid ghost would need but a glance at the pressure guages on the boilers now in use, to find a sufficient inducement to return to the regions from whence it came. Forty years have done much to extend the use of far higher pressure than Watt ever contemplated. Many idle prejudices—many erroneous notions have died a natural death during the last half-century. The employers of steam power, the class really far more interested than engineers, in improvements, day by day become more alive to the fact, that without expansion there can be little economy; and the use of a pressure which the past generation of engineers would have considered dangerous in the extreme, follows as a matter of necessity.

All civilized nations are more or less employers of steam power; and it is strange enough, that in no country save our own, has any extended prejudice been entertained against high pressures. Belgium, France, and America early perceived the advantages to be derived from their use; the latter country, in particular, has received an unenviable notoriety for the reckless disregard of human life displayed in the working, far more than the construction, of some of her river steam-boats; but, that these accidents are not due to the use of high pressure steam alone, is proved by the fact that the greatest number of accidents, taking the

United States as a whole, have been occasioned by boilers working steam of a pressure under 50 lb. to the square inch.

England and America have each been the exponent of a separate system, each capable of giving good results, while the best only can be expected from their union. Each country has followed the teaching of its own great apostle of steam power. England received the steam-engine low pressure from James Watt, and low pressure for many years she has kept it; America got the steam-engine high pressure from Oliver Evans, and high pressure her people have retained it; by grafting Watt's condenser, and the principle of expansion, on Evans' high pressure, we can alone secure such results as 1,980,000 lb. raised a foot high in an hour, by the consumption of little over one pound of coal—a result so astonishing, that nothing but accurate and well-attested experiments, could convince us that practice might be made to wait so closely on theory.

Although high pressure steam is just as safe as low pressure, when raised in properly constructed boilers, yet, in order to secure all the elements of safety, it is found necessary to resort to forms and principles of construction very different from those suitable to low pressure generators. In consequence, their variety is almost endless; good, bad, and indifferent, we could count some hundreds of schemes in the Patent Office for the construction of boilers to raise steam from 100 lb. to 500 lb. per square inch. The fact is, that many practical difficulties are involved, which have proved strong stimuli to the combative faculties which induce inventors to go in search of such obstacles, merely for the pleasure of overcoming them. Our present purpose is to glance at some of the most important desiderata in the construction of high-pressure generators, some of the more obvious difficulties to be encountered, and a few of the plans hitherto adopted with most success.

Boiler explosions have occurred ever since the day water was first boiled in a closed vessel; and boilers will explode, for anything we can see to the contrary, to the end of time. We feel no hesitation in endorsing the words of Dr. Alban, and repeating, that our great guiding principle should be "so to construct the boiler that its explosion may not be dangerous," a result easily attained by generating the steam within small tubes, or flat spaces strongly stayed, so that the boiler really consists of an assemblage of small generators, more or less detached and distinct one from the other. By this means, not only is great strength secured, but the quantity of steam and water to be suddenly dispersed is so much reduced that little danger can result from an explosion. The small tubes are invariably the weakest parts of such boilers, and being thin, they open quietly, without flying in pieces; hence, none of the destructive results due to the propulsion of heavy masses of metal to great distances can ensue. Boilers of this construction are usually termed "tubulous," to distinguish them from "tubular boilers," in which, instead of the small tubes containing steam and water, they are made use of as flues to convey the products of combustion to the chimney.

Very excessive pressures have been raised years ago in these tubulous boilers—pressures, indeed, before which anything we now see in daily use, sinks into insignificance. Jacob Perkins has employed a pressure of 500 lb. on the square inch for propelling bullets; Dr. Alban, of Plau, in Mecklenburgh, worked an engine in London, many years ago, at a pressure of 1,000 lb. on the square inch, with the greatest success. Perhaps the nearest approach we have had to these pressures of late years, was in an engine exhibited at the Agricultural Show at Salisbury in 1857, by Mr. Collinson Hall. This engine was worked at a pressure of 300 lb. to the square inch, and gave an indicated horse-power for each 1.25 lb. of coal consumed per hour. The boiler was, we believe, of the up-right tubular class, some 2 ft. 6 in. in diameter, and 6 or 7 ft. high, with a circular fire-box in the lower part, and 40 or 50 vertical flue tubes passing through the water and steam (which last they superheated considerably) to the up-take. The explosion of such a boiler as this, would, of course, be attended with disastrous results if the outside shell gave way. And although such boilers are very compact, and capable of standing very high pressures with safety, yet they are in general so subject to priming, and difficult to clean, deposit settling in a hard mass on the crown of the fire-box, from which it cannot be removed, that their use is seldom or never to be recommended. Mr. Hall is not, of course, the inventor; it would be difficult, indeed, to say who is.

Mr. Martin Benson invented and patented a very good form of high-pressure boiler three or four years ago. As it was brought a good deal before the notice of the public at the time, our readers may, perhaps, be sufficiently acquainted with it to prevent the necessity of a detailed description, for which we have not space. It consists of a great number of small tubes traversing a vertical fire space; the ends of all the tubes are so connected by a very simple and ingenious arrangement, quite protected from the action of the fire by the side walls, as we may call them, of the fire space, that they become one. A vertical receiver of considerable height and moderate diameter is placed at the side of the generator, A small pump, fixed at the bottom of this, and worked by the engine, forces the water in a continuous current through the tube. Entering at the bottom and passing backwards and forwards through all its windings, it is discharged at the top, mingled with steam, into the upper part of the receiver, or steam chest, where the water, separating from the steam, falls to the bottom, while the steam flows through a suitable pipe to the engine. This boiler is said to have given very good results, but has not hitherto met with much favour, owing to a prejudice against the use of the circulating pump. Whether an injector would better answer the purpose of maintaining a current remains to be proved.

Mr. Benson's boiler may, perhaps, be regarded as the best of a class of generators, in which the distinguishing principle is the forcing of water through a continuous coil of tube of small diameter, exposed in whole, or in part, to the action of a furnace. From various causes these boilers have never met with extended adoption.

Dr. Alban's may be regarded as the type of a far superior class of generator, in which a large flat vessel, with the sides very heavily stayed together, usually called the "heart," is made the means of communication between a very large number of tubes, about 4 in. in diameter, and 6 or 8 ft. long; one end of each of these tubes is firmly fixed in the front plate of the heart, which stands just over the fire door. The tubes traverse horizontally a fire space some 6 or 8 ft. high, built of brick on three sides, the heart forming the fourth. All the tubes are set on a slight incline from the heart downwards, so that the steam may, by its own levity, rise towards and enter the heart, while the water, by its gravity, flows into the tubes to replace that evaporated. The ends of the tubes furthest away from the heart are stopped by moveable covers, which can be removed to clean the tubes, as at this end they pass through the brick wall of the fire space, in order that they may expand freely. A simple arrangement of plates in the heart conveys the steam, as soon as it leaves the tubes, to one side, where rising, it passes through a suitable tube into a separator about 12 in. in diameter, and some feet long, placed horizontally on top of the generator, but not exposed to the action of the fire; the water which rises with the steam flows back from this separator through a second pipe, which descends at the other side of the heart, and rising from it re-enters the tubes, and is in part converted into steam as before. This boiler, though very expensive, is an extremely durable and economical generator of steam, from 100 lb. to 300 lb. on the square inch; and the tubes being the weakest part of it, an explosion never leads to any dangerous results, from the reasons already pointed out. It enjoys a very good reputation on the Continent, although we believe never yet used in Great Britain.

A class of boilers much the same in principle, but very different in construction, has been gradually creeping into favour of late years. The distinguishing characteristics of this generator are an outside shell, square, oblong, or circular, in horizontal section, according to circumstances, which has a second shell, or fire-box, about 6 in. smaller, placed within it, much as the inside fire-box is fitted in a locomotive. In the bottom of the inside box, which is heavily stayed to the outside shell, is placed the fire-grate, while the upper part is traversed by a number of small tubes feruled into the inside shell at each end; the flame and heated air pass upwards between these tubes to the chimney, which is usually placed directly above.

This kind of boiler, although cheap, possesses many disadvantages; it is very heavy; it is impossible to clean the tubes without taking out the whole inside box; it is very difficult to keep the tubes tight at the ends; and as it is frequently constructed without any regard to correct principles, it has, in addition, been accused of excessive priming, which is likely enough when we consider that the tubes are not only very small, but put in on a dead level, so that a constant contention goes on between the water and the steam—one struggling to get out, the other to get in. The tubes should always be put in on an incline of at least 1 in. to the foot, when the steam will escape quietly from the highest end, while the water will enter quietly at the lowest; a constant circulation is thus kept up, which not only permits the supply of dry steam to the engine, but conduces materially to the durability of the boiler.

Whether a boiler can be produced which will permit the use of sea water under high pressures, is a question we need scarcely enter on; the success which has attended the introduction of surface condensation rendering such a boiler needless. Still, certain mechanical difficulties stand in the way of the general adoption of tubulous boilers on board ship; one of the most important is the difficulty of obtaining room enough for the introduction of a new tube in case of accident. This difficulty is now experienced when introducing an ordinary flue tube, because such tubes invariably present their ends to the firing space, which is usually 8 ft. or 10 ft. wide; but, owing to difficulties entailed by the position of the uptake, the tubes, when horizontal, must almost unavoidably run parallel with the firing space when the stoke-hole bulk-heads preclude the withdrawal or replacement of the tubes; another, and still more serious objection, is the great height of boiler necessary when tubes 4 in. in diameter are employed. Unfortunately, when of smaller size, they are never durable, being very liable to boil dry for a few seconds, when, of course, they become overheated, and again cooled down by the rush of the re-entrant water; they are thus soon burned out; large tubes always "steam quietly," and are found durable enough. In consequence of these difficulties, many boilers have been introduced from time to time, in which the steam and water are contained in a large number of flat-sided vertical spaces, well stayed, and arranged like books on a shelf, spaces being provided between them for the circulation of the flame and heated air. Such boilers are all, more or less, complicated, heavy, and expensive; and although the principle is good, it still requires much improvement before it can be considered worthy of general adoption. Marine boilers with vertical water tubes, have met with much favour in America, and seem to deserve the good character they bear. Although horizontal surfaces are invariably the most economical, yet the practical exigencies of marine boiler construction, often dictate a recourse to vertical surfaces as most convenient.

A rather singular arrangement of tubes is sometimes adopted in American steam fire-engines. A large number of moderately-sized tubes descend from a strongly-stayed water and steam space right down to the grate, which they surround; the lower end of these tubes is stopped. Within each of them a second tube, of much smaller diameter, descends nearly to the bottom. The water continually descends through this tube, and ascends, mingled with steam, in the space between the two; a constant current being thus effectually maintained. The products of combustion escape through flue tubes fitted in the water space above.

It is a mistake to imagine that a small quantity of water is absolutely necessary to the rapid generation of steam. We have seen steam raised in a small road locomotive, with an ordinary tubular boiler, from 80 lb. to 100 lb. in one minute and a half, or at the rate of 13 lb. in a minute.

Before concluding this article, we would impress on our readers that nothing is more dangerous than the raising of steam to excessive pressures in boilers of a couple of feet in diameter. The explosion of such boilers, especially if the metal is thick, is certain to be attended with the worst results; and from their small size, it is almost impossible that their workmanship can be as good as when a larger diameter is adopted—say 3 or 4 ft. Boilers of these sizes can be, and are daily worked with safety under pressures of 150 lb. to the inch; and, all things considered, if no increase on that pressure is desired, we know of nothing safer or more economical as a generator than a well-made, properly-proportioned locomotive boiler.—*Ibid.*

THE BOSTON PETROLEUM ORDINANCE.

The following ordinance, to regulate the manufacture and storage of Petroleum, has recently been enacted by the Boston City Council:—

AN ORDINANCE

To regulate the manufacture and storage of Petroleum, Earth, or Rock Oil, Benzole, Benzine, Naphtha, Kerosene, Camphene, and Burning Fluid.

Be it enacted by the Aldermen and Common Council of the City of Boston, in Common Council assembled, as follows:—

SEC. 1. No person shall have, keep, sell or manufacture, in any place or building within the limits of the city of Boston, any crude, or refined petroleum, earth, or rock oil, benzole, benzine, naphtha, kerosene, camphene, or burning fluid, in larger quantities than three barrels, except it be kept in close iron tanks, or in detached and properly ventilated sheds or warehouses, specially adapted for that purpose, by having raised sills, or other contrivance, so as effectually to prevent the overflow of such substances beyond the premises where the same are kept or stored.

SECT. 2. No person shall manufacture or store any of the articles mentioned in section one, in any building or yard, situated less than one hundred feet from any other building, unless separated from said building by a brick or stone wall, not less than six feet in height.

SECT. 3. Every person desiring to manufacture, sell, keep, or store any of the articles mentioned in section one, shall make written application therefor to the Chief Engineer of the Fire Department, stating, in said application, the place or building in which he desires to manufacture, sell, or store said articles, and the manner in which he proposes to keep them, and the Chief Engineer of the Fire Department shall examine the premises, and report to the Board of Aldermen whether, in his opinion, said premises are made conformable to the Ordinance; and, after his report, the Board of Aldermen may act upon said application.

SECT. 4. All licenses granted under the provisions of the previous section shall continue and be in force from the time of granting until the first day of April next succeeding.

SECT. 5. Every person, at the time of receiving said license, shall pay therefor the sum of one dollar.

SECT. 6. It shall be the duty of the Board of Engineers of the Fire Department in addition to the duties now imposed upon them by law, to make an examination of all premises where either of said articles mentioned in section one is manufactured, kept, or stored, so as to insure a strict compliance with all the provisions of this Ordinance; and they shall report all violations thereof at once to the Board of Aldermen.

SECT. 7. Any person who shall offend against either of the provisions of this Ordinance, shall forfeit and pay a sum not less than five, nor more than fifty dollars, for each offence.

SECT. 8. The Ordinance regulating the sale of Camphene or Burning Fluid, passed November 3, 1855, is hereby repealed,

BOSTON, April 25th, 1863.

LORING B. BARNES, Esq., Member of Common Council:—

Dear Sir,—I return you the copy of a draft of an Ordinance regulating the Storage of Oil, as reported by the Chairman of the Committee on Ordinances, and which, as thus reported, seems to me to meet all the wants of the case.

You ask me for any observations on that subject that suggest themselves; and being somewhat conversant with the whole subject, in a practical point of view, it would give me pleasure to comply with your wishes.

In the good old times, which our oldest inhabitants can yet recollect, artificial illumination for our streets, manufactories, and dwellings, was confined to the old-fashioned mould and dip candles, and which gave place, to a great extent, to sperm and whale oil. Both of these articles had so high an igniting point, as any one knows who wanted to light a lamp in a hurry, that no legislation or regulation was ever deemed necessary as regards their manufacture or sale. These have been displaced, by degrees, as illuminating agents, with alcohol, gas, camphene, or refined spirits of turpentine, and coal and petroleum oils.

GAS.—On the first introduction of gas into England, it was met with the most formidable opposition, which soon took the form of legislation, or attempted legislation. It was asserted—it poisoned the air, and it poisoned the earth by being conducted through it, and the gasometer was a powder magazine. It was related of one of the fathers of this great discovery, that when Parliament was about to forbid the construction of what were then called large gasometers, he requested a committee of investigation, and meeting them beside his gasometer, he thrust a ponderous bar of iron through it, and immediately applied a torch, and then turning to the committee, remarked:—"I have nothing more to say." This ended the opposition to large gasometers. Coal-gas has since progressed, extending all over the world, performing its useful mission, and, notwithstanding its volatile and explosive nature, is now unrestricted by vexatious legislation.

ALCOHOL, as an illuminating agent, requires to be of the highest proof and most inflammable igniting point; as a material to commence a conflagration with, it has no superior and few equals; but when diluted with water, its loses its inflammability, and, consequently, easily yields to the efforts of the firemen. It is now transported all over the world in enormous quantities, whole shiploads at a time, both for illuminating purposes, the arts and manufactures, and other less useful or laudable purposes. In its transportation and storage, it is not obstructed by legislation, and the many thousand barrels that are daily and weekly distributed from the city of New York all over creation, meet no impediments from restriction or regulation.

CAMPHENE, or refined spirits of turpentine, and common spirits of turpentine, has an easy igniting point as compared with fatty oils, and a difficult one as compared with alcohol. In its pure state, accidents and casualities would have been so unfrequent, that it would not, probably, ever have been made the subject of special legislation or regulation, but for its admixture with alcohol, under the well-known name of burning fluid; but it had this dangerous element in it. When once ignited, water could not extinguish it, consequently it would have to be left in quiet to burn up. The quantities of spirits of turpentine transported to all the marts of commerce, was, before the rebellion stopped the source of supply, very large, probably amounting to one hundred thousand barrels annually. How safely it was stored and transported, and the few conflagrations and accidents originating from it, is well known; and it was never obstructed by any vexatious or onerous regulations or restrictions.

BURNING FLUID has filled a large space in the "sensational accidents" of the day, and although almost universally feared, was as almost universally used.—At the time of the introduction of the coal-oils, four years ago, its consumption in the United States was greater than that of sperm, whale, and lard oil combined. The accidents from its explosion were of the most frightful nature, frequently fatal to the person holding the lamp. This material was composed of about 95 per cent. of alcohol and one-part camphene; it was not itself explosive, only its vapors when mixed in certain proportions with the atmosphere, and in a metal lamp, and never filled except by daylight, little knowledge of its properties would have ever reached the public ear, as certainly some nine-tenths of the from 200 to 500 accidents yearly happening were occasioned by filling the lamps when ignited, and the remaining one-tenth mostly by breakage by falls. When stored in large lots, and fully on fire, it does not yield to the efforts of the firemen as readily as alcohol, as that combines with the water, and leaves the spirits to be gradually consumed. This article has been subjected to much legislation and many restrictions, but, until the time of the supply being cut off, was universally stored and sold, wholesale and retail, as other articles, and, whatever the legal consequences might have been, the practical effect upon both legislature and insurance regulations was to embarrass without remedying the evil, and at no time was it so universally used, and so rapidly spreading and being stored and sold, the same as other merchandise, with the laws unheeded and unexecuted on the dealers, as at the time the supply was cut off by the rebellion, and the simultaneous introduction of the coal and petroleum oils.

COAL-OILS, at the time of their introduction, were considered, not only as a great blessing from their cheapness and excellent light, but as a substitute for the dangerous burning fluids. Coal-oils have but little napthas generated in their manufacture, and but for the more recent discovery of petroleum, would probably, like the fatty oils, never have been subjected to attention as requiring legislation or regulation; but after two years of very rapid extension, and an entire absence of serious accidents in the storage and sales, they have as rapidly yielded to the petroleum oils, now becoming such a vast article of commerce.

PETROLEUM OR ROCK OILS.—The first successful supply, on a comparatively large scale, was only commenced within three years. It was first brought to public notice by a Mr. Drake, who was a temporary resident at Titusville, Pa., where he went for his health, having previously filled the relation of conductor on the New York and New Haven Railroad. Seeing the surface indications, he conceived the idea of boring into the rock. He did what others since have said they talked of doing, having sunk his shaft about 100 feet, he struck a vein of oil which yielded, by pumping, some 50 or 60 barrels per day. This experiment was pursued the next summer with astonishing celerity, and many thousand others were sunk. Probably some 40,000 or 50,000 barrels were produced during the season, and very large amounts of money lost by unsuccessful adventure and unproductive lands. These were called the pumping wells of the upper deposits. They were of a comparatively heavy specific gravity, and had little light material, and although lighter, and, consequently, more inflammable than the coal oils, would probably never have occasioned any subject of legislative or regulative action. It was only in the early part of the summer of 1861, that the flowing wells were first developed by boring the rock to the depth of some 500 feet. The largest of these wells at first flowed with such power as to force a column of oil, accompanied with immense volumes of gas, through a hole of three inches diameter, some forty feet into the air, and yielding some 1,000 to 2,000 barrels of oils daily. So large was the volume of gas, combined with minute globules of oil, that at the fatal accident on the Buchanan farm, the flame ignited from a steam boiler some rods distant, and killed and wounded some 30 or 40 spectators, most of them fatally, and some were consumed on the spot where they first stood. From this source, in the year 1862, were produced perhaps about one million barrels of forty gallons each, which was exported all over the world, and some 300 oil-works commenced operations. This amount is about equal to three times the production of the whole American sperm and whale fleet, when it numbered 700 or 800 sail of vessels, and the extreme low price to which it fell, proved disastrous to very many engaged in it. Now, these light oils of the flowing wells, full, themselves, of light bodies of the naptha series, and ultimately blended with the non-condensible gases, were forwarded all over both America and Europe in the crude state, and also, through the ignorance of many parties, the manufactured was also put into the market containing all the light bodies. The consequence was, in the autumn of 1861, and winter and spring of 1862, witnessed any amount of conflagrations, explosions, &c., and which was followed, in some instances, by absurd and restrictive regulations. Experience soon learned the parties in interest to ventilate, to some extent, their oil, in vats at the wells, and, consequently, to remove those extremely light and gassy vapors; and manufacturers also learned to separate their benzole and napthas from the burning oils, and the article is fast becoming to be understood, and the objection of insurers, both inland and marine, is becoming modified, and objectionable and absurd restriction ceasing to be subjects of agitation. The napthas and benzole will take their place along side of alcohol, burning fluid, and spirits of turpentine, which are now stored and transported in large quantities, and with very few or no special accidents from them. The English Parliament passed, last year, some very unjust, absurd, and restrictive regulations, which, whilst making all oils, napthas, &c., with an igniting point over 100°, entirely free from restrictions, made all under subject to the restrictions of gunpowder. The commerce of London went on in its usual routine, and we never heard of any restrictions being applied to naptha which affected its sale or use, and a report recently published of the Fire Wardens, says, two conflagrations, &c., originated in oils, &c., and 120 odd in gas in that city.

There is a point of danger that your proposed ordinance covers, and which seems to me very desirable for safety, but which the legislation of other places does not, so far as my observation extends—that is, as oils will always be stored in large bodies, it is to guard against extensive conflagrations when fire does happen, and confine it to its original limits; yours does so. All other legislation to me appears injudicious, as it never will reach, or attempt to reach where the danger, if any, is most prominent, viz., that in the store of the retail dealer, and the cannistry of families, where it is finally distributed, and from whose innumerable premises few or no accidents occur, but what the common insurance fully covers.

The Legislature of this State, as well as that of the city of Boston, has thus far kept themselves free from the absurd legislation, which has come out of the haste and ignorance of other places. The whole subject was, last year, before a committee of the Legislature, and they reported against any action, as time had not developed what might be desirable. Like spirits of turpentine, when once ignited, if confined to the premises by a cellar or brick wall, it is not a dangerous fire. The combustion is comparatively slow for want of a supply of oxygen; there are no cinders, and the flame passes off in vast volumes of smoke. In Pittsburg, the brick depot, nearly as large as the Worcester, had six thousand barrels stored in the cellar; a gauger went down into the cellar to gauge it, put the candle into the bung to see the figures of his rod, and the gas of the light crude oils took fire, and it, of course, all burned up, but no explosion followed. At Schieffelin's yard, Brooklyn, 15,000 barrels were consumed, of course entirely, but no explosions; the yard was an inclined plane, and much went into the dock, and, as good fortune would have it, an eddy kept it there: a lumber yard on the opposite side of the street, the timber of which was not scorched; had it have been on the windward side instead of the leeward side, from the greater supply of oxygen, the result would have been different, but a brick wall would have protected it. Brooklyn has a coal-oil ordinance, but New York and Jersey City none, yet there are five or six yards in Brooklyn, storing from 10,000 to 30,000 barrels each, and most of them about as dangerous for a general conflagration as could be desired by an incendiary; besides, the whole shore is studded with yards for storage of tar, pitch, turpentine, spirits, alcohol, &c. But, as I before observed, your ordinance, as drafted, will, I think, cover the whole subject, and without any decidedly vexatious and useless restrictions, which so embarrass trade without accomplishing any great object.

If these remarks help you in coming to any judicious determination, it will give pleasure to

Your obedient servant,

SAMUEL DOWNER,
President Downer Kerosene Oil Co.

WOOLLEN MANUFACTURES IN THE UNITED STATES.*

The returns of woollen manufactures show an increase of over fifty-one per cent. in ten years. The value of woollen and mixed goods made in 1850 was $45,281,764. In 1860 it amounted to $68,865,963. The establishments numbered 1,909, of which 453 were in New England, 748 in the middle, 479 in the Western, 2 in the Pacific, and 227 in the southern States. The aggregate capital invested in the business was $35,520,527, and it employed 28,780 male and 20,120 female hands, 639,700 spindles, and 16,075 looms, which worked up more than eighty million pounds of wool, the value of which, with other raw materials, was $40,360,300. The foregoing figures include satinets Kentucky jeans, and other fabrics of which the warp is cotton, though usually classed with woollens. In the manufacture of these mixed goods the amount of cotton consumed is 16,008,625 lbs. which, with 364,036,123 pounds used in making cotton goods, as previously stated, amounts to 380,044,748 pounds, or 950,112 bales, exclusive of a considerable quantity used, annually, in household manufactures, and for various household purposes.

The largest amount of woollens was made in New England, where the capital was nearly twenty millions of dollars, and the value of the product $38,509,080, but little less than the total value in 1850. More than half the capital, and nearly one-half of the product of New England belonged to Massachusetts, which had 131 factories of large size. Rhode Island ranked next, and had increased its manufacture 163 per cent. in ten years, that of Massachusetts being 48 per cent. The value of woollens produced in the middle States was $24,100,488, in the western $3,718,092, and in the Pacific and Southern $2,538,303. The sectional increase was, in New England 52·1, in the middle States 54, and in the south 107—the last showing the greatest relative increase. Pennsylvania, next to Massachusetts, was the largest producer, having 447 factories, which made $12,744,373 worth of woollen and mixed fabrics, an increase of 120 per cent. A value of $8,919,019 was the product of 222 establishments in the city of Philadelphia.

The State of New York holds the third rank in relation to this industry, its manufactures amounting to more than nine millions of dollars. The woollen manufactures of Maryland exhibit an increase of 86 per cent. In Ohio, which produced in 1850 a greater value of woollens than all the other western States, there was a decrease on the product of 1850, owing, probably to the shipments of wool to Europe, which, in 1857, was found to be the most profitable disposition of the rapidly increasing wool crops of that State. In Kentucky, now the largest manufacturer of wool in the west, the product was $1,128,882, and the increase in ten years 40·4 per cent.; while in Indiana, which ranks next, it was 31 per cent., and in Missouri 18·8, on the product of 1850.

The extension of this important manufacture is a subject of great interest to the country, inasmuch as our climate renders woollen clothing necessary throughout a large part of the Union during much of the year; and because it would supply the best market to the wool grower.

The quantity of wool returned for the whole Union in 1850 was upwards of fifty-two and a half millions of pounds. Sheep raising has been greatly extended and improved since that date in Ohio, Texas, California, and other States, and the clip in

* From the Census Report.

1860 amounted to 60,511,343 pounds, an increase of 15·2 per cent. in ten years. The yield still falls short of the consumption, and large quantities continue to be imported, notwithstanding the amount of territory adapted to sheep husbandry.

PRINTING PRESSES.

The increase of Printing presses in the book and newspaper manufacture has been great beyond all precedent, and has exerted the most beneficent influence by cheapening and multiplying the vehicles of instruction. Its effects are everywhere apparent. Never did an army before possess so much of cultivated intellect, or demand such contributions for its mental food as that now marshalled in its country's defence. Many of these reading soldiers ripened their intellectual tastes during the last ten years. In fact, many divisions of our army carry the printing press and type, and the soldiers issue publications and print the forms for official papers. The press is, indeed, the great prompter of enterprise. It constantly travels with the emigrant to diffuse light and intelligence from our remotest frontiers, where it speedily calls into existence the paper-mill and all the accessories which it supports in older communities.

In New England, the Middle, and Western States the value of book, job, and newspaper printing is returned as $39,428,043, of which eleven millions' worth consisted of books, the value of the latter being nearly equal to the whole product of the same branch in 1850, which was returned at $11,586,549. The manufacture of Paper, especially of printing paper, has increased in an equal ratio, the State of Massachusetts alone producing paper of the value of $5,968,469, being over 58 per cent. of the product of the Union in 1850. New York returned paper of the value of $3,516,276; Connecticut, $2,528,758; and Pennsylvania, $1,785,900.

SPIRITUOUS LIQUORS.

The manufacture of Spirituous Liquors in the United States employed 1,138 distilleries, independent of a large number of rectifying establishments, the product of the former being over eighty-eight millions of gallons, of the value of $24,253,176. The middle and western states were the largest producers, the latter yielding nearly forty-five and the former thirty-seven millions of gallons of whisky high wines, and alcohol, the aggregate value in each section being almost eleven millions of dollars. It is satisfactory to observe, that more than ninety-five per cent. of all the spirits made, was from materials of domestic production, a little over four million gallons of New England rum having been the product of imported molasses.

The manufacture of malt liquors, though of less magnitude and far less pernicious in its effects, shows a still larger increase. It derives its material wholly from agriculture, and its extension promises more substantial benefits to the country than the last.

The northern States returned 969 breweries, or more than double the number in the Union in 1850. The quantity of all kinds of malt liquors made, including 855,803 barrels of lager beer, was 3,235,545 barrels—an increase of 175 per cent. upon the total product of 1850, while its value was returned at $17,977,135, being more than three times the amount produced by breweries in that year. Nearly one-half of the whole quantity was made in New York and Pennsylvania. The former had 175 establishments—45 of them in the city of New York—and the latter State 172, of which Philadelphia contained 68. The manufacture of lager beer was much increased in all the middle and western States, about 41 per cent. of the whole being the product of the two States last named. Among the eastern States, Massachusetts, and among the western States, Ohio, Illinois, and Missouri, were the largest producers of malt liquors. There were 71 breweries in California, and 8 in Oregon, producing together about 7 per cent. of the total value of the manufacture.

INDIAN SLAVERY.

A new element has been developed by the present census, viz: that of the statistics of negro slavery among the Indian tribes west of Arkansas, comprising the Choctaw, Cherokee, Creek, and Chickasaw nations; also the number of white and free colored population scattered throughout these tribes; all of which, with an estimate from the most reliable sources of the whole number of aborigines will be found appended to the population tables. By reference to this table it will appear that the Choctaws held 2,297 negro slaves, distributed among 385 owners; the Cherokees, 2,504, held by 384 owners; the Creeks, 1,651, owned by 267 Indians; and the Chickasaws, 917 to 118 owners. As, under all the circumstances of slavery everywhere, the servile race is very unequally distributed, so will appear to be the case with the Indian tribes. While one Choctaw is the owner of 227 slaves, and ten of the largest proprietors own 638, averaging nearly 64, the slaves average about six to each owner of slaves in that tribe, while the Indians number about as eight to one slave.

Among the Cherokees the largest proprietor holds 57 slaves; the ten largest own 353, averaging a little over 35, and the number to each holder averages a little more than a half per cent. more than with the Choctaws, while the population of Indians in the tribe to slaves as about nine to one. Among the Creeks two hold 75 slaves each: ten own 433, while the ratio of slaves to the whole number of Indians varies but little from that with the Cherokees. The largest proprietor among the Chickasaws holds 61 slaves; ten own 275, or an average of 27½, while the average is nearly eight to each owner in the tribe, and one to each five and a half Indians in the tribe. It thus appears that in those tribes there are nearly eight Indians to each negro slave, and that the slaves form about 12½ per cent. of the population, omitting the whites and free colored. The small tribe of Seminoles, although like the tribes above mentioned, transplanted from slaveholding States, holds no slaves, but intermarry with the coloured population. These tribes, while they present an advanced state of civilization, and some of them have attained to a condition of comfort, wealth, and refinement, form but a small portion of the Indian tribes within the territory of the United States, and are alluded to on account of their relation to a civil condition recognized by a portion of the States, and which exercises a significant influence with the country at large.

ARTIFICIAL STONES.*

The various compositions that have been invented from time to time to replace natural stone, by substances cheaper, more convenient, or more durable than any that can readily be obtained on the spot where the stone is required, are so numerous that it would be impossible merely to name them without occupying much time, and a mere enumeration could have little or no interest. My object in the present communication is to direct the attention of the section to the different classes of material that have been found available; to point out the principles involved in each, and the special advantage and disadvantage each possesses; to refer to a new, and, I believe, an important material, and to suggest the bearing of the whole subject on that of the preservation of stone from decay. Having for several years, and especially during and since the Exhibition of 1851, taken great interest in the subject of constructive material and the preservation of stone, and having lately been one of a Committee of Inquiry concerning the state of the stone of the Palace at Westminster, I have learnt from experience how little the whole subject is understood, how vague are the notions of intelligent practical men—builders as well as architects —and how difficult, if not impossible, it is for architects, engineers, and builders to determine, by any series of experiments lasting only for a short time, whether a method proposed is likely to have any practical value when applied on a large scale.

The artificial stones hitherto used may be grouped under one of three heads; they are either (1) terra cotta, or manufactures of plastic clay burnt in a kiln; (2) cements, manufactured from a certain kind of limestone, containing foreign ingredients of such a nature that, when converted into lime by burning, the lime thus made possesses the property of setting very rapidly and firmly when wetted; (3) siliceous stone, obtained by burning in a kiln sand and other substances moulded with a solution of silicate of soda, which is converted into a kind of glass firmly connecting the particles. I omit plasters, as rarely exposed to the weather.

Terra Cotta.

The advantages of this material are (1) its cheapness, and the abundance and universal distribution of the clays of which it can be made; (2) the facility with which it can be moulded to any required form; and (3) the pleasant colour of the material when uninjured by long exposure to weather. The work recently executed at the Horticultural Gardens at South Kensington is a favourable specimen. The disadvantages of terra cotta are (1) the uncertainty of the result, owing to the great and unequal contraction of all clays in burning; (2) its want of power to resist damp and frost whenever there is the slightest flaw, whether produced before or after burning; (3) its brittleness and want of strength; (4) its exposure to a disagreeable green vegetation in damp air after a few years' weathering. Terra cottas are better adapted to a dry than a moist climate.

Cement.

Whether of the kind called Puzzolana, Roman, or Parker's, or Atkinson's, or any modification of these, all the cements are similar in their nature. The advantages of cement used as an artificial stone are (1) its cheapness where made, and its ready transport; (2) its not requiring the kiln, but setting at once without contraction; (3) the facility of moulding and making up the material from the manufactured cement supplied; (4) its great strength when well made. The disadvantages are (1) that it cracks and peels badly when exposed to frost and damp air; (2) that it is very irregular, some samples yielding a much harder, better, and more lasting stone than others, without apparent reason; (3) that it is subject to a green vegetation, like terra cotta. These disadvantages do not all apply to its use in making concrete, for which it is admirably adapted.

Siliceous Stone.

This is manufactured under a patent by Mr. Ransome. It attracted attention at the Exhibition of 1851, and has since been much used. Its advantages are, (1) the extreme uniformity of its texture; (2) the almost entire absence of contraction, and its freedom from cracks and flaws produced during burning; (3) its complete resistance to all kinds of weathering, to which may be added (4) its pleasing colour and tint.

On the other hand, among the disadvantages are (1) its cost, which is greater than for either of the other kinds of artificial stone; (2) its being subject to a white efflorescence of salt and a green stain from damp, both of which take away from its value for ornamental purposes, for which it is otherwise admirably adapted.

The mechanical and chemical principles involved in these different contrivances are as follows:—In terra cotta the material is a kind of clay purer and more free from foreign substances than common clay, and mixed with dust from pottery already made. The manufactured article is thus a superior fire-brick. The burning produces little chemical change or metamorphosis, but the condition after burning is so far different that ordinary exposure will not bring back the original texture of clay. Of closer texture than brick, there is less absorption from the surface; but in ornamental work there are always flaws enough to render frost following rain dangerous and injurious. In other respects the material itself is little more liable than brick to injury from exposure.

In cement the raw material is carbonate of lime, with a certain but variable proportion of foreign substances, of which clay or silicate of alumina is an important and even an essential part. All the varieties of cement stone, such as the stones called septaria and other nodules, in the London clay at Harwich, or the Kimmeridge clay in Dorsetshire, or the Lias in the Midland Counties and the north, or the mud of the Medway and Thames, agree in this. On burning this material the limestone is converted into lime, and the condition and proportion of the foreign material determine the value of the resulting cement. It is called *hydraulic cement*, as setting with almost any required rapidity when properly mixed with water, and this in damp air, during rainy weather, and even under water, absorbing no more water than is necessary for consolidation. Under various names, *pozzuolana*, Roman cement, Parker's cement, Atkinson's cement, &c., this valuable material has been used from

* By Professor D. T. Ansted, M.A., F. R. S.

time immemorial, and is especially adapted for making concrete where a large proportion of foreign substances is introduced. As an artificial stone, although it hardens on exposure, its composition is too irregular to justify a very extended use. In the process of setting, the lime first mixes with water and becomes hydrate of lime and is then rapidly converted into silicate of lime, adhering strongly in thin films, to itself and to foreign bodies with which it is in contact.

The siliceous stone of Mr. Ransome consists of sand and foreign substances, worked up into a paste with the fluid silicate of soda. If left to dry in the air it would fall to powder, but being exposed to a high heat in a kiln a chemical action takes place. The alkali of the silicate of soda "combines with an additional quantity of silica, supplied by the sand, &c., with which it is incorporated, and becomes converted into an insoluble glass, firmly agglutinating all the various particles together into a solid, compact substance." No sensible contraction takes place in burning, and cracks rarely occur.

The resistance to weather offered by these three kinds of artificial stone may be thus stated:—1. Terra cotta, contracting irregularly in the kiln, is subject to cracks and flaws, into which water penetrating and expanding during frost, a peeling and splitting of the material naturally follow. It is almost certain, from the nature of the case, that delicate and ornamental work should be more liable to such injury than straight work and plain surfaces. 2. Cement, owing to the want of homogeneity in the raw material, is also very subject to flaws and cracks, and is injured by damp and frost like terra cotta. Both terra cotta and cement require painting in London and elsewhere. 3. The siliceous stone is rarely flawed in the kiln, but even if it is, the stone does not crack, or the surface peel by exposure to damp and frost, owing to the nature of the cement, which is, in fact, glass. It is also worthy of remark, that this material obtains its greatest hardness before it leaves the kiln, whereas cement gradually hardens, and continues to harden for many years if it be not destroyed before the induration is sufficiently advanced.

During experiments made in the laboratory on various methods suggested for preserving stone, by a section of the committee recently appointed by the Board of Works in reference to the Palace at Westminster, Dr. Hoffman, Dr. Frankland, Mr. Abel, and myself, being members of this sub-committee, a very remarkable material was submitted by Mr. Ransome and experimented on to some extent.

Dr. Frankland has since reported on this material. Its discovery arose out of the application of Mr. Ransome's method of preserving stone by effecting a deposit of silicate of lime within the substance of absorbent stones:—Mr. Ransome saturating the surface with a solution of silicate of soda, and then applying a solution of chloride of calcium, thus producing a rapid double decomposition, leaving an insoluble silicate of lime within the stone, and a soluble chloride of sodium (or common salt), which could afterwards be removed by washing. To prove that by this process a coating of hard silicate of lime was actually formed and deposited, as according to his theory it must be, Mr. Ransome made small blocks of various forms, in moulds, by mixing loose sand with the fluid silicate of soda, and then dipping the mould into the chloride of calcium. To the surprise probably at first of Mr. Ransome himself, but certainly of the chemists of the sub-committee, who performed the experiment in the absence of the inventor, there came out almost instanteously a perfectly compact, hard, and, to all appearance, a perfectly durable solid. In such solids, at least, there seems to be no element of destruction.

It was evident that such a result could not be without consequences. So far as it bore upon the inquiry of the committee, it is alluded to in their published report. Many considerations connected with the nature and condition of natural stones liable to destruction by weathering, prevent an absolute decision without much previous experience. Mr. Ransome, however, immediately patented his "concrete stone," and as an artificial stone it deserves to be well known and thoroughly considered. It promises, indeed, to combine the advantages, and seems to show none of the disadvantages, of other artificial stones. It is cheap, being made of almost any rubbish on the spot where it is required, by the aid of materials neither costly nor difficult to convey. It is made with rapidity, and is ready for use without drying or burning. It hardly requires even a temporary shed for the purposes of manufacture, and may be made of any size, and moulded into any form. So far as can be detected, it is subject to no injury from weather, and becomes, in fact, if made with sand, a true sandstone, cemented by silicate of lime, than which there is no better natural material. No doubt it will be necessary to watch carefully for a few years the behaviour of a silicate of lime thus deposited; but if it endure that test, there can be no doubt that it will then improve by time, increased age only hardening all known silicates of lime, especially those formed from lime used as mortar or cement.

In the application of this subject to the preservation of stone, there seems a probability that some valuable result will follow from the suggestion of Mr. Ransome, to effect the deposit of an insoluble silicate within the pores of an absorbent stone by double decomposition. The objection, strongly felt, that the material thus deposited would probably be in the form of unconnected grains, rather than a cementing film, seems answered by the formation of a stone so solid as the specimens show; and although it is unlikely that any contrivance can render absolutely permanent a stone that has once advanced far in decay, it will be a great step gained if poor and doubtful stones can be rendered almost indestructible before being placed in a building and exposed to danger.

So far as artificial stone is concerned, Mr. Ransome's material, if it really shows no unexpected weakness, will answer all requirements. It has been tried on a somewhat large scale in the bed of a steam engine, weighing two tons, in the International Exhibition, and again in the new stations recently erected for the Metropolitan Railway. Smaller specimens are very satisfactory. It seems to combine cheapness with durability and resistance to weathering to an extent hitherto unknown.

I append the following results of experiments recently made, and communicated to me by Mr. Ransome:—

Compared with Portland and Caen, a bar of the concrete stone, the section being 4 inches square, and length 8 inches between the supports, sustained 2,122 lbs. suspended midway between the supports; while Portland and Caen broke at 750 and 780 lbs.

The adhesion of the stone is shown by weight suspended from a piece prepared to express a sectional area of 5½″. Caen stone separated at 768; Bath at 796; Portland at 1,104; Elland Edge at 1,874; and Ransome 1,980 lbs.

A cube of 4″ sustains 30 tons.

BEER *versus* COFFEE.

The following letter to the *Medical Times and Gazette*, is from the pen of Dr. R. Druitt, Medical Officer of Health to St. George, Hanover Square:—

Sir,—Nothing in my opinion would do more to elevate the working classes of this country than the greater use of coffee as a stimulant. I say as a stimulant, because people in general have no correct idea of using it in that form simply. They mix it with various ingredients of a heavy cloying character, such as chicory, brown sugar and hot milk, which make it more or less nutritious, but heavy and unwholesome to the full stomach, and which mask its pure and beneficial action on the brain.

If coffee is to be used to satisfy hunger, or as part of a meal at which hunger may legitimately be appeased, of course it should be treated in an appropriate way. For this purpose it may, if the drinker likes, be mixed with chicory, dandelion, brown sugar, burnt sugar, "finings," and the other adulterating articles, and above all, it should be mixed with abundance of hot milk. This constitutes part of a refreshing and substantial meal —a proceeding intended to appease natural bodily hunger; and along with the coffee and milk, bread butter, meat, bacon, eggs, and similar articles of nourishment are most appropriate.

But people want refreshment at times which shall not be of this solid filling description. There is what the poet calls, in the old song,

> "Drink to me only with thine eyes,
> The thirst that from the soul doth spring."

Man is a social animal, and requires not merely food which shall enable his bodily machine to go through its daily amount of toil, but a kind of sustenance which shall cheer the mind, promote the flow of talk, make him fit for good fellowship, dissipate care and its attendant selfishness (for a man who is brooding over his own troubles is, *ipso facto*, selfish), and excite feelings of benevolence. In fact he wants *stimulants*.

It is no use to argue as some people do, that man "ought not to want stimulants," just as they say too, that he ought not to want music, fine clothes, and the like. To the man of sense the two facts suffice, that man is led by instinct to seek them, and that Providence in its bounty has furnished them. We may as well preach to the wind as say that stimulants ought not to exist, or shall not be used.

Then the question comes, What stimulant? And at present the working man has only three to choose from—spirits, beer and tobacco. These he can get in abundance anywhere, and often of good quality; they serve the purpose desired, but, unhappily, are attended with the most terrible dangers in the temptation to abuse.

Tea is accompanied with disadvantages if used as a pure stimulant. But this I will not enter upon now. But to coffee there is no objection. It is aromatic, warming, and exhilarating, sets the brain at work, inspires social and vivacious ideas, and fulfils all the conditions requisite for a *stimulant* for men who have had food enough, and want to enjoy themselves as rational and social beings.

But how should it be taken as a stimulant? Why, certainly hot, strong, clear, with a little pure white sugar. In this state it stimulates stomach and brain, and adds not a feather's weight to the labour of digestion. With coffee like this working men would find their supper digest, and their talk genial and fluent, and would be disposed to enjoy their book, music or any other rational amusement.

On the other hand, unfortunately, most people know coffee only as a weak, lukewarm, opaque, heavy mess, cloying to the stomach, and damping the nervous energy.

You may see people, even after good dinners at good houses, *horribile dictu*, after soup, fish, solid entrees, roti, fowl, jellies, sweets, cheese, ices, dessert, and half-a-dozen kinds of wine, commit a last outrage upon their unfortunate stomachs by gulping down a mess of lukewarm coffee and milk. What such people are thinking of at the time, or what their dreams at night, or why those stomachs do not burst, it were vain to enquire. What is wanted after a good luxurious dinner is the little cup of coffee, hot, strong, and clear as a fillip—not the nutritious mess that would do for a school-boy's breakfast. But, in this as in most other things, fashion, or supposed fashion (for it is not real; real taste demands the *café noir*, with its *chasse* or *gloria*) overrides common sense.

Still more is the mistake made of supposing that working men can find in the thick, unstimulating mess presented to them as coffee at common coffee-houses, railway refreshment-rooms, and the like, anything to counterbalance their love of or need for beer, spirits, and tobacco. A man whose stomach is full already does not heed hot stuff like soup, but the clear, bright, aromatic, nerve-compelling stimulant.

Some time ago, I entered a coffee-room, which is an appurtenance, and a most rational one, to a "mission-house," established for the purpose of improving the morals and manners of the labouring class in this parish. There was a comfortable room, newspapers, some religious placards, rather too glaringly displayed on the walls, and everything well meant. I sat down and ordered a penny cup of coffee, after some interesting talk with the superintendant on the means of promoting the welfare of the working classes, and weaning them from the public-house. But when my coffee came in all my spirits fled at the sight of it. Not poor Mr. Pallett, in "Perigrine Pickle," could have felt greater horror at the sight of the *sillakickaby* which was offered him at the "feast after the manner of the ancients." I tasted a little drop, opaque, treacly, and vapid. To swallow it would have been *felo de se;* how to get rid of it without offence to the worthy superintendant who was talking to me I could not tell. At last when his back was turned, I offered it to a groom who sat on the same bench. He shook his head emphatically in refusal. I as a last resource, left the table, seized my hat and fled.

As I walked away, I could not help asking myself if it were reasonable to expect working men to leave the cool pewter pot, with its frothy, tonic appetising potation, for such a sickly, and hypocritical decoction of brown paper and treacle?

It would be perfectly easy to give a good cup of coffee for a penny. The superintendant of a coffee shop might roast and grind the berry, and give half an ounce of coffee to a third of a pint of boiling water, add two lumps of white sugar. This would be worth drinking. This might compete with the half-pint of beer which a penny will purchase, and which in my judgment, is a good investment for any poor man's penny.

It is much to be hoped that the promoters of working men's clubs and dining-rooms will not taboo good table beer, not, at least, until Pall-Mall can show a teetotal club for the aristocracy. But, whilst we do not forbid table beer at meals, we should endeavour to shew that, for purposes of stimulation, for the purpose for which wine answers at the rich man's table—that is, to promote jollity good feeling, and social talk—good coffee is better cheaper and more agreeable, as well as safer than gin and water and tobacco. And to this end the working people must have something in the shape of coffee that shall be worthy of the name.

As your ably-conducted journal seems to take an interest in all social questions, I venture to ask you to insert the above.

MECHANICAL EQUIVALENT OF HEAT.

An amount of heat sufficient to raise the temperature of water by 1 deg. of Fahrenheit's thermometer, requires for its production 772 foot-pounds of mechanical power. The expenditure of the same amount of power will also raise 1 lb. of water to 1 deg. Fahr. This "dynamical specific heat of water" is known by the name of "Joule's equivalent," having been first determined by that gentleman through a series of experimental researches extending over many years. 772 (foot pounds being the mechanical equivalent for 1 deg. Fahr.; 1,390 foot-pounds is the equivalent for 1 deg. Centigrade.)

In a most interesting and striking manner, Professor Tyndall traces the existence of water through its various stages. 1 lb. of hydrogen, in combining with 8 lb. of oxygen to form water will, raise 34,000 lb. of water 1 deg. C. "Knowing the number of foot-pounds corresponding to the heating of 1 lb. of water 1 deg. C., we can readily calculate the number of foot-pounds equivalent to the heating of 34,000 lb. of water 1 deg. C. Multiplying the latter number by 1,390, we find that the concussion of our 1 lb. of hydrogen with 8 lb. of oxygen is equal, in mechanical value, to the raising of 47,000,000 lb. 1 foot high!" When this combination is effected, the substance is in the state of vapour; it first sinks to 212 deg. Fahr., and is afterwards condensed into water. The atoms of oxygen and hydrogen clash together and form the compound substance, steam; and molecules of the steam then fall together and form the liquid, water. The mechanical value of these acts can be also calculated. Thus, "9 lb. of steam in falling to water, generate an amount of heat sufficient to raise $967 \times 9 = 8,703$ lb. of water 1 deg. Fahr.; multiplying this number by 772, we have a product of 6,718,716 foot-pounds as the mechanical value of the mere act of condensation. The next great fall of our 9 lb. of water is from the state of liquid to that of ice, and the mechanical value of this act is equal to 993,564 foot-pounds. Thus, our 9 lb. of water, in its origin and progress, falls down three great precipices: the first fall is equivalent to the descent of a ton weight urged by gravity down a precipice 22,320 ft. high; the second fall is equal to that of a ton down a precipice 2,900 ft. high; and the third is equal to the descent of a ton down a precipice 433 ft. high.

DEODORIZING PETROLEUM AND MINERAL OILS.

A patent has been taken out by Mr. J. Moule, chemist, London, for the employment of deutoxide or nitrous gas in removing the offensive odor of petroleum and other mineral oils. One mode of procuring this gas is by using nitric or fuming nitrous acid in combination with shreds of iron, copper or other metal, the nitrous gas thus formed is conducted from the outlet by means of a pipe or tube, into a vessel charged with petroleum to be deodorized, in such a way that this pipe or tube reaches to the bottom of the vessel, thus allowing the nitrous gas to force its way through the whole of the contents. The gas is continued to be generated and forced therein, until fumes of nitrous gas begin freely to escape from the petroleum or oil, thereby indicating its complete saturation. As soon as this has taken place, the whole is to be well roused by forcing air through the liquid, or by a suitable agitation, after which the vessel containing the liquid petroleum or oil is to be closed until, by testing, the petroleum or products thereof are found free from any disagreeable odor, the time for which will be in proportion to the amount of gas generated and forced therein. Should the temperature be so low as to render the petroleum thick, it should be heated to a temperature of 100° Fah., and by thus liquefying it the deodorization will be more quickly and easily effected. Another modification of this deodorizing process is to pass the nitrous gas during the distillation of petroleum into the upper part of the still, so as to bring the nitrous gas into contact with the vapors arising therefrom. The gas for this purpose is collected in a suitable gasholder, and by pressure forced into contact with the petroleum vapors, the proportion of gas being regulated by a suitable stop-cock. The nitrous gas in this process may also be used in combination with ordinary or superheated steam, if thought more desirable. As it may be found convenient to effect the deodorization of the crude petroleum in the casks, other means are made use of as follows:—Into a cask, the contents of which are about 40 gallons, there are poured three or four pounds of nitric or fuming nitrous acid, and the contents thoroughly roused by means of a suitable agitation, or by forcing air through a pipe to the bottom of the cask. After rousing the contents for about five minutes, there is thrust into the cask containing the petroleum and acid about two pounds of scraps or filings of iron, which should be previously moistened with water. The iron coming in contact with the acid, nitrous gas is generated, and, by saturating the petroleum, deodorization is effected. Should the deodorization be not thoroughly complete, the contents are again roused, more acid and iron being added until the object is accomplished. The petroleum or other products, while being subjected to the above treatment, and previous to distillation, should have the acid wholly removed or neutralized by decantation and washing with suitable alkaline substances, or by the addition and subsequent agitation of fresh slacked lime, in the proportion of 6 lbs of lime to 40 gallons of petroleum. After distillation, the oil is sometimes again submitted to the action of nitrous gas.

THE CHARACTER OF GOOD LIME MORTAR.

I.—*Its Constituents.* These, it is well known, are sand and lime. A word should be said upon each.

1st. *Sand,* as generally found, is silex—in other words, finely broken flint stone. It is found in beds, where it has been deposited by natural causes, Silex is one of the hardest and most indestructible of minerals. The sand of some beds appears under the microscope, very smooth, as though the particles had been recently rolled about in water. In other beds it is rough and angular. This last is the best for mortar, and is called *sharp* sand. The cleaner sand is, the better, since clay or muck mixed with it unfits it to combine closely with lime. Its sharpness moreover enables it to adhere to the lime more firmly.

2nd. *Lime.* Solid limestone rock makes a very durable material for building. But if we use blocks of it, or of rough stone or brick, we need something to cement the separate pieces together, so as to give firmness and beauty to the work. For this purpose we use lime and sand mortar more commonly than anything else. Pulverized limestone would not do this. We therefore burn the lime; this drives off the carbonic acid, which had before constituted the particles of lime into a solid rock. Adding water to freshly burnt lime, in the proportion of about one part of water to three of lime, slakes it, so that it falls into a fine powder, called hydrate of lime. This hydrate of lime very readily absorbs carbonic acid, and returns to a condition resembling pulverized limestone, when it is entirely unfit for mortar. Lime should therefore be used soon after being slaked.

II.—*The Preparation of Mortar.*

1st. Sharp, clean sand and fresh burnt lime being at hand, the first question is the proportion of each.

2nd. The principle here involved is that no more lime should be used than is just sufficient to cement the single particles of sand into a solid mass. Mortar which is thus proportioned will grow hard quicker, and cause brick or stone work to stand firmer than that which has a larger proportion of lime.

3rd. The reason is obvious. Mortar (beyond its mere drying in the air) hardens by the re-absorbtion of carbonic acid into the solid mass, where it gradually reaches each particle of lime, converting it into limestone. Well-made mortar, properly hardened by time, thus becomes a sort of silicated limestone. The mortar as it dries rapidly, becomes porous to the extent that it was once filled with water. The gradual absorption of carbonic acid by the lime, fills up these pores, constituting the whole into a sort of stone, as already observed. A native of Prussia once informed me that some old fortress, built by the old knights of St. John, at the city of Thorn, presents this singular spectacle. The bricks of which they are built have gradually disintegrated, especially at the corners, leaving the mortar like a honeycomb of rock, and so firm that persons are able to climb up by the insertion of the fingers and toes in the interstices once occupied by the bricks.

Poor mortar, as the masons sometimes call it, thus makes the firmest work, if the whole be done with care.

4th. Of the mixing of mortar, but a word need to be said. If the foregoing principles are correct, the mixing should be very thorough. It should be worked over and over again with the hoe, crin or mortar mill, so that each particle of sand may be brought into contact with its necessary surrounding of lime.

May it not be inferred also that no more mortar should be put between well faced stone and brick than is just sufficient to make them adhere, since a small portion will more readily harden by the absorbtion of carbonic acid than a large one.

Where lime is cheap, and there is no great need of firmness and durability in the structure which is being erected, lime may be used more freely, the mortar made more hastily, and the sand be less select than above directed. A large proportion of lime constitutes a mortar that is readily used, even when made in a very hasty manner.

The record of falling buildings shows, alas! that too many have been built under the spur of cheapness and haste, with the risk of the durability of the structure and the life of its occupants.—*C. E. Goodrich in Country Gentleman.*

Miscellaneous.

USEFUL RECIPES.

Dying of Woollen Stuffs.

(*Continued from page* 188.)

10. *Yellow.*—Work for twenty minutes in a bath with eight ounces of tartar, eight ounces of alum; lift and add to the bath two pounds of bark, eight ounces of sumach, eight ounces of fustic, one pint of red spirits; work in this for forty minutes; wash out and dry

11. *Orange.*—Work for forty minutes in a bath with two pounds of sumach, three ounces of Cochineal dry, one pound of fustic, eight ounces of tartar, one pint of red spirits; wash out this, and dry.

12. *Sky-blue.*—Work in a bath for half an hour with eight ounces of argol, one pound of alum, one gill of indigo extract; wash out this, and dry.

Different depths of shade may be made by varying the quantities of indigo extract.

13. *Pigeon-blue.*—Work in a bath for forty minutes with two ounces of chrome, four ounces of alum, one ounce of tartar; wash from this in cold water and then work for half an hour in another bath with three pounds of logwood; lift, and add one ounce of verdigris; work for fifteen minutes, and wash, and dry.

14. *Apple-green.*—Work for half an hour in a bath with one ounce of chrome, one ounce of alum; wash through cold water, and then work for half an hour in a second bath with two pounds of fustic and eight ounces of logwood; wash and dry.

A variety of this shade can be obtained by diversifying the proportions and quantities.

15. *Green.*—Work for fifteen minutes in a bath with five pounds of fustic, two ounces of argol, five ounces of alum; lift, and add half a gill of indigo extract; and then work for half an hour, and dry.

If the green seem too yellow, a little more extract of indigo may be mixed with the others.

16. *Fast-Green.*—This is first dyed blue in the indigo or wood vat, according to the depth of the green required, and then work for an hour in a bath with four pound of fustic, two pound of alum and dry out.

By dying the vat blue lighter than is required for the green, and adding to the bath a little logwood will give the required depth and a good shade; but the colour is not so fast.

17. *Olive.*—Work for an hour in a bath with ten ounces of fustic, eight ounces of logwood, four ounces of madder, two ounces of peachwood; lift and add to the same bath four ounces of copperas in solution, and work for half an hour and dry.

18. *Wine colour.*—Work the goods for an hour in a bath, with four pounds of cudbear and dry.

If a darker shade be required, give more cudbear; if the tint be desired bluer, add, after half an hour's working, one gill of ammonia: if a redder tint is wanted, add a wine glassful of hydrochloric acid.

If the acid be added, the goods should be washed before drying.

19. *Light violet.*—Work for an hour in a bath with four ounces of cudbear, four of logwood, two of barwood or caunwood, two of peachwood; lift and add two ounces of alum in solution, and work half an hour, and dry.

20. *Puce.*—Work in a bath for one hour, with ten ounces of logwood, one ounce of caunwood, eight pounds of cudbear; lift and add two ounces copperas in solution; work half an hour, and dry.

Recipe for Dyeing Hats.

The bath for dyeing hats, employed by the London manufacturers, consists, for 12 dozen, of

144	Pounds of	logwood.
12	"	green sulphate of iron or copperas.
7½	"	verdigris.

The copper is made of a semi-cylindrical shape, and should be surrounded with an iron jacket, or case, into which steam may be admitted, so as to raise the temperature of the interior bath to 190° Fah., but no higher; otherwise the heat is apt to affect the stiffening varnish, called the gum, with which the body of the hat has been imbued. The logwood having been introduced and digested for some time, the copperas and verdigris are added in successive quantities, and in the above proportions, along with every successive two or three dozen of hats suspended upon the dipping machine. Each set of hats, after being exposed to the bath, with occasional airings, during 40 minutes, is taken off the pegs, and laid out upon the ground to be more completely blackened by the peroxydizement of the iron with the atmospheric oxygen. In 3 or 4 hours the dyeing is completed. When fully dyed, the hats are well washed in running water.

A skilful operator furnishes the following valuable information relative to the *stiffening* of hats. He says:

All the solutions of gums which I have hitherto seen prepared by hatters, have not been perfect, but in a certain degree a mixture, more or less, of the gums, which are merely suspended, owing to the consistency of the composition. When this is thinned by the addition of spirit, and allowed to stand, it lets fall a curdy-looking sediment, and to this circumstance may be ascribed the frequent breaking of hats. My method of proceeding is, first, to dissolve the gums, by agitation, in twice the due quantity of spirits, whether of wood or wine, and then, after complete solution, draw off one half the spirit in a still, so as to bring the stiffening to a proper consistency. No sediment subsequently appears on diluting this solution, however much it may be done. Both the spirit and alkali stiffenings for hats made by the following recipes, have been tried by some of the first houses in the trade, and have been much approved of:

Spirit Stiffening.—7 pounds of orange shellac; 2 pounds of gum sandarac; 4 oz. of gum mastic; ½ pound of amber resin; 1 pint of solution of copal; 1 gallon of spirit of wine, or wood naptha. The shellac, sandarac, mastic, and resin, are dissolved in the spirit, and the solution of copal is added last.

Alkali Stiffening.—7 Pounds of common block shellac; 1 pound of amber resin; 4 oz. gum thus; 4 oz. gum mastic; 6 oz. borax; ½ pint of solution of copal.

The borax is first dissolved in a little warm water (say 1 gallon); this alkaline liquor is now put into a copper pan (heated by steam), together with the shellac, resin, thus, and mastic, and allowed to boil for some time, more warm water being added occasionally until it is of a proper consistence; this may be known by pouring a little on a cold slab, somewhat inclined, and if the liquor runs off at the lower end, it is sufficiently fluid. If, on the contrary, it sets before it reaches the bottom, it requires more water. When the whole of the gums seem dissolved, half a pint of wood naptha must be introduced, with the solution of copal; then the liquor must be passed through a fine sieve, and it will be perfectly clear and ready for use. This stiffening is used hot. The hat bodies, before they are stiffened, should be steeped in a weak solution of soda and water, to destroy any acid that may have been left in them (as sulphuric acid is used in the making of the bodies). If this is not attended to, should the hat body contain any acid when it is dipped into the stiffening, the alkali is neutralized, and the gums consequently precipitated. After the body has been steeped in the alkaline solution, it must be perfectly dried in the stove before the stiffening is applied; when stiffened and stoved, it must be steeped all night in water to which a small quantity of the sulphuric acid has been added; this *sets* the stiffening in the hat body, and finishes the process. A good workman will stiffen 15 or 16 hats a day. If the proof is required cheaper, more shellac and resin must be introduced.

Bleaching and Colouring Bonnets.

Bonnet Bleaching Recipe.—*First.* Wash the bonnets in warm soap and water. *Second.* Take two tablespoonfuls of sal soda, and two quarts of soft warm water; dissolve the soda, then put in the bonnets and let them soak three to five minutes; then take them and put them into the bleach box—put in about a tablespoonful of brimstone, and bleach over night; then take them out; then take two quarts of warm water, and one good tablespoonful oxalic acid; dissolve the acid, soak the bonnets about five minutes in the same, then rince them in clean warm water, and hang them out to sun. Sun them until about half dry, then put them in the bleach, if you have time; if not, dry and size them, and they are ready to press.

Colouring Brown and Drab Straw Bonnets.—*First.* To twelve quarts of water add one teacupful of black tea; heat the water and tea until they boil; then add one teaspoonful of copperas; stir the same one minute or so; then take it off and let it stand about five or ten minutes; then put in the bonnets to be colored drab; such as Neapolitan, chip, rice, straw or fine Dunstable, that are clear and white, and they will color very quick. All other braids had better be colored brown, and let them remain in the dye some six hours, but look to them, and if they don't take good color, let them be until they do. You can color any shade of brown, by giving longer or shorter time in the dye.

For Coloring Black.—Take logwood, or the extract—which is better; half pound of chips or a small quantity of the extract to twelve quarts of water; heat it to boiling; then add one teaspoonful of copperas; put in the bonnets and boil until black. It generally takes six hours—and if the dye is not strong, it will take longer. Take them out, wash them dry, and brush them.

To Remove Stains.

Stains of *iodine* are removed by rectified spirit. *Ink* stains by oxalic acid or superoxalate of potash. *Iron moulds* by the same; but if obstinate, it has been recommended to moisten them with *ink*, then remove them in the usual way.

Red spots on black cloth, from acids, are removed by spirits of hartshorn, or other solutions of ammonia.

Stains of Marking Ink, or Nitrate of Silver, to remove.—1. Wet the stain with fresh solution of chloride of lime, and after 10 or 15 minutes, if the marks have become white, dip the part in solution of ammonia or of hyposulphite of soda. In a few minutes wash with clean water.

2. Stretch the stained linen over a basin of hot water, and wet the mark with tincture of iodine.

Browning or Bronzing Liquids, for Gun Barrels.

1. Aquafortis ½ oz., sweet spirit of nitre ½ oz., spirit of wine 1 oz., sulphate of copper 2 oz., water 30 oz., tincture of muriate of iron 1 oz. Mix.

2. Sulphate of copper 1 oz., sweet spirit of nitre 1 oz., water 1 pint. Mix. In a few days it will be fit for use.

3. Sweet spirit of nitre 3 oz., gum benzoin 1½ oz., tincture of muriate of iron ½ oz., sulphate of copper 2 dr., spirit of wine ½ oz. Mix, and add 2 lbs. of soft water.

4. Tincture of muriate of iron ½ oz., spirit of nitric ether ½ oz., sulphate of copper 2 scruples, rain water ½ pint. The above are applied with a sponge, after cleaning the barrel with lime and water. When dry, they are polished with a stiff brush, or iron scratch brush.

Bronzing Liquids for Tin Castings.

Wash them over, after being well cleaned and wiped, with a solution of 1 part sulphate of iron, and 1 of sulphate of copper, in 20 parts of water; afterwards with a solution of 4 parts verdigris in 11 of distilled vinegar; leave for an hour to dry, and then polish with a soft brush and colcothar.

Solvents for Gutta Percha.

Benzole readily dissolves it: so do chloroform and bisulphuret of carbon.

Processes for Staining Woods.

Mahogany Color (*Dark*).—Boil ½ lb. of madder and 2 oz. of logwood in a gallon of water; then brush the wood well over with the hot liquid. When dry, go over the whole with a solution of 2 drachms of pearlash in a quart of water.

Mahogany Color (*Light*).—Brush over the surface with diluted nitric acid, and when dry apply the following, with a soft brush: Dragon's blood, 4 oz.; common soda, 1 oz.; spirit of wine, 3 pints. Let it stand in a warm place, shake it frequently, and then strain. Repeat the application until the proper color is obtained.

To Stain Maple a Mahogany Color.—Dragon's blood, ½ oz.; alkanet, ¼ oz., aloes, 1 dr.; spirit of wine, 16 oz. Apply it with a sponge or brush.

Rosewood.—Boil 8 oz. of logwood in 3 pints of water until reduced to half; apply it, boiling hot, two or three times, letting it dry between each. Afterwards put it in the streaks, with a camel's hair pencil, dipped in a solution of copperas and verdigris in a decoction of logwood.

Ebony.—Wash the wood repeatedly with a solution of sulphate of iron; let it dry, then apply a hot decoction of logwood and nutgalls for two or three times. When dry, wipe it with a wet sponge; and when dry again, polish with linseed oil.

Red.—1. Take a pound of Brazil wood and mix it with a gallon of stale urine. Pour over the wood while boiling hot. Before it dries it should be laid over with alum water. 2. A fine red may also be obtained by a solution of dragon's blood in spirits of wine.

Yellow.—Nitric acid, lightly diluted, will produce a fine yellow on wood. Sometimes, if the wood is not in proper condition, it will create a brown. Care must be taken that the acid used be not too strong, or it will render the wood nearly black.

Blue.—Take of alum 4 parts; water 85 parts. Boil.

Purple.—To produce this color, take of logwood 11 parts; alum 3 parts; water 29 parts. Boil.

Mahogany.—1. Linseed oil 2 pounds; alkanet 3 ounces. Heat them together and macerate for six hours, then add resin two ounces; beeswax 2 ounces. Boiled oil may be advantageously used instead of the linseed oil.

2. Brazil wood (ground): water sufficient; add a little alum and potash. Boil.

3. Logwood 1 part; water 8 parts. Make a decoction and apply it to the wood; when dry, give it two or three coats of the following varnish: dragon's blood 1 part; spirits of wine 20 parts. Mix.

To take Stains out of Mahogany.—Spirits of salts 6 parts; salt of lemons 1 part. Mix, then drop a little on the stains, and rub them until they disappear.

To Stain Musical Instruments.—Crimson: Boil one pound of ground Brazil wood in three quarts of water, for an hour; strain it, and add half an ounce of cochineal; boil it again for half an hour gently, and it will be fit for use.

Purple.—Boil a pound of chip logwood in three quarts of water, for an hour; then add four ounces of alum.

A few Hints on Dyeing.

To those who wish to have certain fabrics dyed, the following information will be found useful, as regards the colours they will take. Thus if the material be black it can only be dyed black, brown d. green, d. crimson, d. claret, and d. olive. (d stands for dark in all cases.) Brown can only be dyed black, d. brown, d. claret. Dark green: black, brown, d. green, d. claret, d. olive. Light green: d. green, black, d. brown, d. crimson, d. claret, d olive. Dark crimson: black, brown, d. crimson, d. claret. Light crimson will take the same as dark crimson. Claret: black, brown, d. crimson, d. claret. Fawn will take d. crimson, d. green, black, brown, d. claret. Puce: black, brown d. olive, d. crimson, d. claret. Dark blue: black, brown, d. crimson, d. green, d. claret, d. olive, d. blue. Pale blue: d. crimson, d. green, black, brown, claret, puce, d. blue, d. olive, lavender, orange, yellow. Olive will dye brown, black, d. green, d. crimson, d. claret. Lavender: black, brown, d. crimson, claret, lavender, olive. Pink: d. crimson, d. green, black, brown (as all tints will take a black and brown, these colours will not be repeated), pink, olive, d. blue, d. puce, d. fawn, Rose, same as pink, but also orange, scarlet and giraffe. Straw, primrose and yellow will dye almost any colour required; as also will peach, and giraffe. Grey will only dye, beside brown and black, d. green, d. claret, d. crimson, d. fawn, d. blue. White silk, cotton and woolen goods can be dyed any colour. As cotton silk and wool all take dye differently, it is almost impossible to re-dye a fabric of mixed stuff any colour except the dark ones named. It will be observed by the above list that pale blue will re-dye better than any other colour.—*Septimus Piesse, F. C. S.*

Application of Aluminum.

In the hands of Messrs. Bell, of Newcastle, the results obtained by Wöhler, Deville, and others, have been brought into a practical shape, and the manufacture of the metal may now be said to be well started.

Unquestionably there are difficulties still to be overcome, but with the start that has been made they are in a fair way of being met. The softness, the dull appearance, and the fragile nature of the metal are objections to its use when compared either with silver or with plated goods. But there are many applications in which these characters would be of far less importance than its cardinal merit of lightness, and, as compared with inexpensive metals, its lesser liability to discolour, tarnish, or oxidise by exposure to the atmosphere.

The applications that have hitherto been made of aluminum have been most in the way of ornamental purposes; but, nevertheless, its price has been brought down to about sixty shillings the pound, whereas three or four years ago it cost as much an ounce.

As regards aluminum itself, one of its most likely applications is probably as a material for statuettes and small works of art of this description, especially if a means could be found of giving to it a richer colour and appearance, either by a kind of bronzing or by the addition of some alloy. It requires a much less intense heat than silver for melting, and when melted, it solidifies much more slowly. Consequently, it is particularly well adapted for castings that require to be executed with great delicacy.

The sonorous character of aluminum is very peculiar, far exceeding that of silver as regards clearness, and this, together with its lightness, may become serviceable in the construction of musical instruments.

The alloys of aluminum have been less minutely studied than they deserve to be, but the alloy of copper with 10 per cent. of aluminum is one which by its beautiful appearance and other characters will no doubt be of importance. This aluminum bronze has, like aluminum itself, been chiefly applied for ornamental purposes, and its beautiful yellow colour and lustre render it well adapted for such purposes, not because it is like gold, without being it, but because it is nearly as beautiful in itself, and combines with this character an intrinsic value so much less than that of gold, that it may be applied to purposes for which gold could not possible be used at all. It is very strong, tenacious and malleable, and remarkably hard, this character being in fact so marked that it constitutes one of the greatest present difficulties in the working of the alloy.

The alloy of aluminum with silver seems likely to prove more useful as a material for articles of domestic use than the bronze, for notwithstanding the beauty of the latter, the fact of its containing 90 per cent. of copper would tend to limit its applicability more to articles of ornament than of utility. The silver alloy would not be open to this objection, but little seems yet to have been done with it.

A very interesting collection of articles manufactured in aluminum bronze have been exhibited for some few days by Messrs. Mappin, of Regent Street, who have taken up the working of this metal and its alloys in earnest at their Sheffield works.

Effects of Tobacco on the Mental Faculties.

In reference to the question of the influence of smoking on the mental faculties, Dr. Richardson, in the *Social Science Review*, says tobacco like all agents of its class, has the property of checking the oxidation of the body, and thus of diminishing waste. If mental labour is commenced when the system is well sustained, and the supply in excess of the waste, indulgence in smoking does produce in most persons a heavy dull condition, which is difficult to throw off, because it stops the processes of assimilation and destruction. But if mental labour be continued until the wasting of the corporeal power is greater than the supply, then the resort to tobacco gives a feeling of relief; it checks the rapid waste that is going on, and enables the mind to bear up longer in the performance of its task. Many men who commence a day of physical or mental work on a good breakfast and tobacco, find that they go through their labours with much less alacrity than other men who are not smokers, while the majority of smokers feel that after a day's labour the resort to a pipe, if the practice is moderately carried out, produces temporary relief from exhaustion. He also adduces the well-known fact that many persons of great energy and industry cannot sleep owing to the actual severity of mental or bodily effort to which they have subjected themselves. In this condition there can be no doubt that tobacco produces a soothing effect, causing mental rest. Dr. Richardson does not advocate the necessity of tobacco as a requirement of the natural life. He believes that in this day we are not living naturally; we have run into the extreme of industry; have carried our exertions to the borders of insanity; and so it is to be admitted that to the natural man such adventitious aids as tobacco are unnecessary. He condemns the use of tobacco until the body is fully developed; and states that the indulgence in it by our children and youths is degrading the national intellect, and establishing a race which will transmit its own degradation to future generations.

Manufacture of Linseed Oil.

The attention with which farmers have of late regarded the cultivation of flax and its estimated value as a rotative crop, has caused it to become a highly important staple. The quantity, both of seed and fibre, now raised in the Upper Province is very considerable, and is steadily increasing every year. There are several manufactories in operation for working up the latter and creating a large yield this year. Some of those are being enlarged and extended. But, with the exception of a very small portion crushed at Bridgeport, C. W., the seed has as yet to find in Lower Canada a market, from whence and from England we now derive our supplies of linseed oil, which could so readily be obtained on the spot, saving the heavy cost of duty and transport. These facts have influenced persons to contemplate the erection of an oil mill at this point, as an enterprise which will not only prove very lucrative to those who engage in it, but also aid materially in developing the resources and fostering the manufacturing interests of the country. With this view it is proposed to form a Joint Stock Company, under the management of a gentleman from England, who has for a number of years been engaged in the oil business and thoroughly understands the manufacture in every branch, and who demonstrates to the satisfaction of experienced men that this point is peculiarly adapted for the profitable working of such a manufactory. The capital required for the efficient working is estimated at $10,000. It is proposed to issue shares of $50 or $100 each, and it is hoped that capitalists and property-holders interested in the welfare of the city will look into the scheme and give it that encouragement it truly deserves.—*Toronto Leader.*

Patent Ice-making Machine.

The *Birmingham Post* gives an account of a very ingenious machine for the manufacture of ice, patented by Messrs. SiebeBros., Mason-st., Lambeth, London, and manufactured by Mr. W. H. Phillips, of the Atlas foundry, Oozellsstreet, Birmingham. The machine has been made for a firm in Banbury who have now in use one of Messrs. Siebe's machines, which is capable of producing four tons of ice per day. This machine which is the first of the kind made in Birmingham, is capable of producing ten tons per day, and is driven by an engine of twenty horse power. The machine has been completed only a few days, and as it was necessary to try it before exportation, it has been used, and the ice manufactured has been bought by Mr. Copner of New-street and others. The machine consists of an engine, a large tank, and four longitudinal troughs of considerable dimensions, and placed side by side. In these troughs the spring water to be converted into ice is placed, in metal vessels about 2 in. wide, and some 2 ft. deep. Brine containing as much salt as can be held in solution is forced through the troughs, and runs round the vessels containing the spring water, and when it has run through the whole series it is pumped back into a large tank, and after being again reduced to an intense degree of cold is once more forced though the troughs; and this process is repeated until the whole of the water is converted into ice, which is turned out in slabs of even size and thickness. The degree of cold produced is so intense that the ice begins to form in about twelve minutes from the commencement of the operation. The ice made by the machine is beautifully clear, and not the least of the many advantages of the process is that no chemicals whatever are used. The manufacture of ice in tropical climates is a most important operation, and to this end Messrs. Siebe's machines have been extensively applied, one of them being now at work in Peru, almost under the Equator.

Another New Metal.

A letter from France says that another new metal has been announced during the week. M. Osravais, Professor of Geology at Strasbourg, has obtained a hard shining metal, of the colour of gold, but soft as lead, from the mineral waters of Alsace. The metal, not admitting of a high degree of polish, will be useful to employ in the dull or coloured goldsmiths' work so much in fashion for ornament just now. The specimens, submitted to connoisseurs in Paris, have excited the highest admiration.—*Mining Journal.*

The Habits of a Man of Business.

A sacred regard to the principles of justice forms the basis of every transaction, and regulates the conduct of the upright man of business. He is strict in keeping his engagements; does nothing carelessly or in a hurry; employs nobody to do what he can easily do himself; keeps everything in its proper place; leaves nothing undone which ought to be done, and which circumstances permit him to do; keeps his designs and business from the view of others; is prompt and decisive with his customers, and does not over-trade for his capital; prefers short credits to long ones, and cash to credit at all times, either in buying or selling; and small profits, in credit cases, with little risk, to the chance of better gains with more hazard. He is clear and explicit in all his bargains; leaves nothing of consequence to memory which he can and ought to commit to writing; keeps copies of all his important letters which he sends away, and has every letter, invoice, &c., belonging to his business, titled, classed, and put away; never suffers his desk to be confused by many papers lying upon it. Is always at the head of his business, well knowing that, if he leave it, it will leave him; is constantly examining his books, and sees through all his affairs, as far as care and attention enable him; balances regularly at stated times, and then makes out and transmits all his accounts current to his customers; avoids, as much as possible, all sorts of money matters and law-suits where there is the least hazard; keeps a memorandum-book, in which he notes every little particular relative to appointments, addresses, and petty cash matters; is cautious how he becomes security for any person, and is generous only when urged by motives of humanity.

Magnitude of Waves, by Mr. Thos. Herless.

The highest waves measured were about 35 feet in height from the trough, no broken crests having been measured. Their speed varied (the force of the wind being 8 according to the Board of Trade scale, and equal to weather in which a ship on a wind can just carry treble-reefed topsails) from twenty to twenty-three miles per hour, the breadth of trough being 300 to 350 feet. The observations show that usually the succession of magnitudes (or heights) returns in series of twelve waves, the first and second of each series being very large, the sixth or seventh being also large, but inferior in magnitude to the first and second, and the intermediate ones being small. The observations show that waves are limited in length, measured along their bases, the crest being apparently at the middle point of the base, and the length varying with the altitude of the crest, and that the order of succession of magnitudes depends upon their being arranged so that the crest of one wave follows on the same line as the lower flanks of a preceding wave. The speeds also of waves appear to vary, so that a following wave often coalesces with, and is increased in size by, absorbing one immediately preceding. When a wave is first formed, it is small, and increases in size in its progress, until the crest topples over in foam, after which the height decreases rapidly; and there seems reason for thinking that if ordinates were drawn so as to represent the height of any wave at diffierent periods of its existence, its height would be found to coincide with Mr. Scott Russell's wave-line curve. The length of a wave in open water, measured along its base, seems also to depend upon and bear a definite relation to the width of the trough between two successive waves. The speed of the waves is not so much affected as would naturally be imagined by the force of the wind. In a moderate gale they run as fast as in a heavy one. It is otherwise with their height.

Extraction of Copper from Roasted Pyrites.

In the year 1850 Mr. Gossage showed that the copper amounting to about one per cent. in Irish pyrites, could be extracted, and this is still more practicable in the case of Spanish pyrites, which contain about 3 per cent., and, after roasting, from 5 to 6 per cent. The extraction of copper is, however, rarely carried out by the sulphuric acid manufacturer. In England the copper is obtained in the dry way by successive meltings. In France the roasted mineral is exposed to the action of the air, the copper sulphate thus produced is extracted by water, and the metal precipitated by iron. More recently the copper has been extracted as chloride, by melting the roasted mineral with sodium chloride. The method patented by Mr. Henderson, is worked at Mostyn with the pyrites residues from Messrs. Muspratt's works, and works are being erected near Glasgow for treating the residues from Messrs. Tennant's works.

Application of the Sulphur obtained in purifying Coal Gas.

The method introduced by Mr. F. C. Hills for purifying coal gas from sulphur consists in passing it over a mixture of sawdust and hydrated ferric oxide. By exposing the iron sulphide, thus produced to the air, it is oxidised, sulphur being separated, and hydrated ferric oxyde reproduced. After this operation has been repeated several times, the sulphur will amount to about 40 per cent., and the material is then unfit for the purification of gas, but is used for producing sulphurous acid by roasting it in reverbratory furnaces, so as to present a large surface for oxidation. In 1859 the consumption of this material at Mr. Lawes' factory at Barking Creek, was 737 tons, and in 1861 it was 2180 tons. This material is said to yield one and a-fourth its weight of oil of vitriol.

Cements for Steam Joints.

Plumbago has recently been introduced as the basis of a superior cement for steam joints, and the general metallic connections of the Engineer. It is composed of six parts of Plumbago, three of slacked lime, eight of sulphate of baryta, and three of boiled linseed oil. This compound, it is said, secures a perfectly air and steam-tight joint, much superior to that obtained by the use of red lead.

Importance of Manufactures.

If we aspire not to be a manufacturing country, we need not aspire to be a great or populous country, nor to enjoy any large share of the luxuries or comforts of civilized life. England is great because of her manufactures, and Canada will only be great when her staple manufactures are at least sufficient to supply the wants of her people.