THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

SEPTEMBER, 1863.

CULTIVATION AND MANUFACTURE OF FLAX AND HEMP IN CANADA.[*]

(Concluded from page 230.)

Flax as a Farm Crop.[†]

Flax is one of those hardy plants which grow upon almost any kind of arable soil capable of producing average farm crops in common cultivation. Like other plants it has its likes and dislikes, and succeeds best when cultivated on a medium rich sandy loam. The fibrous nature of its roots causes it to delight in a deep and open soil, through which they may ramify, both vertically and horizontally. Low alluvial soils tend to encourage mildew, which, not unfrequently, attacks flax cultivated in such situations in America.

Rotation is almost immaterial, provided the soil is in good heart and free from weeds. In Europe it is made to take every position which can be assigned to it in rotation with other crops, convenience generally being the rule which determines its place, but when special attention is devoted to rotation, practice serves to indicate that it should follow a straw or hoed crop.

The Seed.

European flax-growers exercise the greatest care in the selection of their seed. In Germany particular value is attached to linseed from Courland and Livonia, where the soil and the nature of the climate, especially the short hot summer, bring the flowering and fruit time near together; so that the flowers, being simultaneously and uniformly fructified, produce ripe and perfect seeds. The Belgians, also, always select Baltic flax for their seed. For the heavy soils the Dutch seed is frequently used, which is the produce of Riga seed, once grown in Flanders. The American seed has been tried, but experience has shewn that the plants had a tendency to grow branchy instead of a single erect stem; and although good for seed purposes, a large portion of the fibre was necessarily lost in scutching. In the regular flax growing countries, where they rely greatly upon their flax as the money-producing crop, they always obtain a new supply.[*]

Professor Wilson recommends sowing merely sufficient foreign seed to reproduce the quantity required for the succeeding flax crop, in order that a clear sample may be obtained, for foreign seed is notoriously dirty. This practice is generally followed in Belgium and Ireland.

The quantity of seed sowr varies from one to two bushels to the acre. The larger quantity being used when flax is grown for the sake of its fibre. Thick sowing induces the plant to grow up a tall slender stem, and its fibre is developed at the expence of the seed. When sown for fibre and seed it is recommended to be sown earlier then when seed alone is the object of its cultivation. The seed should be very lightly covered, a common brush-harrow being used for the purpose; and the work finished with a light roller.

Sown in the last week of April, or the first week in May, after danger from frost is over, the flax crop will be ready for pulling in Canada about the middle of July, according to the season and the latitude, and the exact time for pulling, if both fibre and seed are to be saved, is a matter of much importance. "In Belgium—and we instance that country, as the flax cultivation has a higher importance there and receives far more attention than with us—the way they proceed is this:—A full grown plant is selected, and the best matured and richest capsule is taken. This is cut across with a sharp knife, and the section of the seeds examined if they have become firm inside, and the outside has assumed a good deep green colour, the plant is considered fit for immediate pulling. At this time the entire plant will exhibit signs of its approaching maturity. The bottom of the stalk will be seen to have assumed a yellowish tint, and have become much harder to the touch than it was before, good indications of an interruption to the circulation of the juices of the plant. If this altered condition be allowed to go on by the plant remaining in the ground, the change of colour will rapidly make its way up the stem until it reaches the capsules, and then the seeds will be found to be fully matured, quite hard, and to have assumed the dark colour with which we are so familiar in the market samples. The next stage of the plant would be the bursting of the seed-vessels, and disjection of their

---

[*] This article, by the Editor, was published in the *British American Magazine* for August.

[†] It does not como within the scope of this article to discuss, or even to describe the minutiæ of flax cultivation or the preparation of the fibre. The reader who is desirous of devoting attention to this part of the subject will find ample information in "Our Farm Crops," by Professor Wilson, of Edinburgh; also in various articles and Correspondence in the *Canadian Agriculturist*; Kirkwood on Flax in the Parliamentary Reports. A small pamphlet entitled "Flax, directions for its Cultivation and Management." "A manual of Flax Culture," (Moore, Rural Manual, Rochester. N. Y.) The same remarks apply also to hemp.

[*] The amount of Riga flax seed exported for sowing in 1850 was 126,518 barrels. Each barrel weighs about 200 lbs, and contains three and a half bushels. The prices of Riga seed have ranged from 35 shillings sterling to 53 shillings per barrel, or about $2.50 to $3.75 per bushel, within the last twenty years.

contents, and the decay of the entire plant; but to perserve both seed and fibre, the plant should be harvested at the earlier stage, at which time the fibre is at its best condition. If left until the seeds are quite matured, the stem gets hard and woody, and the fibre is apt to get much broken in the subsequent process of separation. Long experience has proved that this is the best time to pull the flax; for although the seeds are not at that time fully ripe, yet if allowed to remain in the sheaf, they will absorb from their integument a quantity of sap to render them sufficiently mature for the purpose of vegetation, though perhaps for commercial purposes their market value may not be so high as if allowed to stand a little longer in the field."

Taking the Crop.—Flax-Pulling Machines.

As it is probable that the ordinary mode of taking the crop, technically called "pulling," will be commonly practised for some years to come in Canada in many localities, a brief reference to it is necessary before alluding to the flax-pulling machines. Flax is pulled, stem and root, by the hand, bound in small sheaves to dry the fibre and ripen the seed thoroughly. It is then stooked, and when cured it may be housed at once. The idea that it is necessary to pull flax by the hand in place of using machinery for gathering it or cutting it, is fast giving way to more advanced opinions.

There can be no doubt that the supposed necessity for pulling flax by hand has been one cause of the neglect of its cultivation, "but it need not be so for the future; it is now found, that when the ground is smooth and well rolled, it may be as well cut with the reaping machine, except for the very finest fibres; in this case a machine for pulling it has been invented, which executes the work with great rapidity, and at a very small expense."* Such is the evidence of competent men in America. —In the United Kingdom Professor Wilson says, "If the tillage operation of the farm have been properly carried out, and the direction given as regards tilth of surface, and rolling after the seed is got in, has been attended to, there is no reason why we should not avail ourselves of the 'mowing machine,' which is now doing such good work in our grass fields, and cut down our flax, as near the ground as possible, in the same manner." For all textile uses, the portion of the fibre, of any value, exists only in the stem above the ground, the lower part of the stem cut off by the mowing machine is worthless for fibre producing purposes, and arrests the process of fermentation when in the "steep." The ends or buts of the steeped straw are also injurious in the process of dressing the fibre, so that on several grounds the use of the mowing machine is preferable to pulling.

Rippling.

"Rippling," or the process of separating the seed from the straw, is best accomplished with a common rippler or comb soon after the crop is cut; if it be delayed until the winter, it undergoes a beating process, which separates the seed from the capsules without difficulty. Rippling can only be undertaken with safety soon after the crop is pulled, as the fibre becomes too brittle for this process if the plant is permitted to get thoroughly dry. The seeds may either be used directly as food or sold for the extraction of the oil they contain, and the manufacture of oil-cake.

The Rotting Process.

We now arrive at the most serious objection to the extended cultivation of flax, at least in this country and the United States. The rotting process in unskillful hands is always uncertain, and frequently leads to disappointment and serious loss; nevertheless it is essential that this necessary part of flax manufacture should be carried on within a few miles of the spot where the crop is grown, otherwise the expense of carriage of the straw would so far diminish profits as to render flax cultivation unremunerative. About three-fourths of the entire weight of the straw is useless for textile purposes, but it is not useless as fodder or manure.

Since the straw will not bear the expense of transportation to any considerable distance, it is clear that the farmer must either consent to perform the rotting, breaking, scutching, and hackling processes as they do in Ireland, or factories for the express purpose of preparing the straw for the manufacturer must be situated near where the flax is grown. A flax district must, as it were, be created, and a factory erected within the limits of the district, just as sawmills are generally built near the supply of timber, instead of remote from it. Experience shows that where a constant supply of flax is cultivated, and enough to support a factory can be relied on, there is never any trouble or difficulties in finding enterprising and capable men willing to erect and work a factory. It is a want of mutual confidence on the part of the grower and the flax-factor which has checked the cultivation of flax in Canada: the factor has not erected his mill, because the farmer showed no reliable disposition to cultivate the flax, and the farmer refused to grow his crop because he was not sure of the factor being ready with his mill to consume it. It is thus that a generation has passed away without any improve-

---

* Report on Flax and Machinery for making Flax Cotton: By a Committee of the New York State Agricultural Society.

ment being made, and those lessons of experience which the first settlers had learned in the cultivation of this plant and its subsequent manipulation, or knew before they emigrated from "home," have not been transmitted from father to son; hence the present generation, as a class have actually to be taught a portion of that valuable industry with which their fathers were familiar, and by neglect has grown out of date and perhaps out of remembrance. The State of New York cultivated 46,000 acres of flax in 1845; ten years later the area under that crop had diminished seventy-five per cent. The United States, in 1850, produced 7,709,678 lbs. of flax; in 1860, only 3,783,079 pounds, a diminution of more than fifty per cent.

In order to understand the true nature of the preparation of flax for the market, and the difficulties and chances which attend it, a brief description of flax straw is necessary, so that the object of the successive manipulations to which it is subjected may be understood.

Composition of Flax Straw.

If we examine minutely the structure of flax straw, we shall discover that it consists of five parts 1st, the epidermis or outer covering; 2nd, the bark; 3rd, the fibres, which make it commercially valuable; 4th, the woody centre, or "shove;" 5th, the pith. The "fibres" form a tubular sheath round the woody centre or shove, and are cemented together by a mucilaginous compound which it is the object of the manufacturer to dissolve, so that the fibres may be separated after they have been removed from the bark and woody centre, into delicate filaments or fibrilla. The grand object of the flax-fibre manufacturer, then, is to separate these filaments uniformly from one another by a cheap mechanical or chemical process. This is effected in a greater or less degree by the steeping, raking and scutching processes. The "steep" dissolves, after fermentation, the mucilaginous cement which binds the filaments into fibre and the fibres into a tubular sheath. The breaking process enables a considerable portion of the woody centre, or "shove," and the bark to be separated, the remaining part is removed by the scutching machine, when the material is considered to be fit for market purposes. All of these objects can be effected by hand labour, and the greater part of the flax fibre in Europe is so prepared; but hand labour in this country is too expensive, and would always operate as a bar to the extensive preparation of flax fibre among our farmers, hence the absolute necessity of performing as much of the mechanical processes by machinery as possible, if we desire to extend the cultivation of this valuable plant.

A great step has already been made in advance by the Government introducing into the country Rowan's flax-scutching machines. To this machine has recently been awarded the gold medal, from among forty competitors, at the late Agricultural Meeting at Lille, the centre of a district where the cultivation and manufacture of flax is the staple industry.

The cheapness of Rowan's machine places it within the reach of small manufacturers, and the excellent work it accomplishes, with the small amount of loss, gives it a practical recommendation of the highest value in extending the sphere of this important branch of industry.

It will be argued by many that in the present scarcity of capital in Canada it will be necessary to rely upon the farmer preparing the straw for the operation of the scutching machine; that there is no prospect of the establishment of a sufficient number of factories in districts where flax would probably be grown if the entire process, from the steep to the prepared fibre, is to be accomplished in one and the same establishment, the farmer merely supplying the straw. Although the arguments which could be advanced in favour of home steeping are very strong, yet they are far from opposing an obstacle to the gradual introduction of a modification of Schenck's process in factories especially designed for the purpose. Schenck's process is speedy, economical, reliable, and can be conducted throughout the year. It does not involve much outlay of capital, and has been actually introduced, to a considerable extent, in Ireland, where skilled labour available for the ordinary rotting process is everywhere abundant. In Ireland there are now upwards of thirty establishments at work on this principle, requiring annually from fifty to sixty thousand tons of straw.

The mode of operation is simple in the extreme; it consists in submitting the straw to the solvent action of water at a uniform temperature of 80° or 90°. Instead of the flax requiring to remain in the steep for 10 to 20 days, according to the temperature, the whole fermentative process is completed in three or four days. The operation is altogether independent of the weather, and can go on uninterruptedly throughout the year. Tanks, with a hot water pipe passing through them are all that is required. The results have been favourably reported on by the Irish Flax Improvement Society. The investigations of that body led to the conclusions that Schenck's process increased the yield of fibre, increased the strength of the fibre, and increased the quality of the linen made from the fibre. Prof. Wilson speaks of this process in the following words: "This process is so simple, and its advantages over the old method so manifest, both in respect to time, quantity and quality of produce, that it is somewhat remarkable that, notwithstanding the knowledge which existed of the value of temperature in respect to fermentation, even indeed in reference to flax itself, it has only so comparatively recently been employed." [*]

In the Report of the Committee of the New York State Agricultural Society (Feb.1863) the following words occur: "It seems to us that our experimentalists have much neglected Mr. Schenck's method of steeping the flax in warm water at ninety degrees, with Mr. Pownall's improvements in exposing the steeped straw to the pressure of a pair of smooth iron cylinders, while at the same time a stream of water is made to flow upon the rollers, so as to wash away the softened organic matters which adhere to it." Numerous other processes for separating the fibre have been invented and to a small extent practised, but they are not suitable to Canada.

Flax-Cotton.

The process for the manufacture of flax-cotton which some years ago excited so much attention in connection with the name of the unfortunate M. Claussen, although previously discovered by Lady Moira, in 1775, failed on account of the attempt to obtain uniformity in the length of the fibre by the simple process of cutting, which had the effect of leaving rough or "stumpy" ends, which so impaired the quality of fabrics made from the so called flax-cotton as to prove fatal to the success of the process. Nevertheless, well founded expectations are entertained that flax cotton is no idle dream, and that a process will soon be developed for obtaining this result. Indeed so confident are persons interested in the cultivation of flax in the ultimate success of the project, that the United States Commissioner of the Census states in his report published in 1862, that "the manufacture of fabrics from flax-cotton has been commenced and success in a new branch of industry is confidently expected."

Encouragement of Home Industry.

With respect then to the encouragement of the cultivation of flax in Canada it appears essential that the following steps require to be taken:

1. The annual importation and subsequent distribution under careful and responsible supervision of a certain amount of Riga Flax Seed.

2. The establishment of flax growing districts, in each of which a flax mill for the preparation of the fibre should be established and efficiently sustained.

3. The purchase from the farmer of crude flax straw by flax factors at the district mills.

The introduction of Schenck's improved process and the employment of Rowan's scutching machines.

It is not to be supposed that the purchase of flax straw, at the district mills, precludes the purchase of fibre prepared by the farmer by the steeping or dew-rotting process, it is rather to secure a certain market for flax-straw in suitable condition, and by the employment of Schenck's process, and Rowan's scutching machine to prepare an article for exportation which shall by the price it will command abroad encourage private enterprise to establish mills in all suitable localities.

It is suggested that any government aid which the Minister of Agriculture may be disposed to recommend should be placed at the disposal of the Boards of Agriculture for Upper and Lower Canada for the purpose of importing Riga Seed; also that handsome premiums be offered for a certain number of bales of flax, the produce of *district mills* either erected by private enterprise or joint stock companies, where crude straw would be purchased from the farmer and manufactured into merchantable fibre.

The experience of the past two years shows that the efforts which have been made in various parts of Upper and Lower Canada to encourage the cultivation of flax among our farmers is beginning to produce good results,[*] but before the introduction

---

[*] "Our Farm Crops."

[*] BRITISH AMERICAN LAND COMPANY,
Sherbrooke, C.E., 23rd June, 1863.

DEAR SIR,—I hasten to reply to your letter of the 20th instant just received.

I can give you no exact statistics, but a few words will convey to you what has been done, and is now doing, on the subject by our people.

Throughout Lower Canada, some years ago, every farmer—whether French Canadian in the Seignories, or English in the townships—grew more or less flax for domestic use. The French still continue the growth, for their own domestic manufacture, in small garden patches; but the practice was almost entirely discontinued in the townships when cotton goods took the place of the home-made linens to a great extent. The cultivation of flax is now being revived, but not for domestic use so much as for export to to England, Ireland, and the United States. The quantity grown has been as yet very small, but it is increasing rapidly, the only drawback being that the farmers are slow to be convinced that the market is likely to be permanent.

The townships of Eaton, Ascot, and Lingwick grew a small quantity last year. I have had the Eaton flax—which was dew-retted only—scutched by Rowan's machine, and have sent two sample bales home—one to Messrs. Marshall, of Leeds, the other to Belfast—to get a report as to quality, &c. The report from Messrs. Marshall is, on the whole, very favourable. I am, as yet, without any report from Belfast; but I believe they are spinning and making the flax into cloth, with the view of shewing its capabilities.

This year I have distributed about two hundred bushels of seed in the townships of Bury, Lingwick, and Eaton, and as the season is much more favourable than last year, I anticipate a very good result; I hope also to have this flax water-retted and not dew-retted.

of this most important plant as a farm crop becomes general throughout the country, the subject will have to be warmly entertained and discussed by the different agricultural societies, and measures taken to secure a market for the crude straw* besides circulating such information among farmers as will enable them to effect the water-rotting process in a satisfactory and profitable manner, if they prefer it, within easy reach of a scutching machine.

There are besides large experiments being made in flax in the Bedford District of the Eastern townships, including the counties of Shefford, Brome, and Missisquoi. In the village of St. Armand in the Bedford District, a woollen and flannel manufacturer, of the name of Lagrange, has purchased flax (some of that grown in Eaton) to mix with wool, and with a most satisfactory result.

The Eastern townships generally are exceedingly well adapted for flax growing. The soil of the valleys (intervale lands) is very fine, and the uplands are mostly of very good quality. We have generally more moisture than in Western Canada, although I fancy the Western farmers are generally more painstaking.

We possess very great facilities, not only for growth, but for the after preparation of flax, in the abundance of water for steeping, and water power for scutching and manufacture into linen.

I am dear Sir,
Yours faithfully,
R. W. HENNEKER.

Editor of the *British American Magazine.*

MONTREAL, August 10th, 1863.

DEAR SIR,—Absence from home for some time, and a pressure of engagements on the part of the writer since, have prevented an earlier acknowledgement of your much regarded favour of the 10th ult. We feel a deep interest in the culture of flax in this country, believing that, if properly developed, it may prove of very great value as a staple article of export and domestic manufacture. It has obviously this advantage over wheat, that it is not subject to the destructive attacks of insects and rust, which render the latter so precarious as a crop; nor does the market price of fibre and seed fluctuate so much as the cereals which have heretofore claimed the chief attention of the agriculturalist.

We are convinced that a general adoption on the part of our farmers of systematic drainage, deep cultivation, and rotation of crops with a considerable breadth devoted to flax, would render our agricultural interest extremely prosperous: and with its agriculture, every other species of industry would necessarily advance in a corresponding ratio.

With the view to promote the growth of flax and hemp, we imported a quantity of Riga flax seed and Piment hemp, for sowing which we supplied at cost. We have a sample before us of Riga flax grown this season in this vicinity, which measures forty-six inches. This description of hemp (piment) grows from ten to twelve feet in height.

We purchase from twenty-eight to thirty thousand bushels of flax-seed annually, which produces from fifty to sixty thousand gallons of oil and about five hundred tons of linseed-cake. The latter is mostly shipped to Great Britain, for cattle food. Our machinery *could work up a much larger quantity if the seed could be obtained.* This department of our works is idle for a portion of the year on account of the paucity of the raw material.

We enclose a copy of a circular which we printed last spring for circulation in the rural districts, and we shall be happy to supply any further information which we may have it in our power to contribute, to promote an object which we deem so important.

We are, very respectfully,
Your most obedient servants,
LYMANS, CLARK & CO.

Editor of the *British American.*

---

* In the State of New York last year, the average crop in Niagara County was one ton of straw and fourteen bushels of seed to the acre. The Lockport Flax-cotton Company contracted last year with the farmers of the neighbourhood for flax straw at $10 a ton. Flax seed is worth $1.50 a bushel.

THE PROVINCIAL EXHIBITION.

This year, the Exhibition at Kingston promises to show a considerable improvement in that department of the country's industry upon which its real progress in wealth and prosperity chiefly rests, namely, its manufactures. People are now learning to understand the true value of great manufacturing power. But it is not in Canada that the lesson has been learned: it has been suddenly and marvellously taught to all civilized nations during the past two or three years.

The general fact that manufacturing industry was one great source of England's superiority had been long acknowledged, but it was not accepted as a general truth that it was *the* great source of her present power until recent events disclosed, in an unexpected manner, the value of mechanical ability, both to conceive and to execute. Not only during the Crimean war, but more recently, the extraordinary capabilities of private manufacturing establishments, has been put to a very singular test. The fact is that England is fast becoming the workshop of the world for certain kinds of expensive and ponderous machinery, which require great establishments to complete. The United States have, also, made remarkable progress in this kind of industry, but are still far behind the United Kingdom.

M. Xavier Raymond has recently published a work on the navies of England and France, in which he has enumerated some remarkable instances of the resources and capabilities of private manufacturing establishments in Great Britain.

"The English, feeling dissatisfied with the part they had played in the Crimea, proposed to take their revenge in the Baltic. They wished to destroy Cronstadt, which they had had leisure to study during the two preceding campaigns. Whether their plan was good or bad we need not discuss here, but they conceived the idea of crushing or burning it under a shower of projectiles thrown from small craft, gunboats, and mortar vessels, to be built for that special service. For the construction of these small vessels recourse was had to private builders, and, amongst others, to the celebrated builder, Mr. Laird, M.P. for Birkenhead, where his building yard is situated on the Mersey, opposite Liverpool. It was the 25th of October when the plan of the first gunboat reached him, and when, consequently, he could only begin his work. On the 11th of the next November, the gunboat, fully fitted, except her engine, entered Portsmouth under sail. We don't know the tonnage of this vessel, but for the reader's information we may mention that these gunboats were of several classes, from 212 to 868 tons each: she must therefore, have been above 200 tons. After giving this proof of activity, Mr. Laird signed a contract with the Government authorizing him to build on plans supplied to him, and at prices agreed on, as many gunboats as possible until the day when notice should be given of terminating the contract. The Government, on its part, engaged to take until the contract was fulfilled whatever there should be in the yard. On this understanding Mr. Laird organised his works, where they laboured day and night with such effect that, when he received the order to stop work, he was delivering one vessel daily to Government." (P. 419.)

Extraordinary as was this feat of private enterprise, we are told that Messrs. Penn, of Greenwich, equalled it in the construction of the engines, turning out eighty between December and April, and thus enabling us to make the great Spithead demonstration in that month.

At this demonstration M. Raymond was present, and says:—

"We saw there 50 bomb vessels, all ready for service, 140 steam gunboats, completely armed, rigged, and stored, sailing, manœuvring and firing before 100,000 spectators. This was the creation of the last winter; it was the vanguard of the fleet which already possessed imposing reserves, and which could easily have been doubled within the year. It was also a great lesson to the world, which Lord Palmerston summed up in a significant sentence, when, on the following 8th of May, he said in the House of Commons, "We began the war (Feb. 1854) with 212 ships in commission, we had at its close (in March, 1856) 590."

At the present time, England is building iron-clad steam navies for Italy, Denmark, Russia, Spain, and many other countries, to say nothing of the Confederate States; all of these vast efforts of mechanical skill and enterprise are conducted by private firms. The real state of the case being simply this, that from Cornwall to Invernesshire, Great Britain is a vast machine-shop. Manufactures are the source of her power; agriculture holds only the second rank. Manufactures have made the empire what it is: the greatest, the most enlightened and powerful the world has ever seen. Wealth, manufactures and commerce are mainsprings of a successful and progressive nationality, and they are equally dependant one on the other, so that if a link in the chain shows signs of weakness, the stability of the system must be measured by the internal strength of that link.

In Canada we are taking slow but sure steps to give our manufacturing industry a chance to acquire the high position it is one day destined to possess. But here, as elsewhere, private enterprise is the mainspring, and will be, eventually, the chief source of our future means of developing the resources of the country with rapidity.

Already, we notice very considerable improvement; already, we find that the country is capable of taking a respectable position among manufacturing people, and but a very short time will elapse before we shall be able to throw out of our imports all the more common articles of daily consumption or necessity, and find home industry, skill and enterprise adequate to supply whatever is necessary for our comfort, and the preservation and extension of our civilization. The Kingston Exhibition, we hope, will afford positive proofs of the progress we know has been made throughout the country; and, although no one looks upon our annual gatherings as typifying the actual state of the country in all particulars, yet it is a good and safe guide from which much may be learned, if properly studied and appreciated.

STONE PAPER.*

Stone-paper is an invention of a Dr. Faxe, Com. of the Admiralty to the King of Sweden. It was Mr. Buscher, senior, who learned the method of manufacturing stone-paper, when residing with Dr. Faxe. The following are its most important characters, which will perhaps soon make it a valuable material for Canda:—

Solidity.

Stone-paper is, as the name indicates, made of pasteboard, in long stripes, three feet broad, and generally fifty feet long; but when required for special purposes it is made to any length.

It has the property of hardening when in contact with the air. This *hardening* is the consequence of the oxidation or formation into rosin of the oily substance which is necessary in the manufacture of the stone-paper, and it gives a faster connection with the mineral substances used during the process of manufacture, and with the coating of the Stone Paper, viz., sand, gravel, ashes, lime, and chalk. A well made roof of Stone Paper, which is kept properly in order (that is, by renewing the coating about every four years) will gain in hardness so that after some years it

---

[*] A roofing material, manufactured by Messrs. Buscher & Hoffmann at Neustadt, Eberswalde, near Berlin, Prussia, introduced by William Wagner, P.L.S. and Architect, 47 Alexander Street, Montreal.

will have the appearance and sound of sheet iron; yet it does not lose the flexibility which is necessary to its connection with wood.

This property makes the stone paper well adapted for roofing manufacturing establishments where much steam is employed: steam and vapor, which cause contraction and expansion of the wood, will not injure the durability of this new roofing material. Amongst many certificates which are in the hands of Messrs. Buscher & Hoffmann, it is sufficient to allude to those given by some engineers and the directors of the Magdebourgh Wittenberge Railway, who have used this stone-paper for covering their coke ovens.

A roof made in 1853 over a coke oven was in in October, 1856, that is, after four years nearly—according to the statement of Mr. Simons, chief engineer and manager of this railway—in very good order, although it had to suffer much from water vapors originated by cooling the coke.

The stone-paper has been used in cold and warm climates, and always with the same good results.

Nearly Fire-Proof.

This stone-paper has proved an excellent protection against fire, therefore we say it is *nearly* fireproof.

Different trials made by Royal authority in Prussia were so satisfactory, that, in consequence, by an order in Council, dated Berlin, 14 July, 1854, buildings covered with this material are to be taken in the same class as those covered with zinc, copper, &c., for insurance purposes.

We give now the result of these trials in the words of the engineer entrusted with them.

Our trials began with a heap of red hot coals about 1½ feet diameter, which was laid out on the roof.

After three minutes a few little flames became visible, originated by the freed tar gas, but after ten minutes they died out.

The fire was kept up during three quarters of an hour by an easterly breeze, but at last extinguished for want of fuel. The only effect of the fire was the carbonization of the paper without injuring the lining.

The second trial was made with a heap of 16 pieces of wood 1½ feet long, and about three inches thick. The heat of this fire, increased by a fresh breeze, was so intense, that to stand near the fire was an impossibility; and when the fire was out we found that the paper raised bubbles, likely created by the steam or vapour coming from the lining underneath, and carbonized the same. No injury was done to the lining itself.

We are confident that by such a heat tiles would break, and zinc would melt away. The fire was kept up 50 minutes and went out by itself.

The third trial was made with a well-kept up fire under the eaves, on the corner of the building against the wind, and after a few moments the whole woodwork was one blaze. After eleven minutes the lining was burnt about half an inch, and ofter one hour and forty-five minutes a large opening was made in the wall and the lining totally burnt; yet the stone-paper kept good, and saved the spreading of the fire.

A certificate of Major Ahrens, director of the Lubeck Fire Insurance Company, states as follows:—

"On the 1st Sept., 1851, at 10 p.m., a spirit distillery got on fire. It was impossible to save the main building, which contained a large quantity of high wines, but next to the main building and about half its height was the engine-house, also covered with stone-paper. During the fire, burning timber fell upon this roof, and not long after a new fire commenced here again. After twenty minutes the fire was extinguished, and when removing the remainder carefully away, we found that the place where the fire had been was more or less injured, and the lining commenced to be carbonized; but at the edges of the hearth of this fire, the stone-paper was hard and only partially carbonized. Therefore, the Director of this Insurance Company gives it as his opinion that this stone-paper covering is as good as all metal roofs, if not to be preferred. It is of great importance for the firemen that the stone-paper by its density keeps the fire inside, and the chances of extinguishing it are greater than by any other roofing material. Finally, we must say, that by houses covered with stone-paper, the firemen, in executing their duty, are not so liable to injury and accident as is the case by metal or tile or slate roofs.

"By order of Major Ahrens, Director of the Lubeck Fire Insurance Company.

(Signed) "ALPHONS PLESSING,
"*Dr. Sec. to the Co.*"

"LUBECK, 12 Dec., 1859.

Again; at a fire at Alt Staednitz, which commenced in a barn 150 feet long, 45 feet deep, and in its posts 23 feet high, filled up two-thirds with straw and unthrashed rye, this stone-paper covering kept the fire inside for *seven hours*, and as soon as the fire broke through the roof, the rafters, etc., fell down, and it was extinguished without the help of an engine; this is certainly a good proof for security against the spread of fire.

The price of this stone-paper is one penny sterling per square foot at Berlin, and costs in Montreal, including duty, three cents.

Messrs. Buscher & Hoffmannn have received the exhibitors' premium at the last great Exhibition in London for their stone-paper.

◆

COTÉ ST. PAUL—ITS MANUFACTURES.

The village of Coté St. Paul is situated on the Island of Montreal, on the south side of the Lachine Canal, about three miles from the city.

From the facilities afforded by the canal for furnishing cheap means of transport and unfailing water power, this village bids fair to become an important manufacturing centre. We copy from the *Montreal Transcript* a description of several manufactories already established.

"About the year 1852, Mr. Parkyn, engineer of this city, purchased a property there, having a frontage of 3,400 feet upon the Lachine Canal, containing 110 arpents of land and extensive water power, with the idea of connecting manufacturing operations with a dry and wet dock for building and repairing vessels. It being impossible to carry out this plan on account of the line of canal of the water works, he constructed a splendid head race about 2,000 feet in length and 44 feet wide, at a cost of £2,000.

He also erected the following works: a Grist Mill with four run of stones, cost £2,000; Axe Factory, £1,500; Saw Mills, £3,000; three dwelling houses, £600. The discharge to the water power was about 12,000 inches, with nine feet four inches fall. The head race runs at the back of each of the various works, which, with one or two exceptions, may therefore be said to be on an island, having the canal in front of them. We must now take as condensed a survey as possible of the modern state of things, commencing with the first establishment.

Mr. Parkyn's Old Mill.—This we suppose is the one originally erected by him as a grist mill, although it is now a flouring mill with five run of stones, turning out 200 barrels per day, and employing 18 men and 4 millers. The store adjoining holds 20,000 bushels of grain. Both the store and the mill are comprised in a neat substantial brick building of two or three stories high.

Mr. J. J. Higgins Axe Factory.—This long established factory, adjoining Mr. Parkyn's old mill, is also a good brick building, and doubtless the one originally erected by that gentleman. It employs from 30 to 35 hands, and is capable of turning out from 3,000 to 5,000 dozen a year. The material mostly used is fine English Iron and the best quality of English Steel. The manufactured article is of excellent finish, and competes favourably with anything in the market. The machinery, which of course includes trip hammers, is driven by three centre discharge wheels.

Frothingham & Workman's Shovel and Scythe Factory.—These establishments occupy brick buildings forming two sides of a quadrangle.

The shovel Factory employs 20 hands turning out 3,500 dozen a year, of shovels, spades and grain scoops, of both steel and iron. The material is imported partly from Norway, and partly from England. The Shovel and Spade Handles are imported from the States, and there is now a capital opening for any one capable of carrying out this branch of the business, as they would be able to dispose of 3,500 dozen almost without moving them.

The Scythe Factory employs 25 men besides boys, and yearly turns out 3,500 doz. of Scythes and Hay Knives. Material, the best of Norway iron, and steel from Germany. In these two factories, there is a considerable division of labour; in the Shovel Factory, for instance, one man sees to the cutting of the shovels from iron or steel plates, another to fixing on the part that holds the handle, a third puts in the handles and so forth, till the finished article is completed.

J. & P. Dunn's Nail Factory employs 25 hands, and turns out 5 tons of nails per day, which range from ½ inch to 6 inches, adapted to various purposes. There are about 20 machines, 10 of which are self-acting. The combined heavy mass of moving machinery collected in the centre of the ground floor gives an idea of irresistible force. The iron is presented to the machines in strips just the width of the length of the intended nail, so that each motion of the shears snaps a nail off perfect in form. Up stairs we saw a machine making shoe nails of plate zinc, at the rate of a thousand a minute. The iron used is the product both of the English and Montreal rolling mills.

"**Mr. Parkyn's New Flouring Mill and Grain Store** is 125 ft. by 52 ft.; height of main building seven stories. The elevator in the centre rising to nine stories. The capacity of storage is 80,000 buhsels of grain, and 125 tons of bran. The mill is driven by five Tyler wheels, and is capable of turning out from 350 to 400 barrels a day. The hands employed are as follows: 6 millers, 12 laborers, 6 carters. The barrels are made, and the cooperage done by the firm of Paxton Brothers, whose large premises we shall shortly have occasion to discuss.

"This mill has been going about three weeks, and is fitted up with all modern improvements known to the trade; being erected by Thomas Springle, contractor and builder, at a cost, including machinery of from 35 to 40,000 dollars.

"**Mr. Gawen Gilmore's Auger Factory** has been established seven years, and employs 13 hands. This gentleman manufactures all sorts of augers and brace and bits, including aqueduct augers, ship carpenter's augers, and a new style of auger called 'single twist;' he is also bringing out an improved boring machine for carpenters. In common with those used in the other hardware establishments, the forging hammers are all driven by water-power. The most difficult part of the auger to form is the small screw at the end, which in the first place is beaten out by hand, the worm of the screw being afterwards formed by a machine. The goods we saw appeared to be accurately finished and are manufactured only for the wholesale trade.

"**Clark, Watrous & Co.'s Bell Manufactory** is somewhat of a novelty, nor has it been very long established. They manufacture all sorts of bells, with the exception of *church bells*, confining themselves at present, however, to the manufacture of the different kinds of sleigh and house bells, of the varieties of which they have a long published list. They employ from 8 to 12 hands. Some of the tin-plated sleigh bells shown to us might easily have been mistaken for silver-plated.

"*Jacob DeWitt* has also an establishment here for cleansing and preparing skins used in the manufacture of gloves and mittens by water-power, previous to their being finished at his establishment at St. Gabriels Locks.

"There is also a large saw mill not at present in use.

"PAXTON (BROTHERS) BARREL FACTORY is one of the largest, most novel, and interesting of the manufactories at Coté St. Paul. It is situated at the furthest extremity of the village, occupying with its various appurtenances about 4 acres of land, and employing about 80 hands. The material is received in a raw state, in the shape of rafts of timber, which come down the canal, and consists of Elm, Ash, Soft Maple and Pine, the consumption of which is 150,000 cubic feet annually, besides 150,000 hoop poles (unsplit) and from 6 to 700,000 flat hoops. All this raw material is worked up by a continuous process, which with scarcely an exception, is beautifully and accurately carried out by machinery. To give a general idea, we may say that a saw log is drawn out of the basin by machinery, sawn into thick planks, subdivided into blocks, of the size for staves or heads, as the case may be, and afterwards cut and sliced up by other machines into the staves or heads themselves; so that by this arrangement all waste of material is prevented and the utmost economy secured.

"The Factory is, however, divided into two departments, one for nail kegs and the other for flour barrels.

"*The Nail Keg Shop* contains 16 hands, which turn out 700 kegs a day. The keg staves are sawn by a self acting machine, into which a block of the requisite length is fixed; the cutting apparatus has simply the appearance of a steel keg with a saw edge which, being exactly modelled, cuts the staves with the uniform bend required, so that after leaving the machine they are ready to put together. A man can cut 6,000 staves a-day. In addition to a stave cutting machine, there is also one for heads, which we were informed was the invention of Mr. Samuel Jennings, for which he received a Bronze Medal at one of the Provincial Exhibitions. As it is very effective and simple we shall describe it. The main idea is that of an iron disc revolving in a diagonal position, against a cutter; on this disc, as it revolves the pieces intended for heads are fitted by the hand in a continuous stream from a pile on one side the operator, while a boy on the other receives each piece as it falls from the disc, cut in a regular segment and having a proper bevel, or thin edge to fit into the nick in the staves of the keg. This is of course given by the '*slantingdicular*' position of the revolving disc. As fast as the heads are cut, they are piled up in regular order ready for the cooper, and a man with one of these machines will cut 400 pair of heads per day. By these machines, of which there are two, Messrs. Paxton not only supply their own shops, with heads, but most of the coopers in town.

"Having now got our keg staves and heads made by machinery, let us go to the cooperage and see how rapidly they can be put together. The first operation is to build the keg by putting the staves on end inside an iron hoop; if one stave won't fit another will, and when this is effected the iron hoop is forced down tight; the other end is served in the same way. In a trice the cooper has a slight unbarked wooden hoop nicked and fitted on the keg, then another and another. The head being fitted in two more are put on each end, and in the time the reader has taken to peruse this a complete keg is made and rolling along the floor. A keg was put together for our special instruction in four minutes and a half, and had the conditions been more favourable, the time would even have been less. A gifted hand, we were assured, would make eighty of these kegs a-day. In Messrs. Dunn's Nail Factory we had afterwards an opportunity of testing the machine made article with those made by hand; the former 'bearing away the bell' at every point; both in strength, lightness, and symmetry of form.

"Before proceeding further, we may mention that there are two drying kilns on the premises, one for staves and another for heads; so that the various parts being thoroughly dried there is no shrinking in the finished article.

"*The Barrel Shops* contains 25 men who average each 15 barrels a-day; smart hands making 20. The staves are not sawn as in the former case, but cut by an American stave-cutting machine which slices up a tough block of wood as if it was a turnip.

"The flour barrel is altogether a more aristocratic party, than its fellow the humble nail keg; its staves are more accurately cut and smoothed, and it is bound together by neat flat hoops, which, however, are not half so strong as those which are round and unbarked. Its education is more gradually and carefully conducted, and it often finishes up with a European tour. The staves of the barrel are not forced together by iron hoops like those of the keg, but thick wooden hoops are used as presenting more surface to the driving tool. The staves being cut perfectly straight, when put together in a barrel, they have to be fired to make them retain the bend they receive from compression. The old plan of doing this was by burning chips or shavings inside the barrel, which by blackening the staves often rendered them unfit for contact with the flour. Messrs. Paxton have, however, invented a conical stove, something like an iron sugar loaf, the surface of which is heated by a peculiar arrangement of the draught. Over this the barrel, as yet having no ends, is placed, the top being fitted with an iron cover, which keeps the heat in; a few minutes being sufficient to make the inside of the barrel a tolerably "warm shop." Two of these stoves are sufficient to heat all the barrels made in the establishment. In winter Messrs. Paxton also use a boiler for softening the wooden hoops.

"We have now described as accurately as possible the details of Messrs. Paxton's establishment; we believe soon after they commenced in a small way, they were burnt out, but that every year since their business has doubled, so that they had to run up buildings as they could, without regard to any labour or time saving arrangement. We have been given to understand that their next effort will be to condense their works, and it is possible, that ere long, new buildings will replace the old ones. At present, the extent of their business could only be guessed at by the space occupied by the various wooden sheds, and the piles of material about the premises, while underfoot, the ground is one mass of *debris* consisting of broken hoops, chips and shavings. One striking feature is a large barn wherein are stored many thousand barrels, which acts as a sort of barrel reservoir, to supply the demand in the busy season, which the factory alone would be unable to do.

"Besides the hands employed in the various shops, there are about 40 others engaged about the premises. The machinery is driven by two Tyler wheels.

"MR. THOMAS LUNN, WALKING STICK MANUFACTURER.—Last, though not least, is Mr. Lunn's establishment for the manufacture of Walking Sticks of every kind, from the first class Hickory down to the commonest. We can hardly call it a factory since he only employs two hands, notwithstanding which he believes he could supply all Canada. Mr. Lunn is in fact an original, and on gaining access to his premises, we find his workshop so barricaded within and without with fascines made of bundles of walking sticks, that we seriously doubt, even if red hot shot would reach him, or oblige him to '*cut his stick*' in any other manner save that of his lawful calling. The handles of the sticks are bent by steam and tied down with wythes; Mr. Lunn had over 500 dozen on hand in various stages, informing us it took two years to realize the profits, one year for seasoning, and the other for sale. His greatest grievance was the high price of varnish in the States, which he ascribed to the quantity used in getting up accounts of the war.

"Mr. Parkyn may be regarded as the father of this manufacturing colony, and one of the principal owners of the property as well as of the water power."

◆

Useful Table.

Contents of a tube of one inch diameter for any required height:

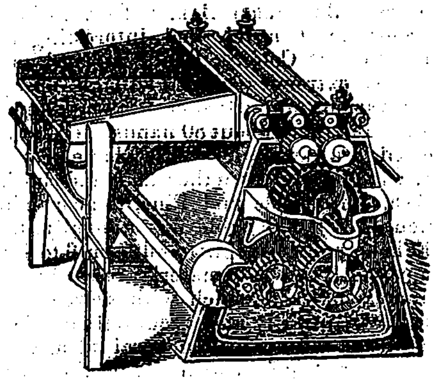
Feet high.	Cubic inches.	Water, weight in oz. avoirdupois.	Feet high.	Cubic inches.	Water, weight in oz. avoirdupois.
1	9·42	5·46	20	188·49	109·24
2	18·85	10·92	30	282·74	163·86
3	28·27	16·38	40	376·98	218·47
4	37·70	21·85	50	471·24	273·09
5	47·12	27·31	60	565·49	327·71
6	56·55	32·77	70	659·73	382·33
7	65·97	38·23	80	753·99	436·95
8	75·40	43·69	90	848·23	491·57
9	84·82	49·16	100	942·48	546·19
10	94 25	54·62	200	1884·96	1092·38

The pressure of a fluid against a surface, in a direction perpendicular to it, is as the area of the surface multiplied into the depth of its centre of gravity below the surface of the fluid, multiplied into the specific gravity of the fluid; and is = to the weight of a cylinder of the same fluid, the area of whose bottom = given surface, and altitude the depth of the centre of gravity: hence the pressure is entirely independent of the weight of the fluid. From this table the contents of tubes of any size may be easily ascertained; as a tube two inches in diameter contains five times the quantity of a one-inch tube, and so on for all sizes.

◆

PORTABLE FLAX AND HEMP DRESSER.

Patented in U. S., Sept. 16, 1862, *and April* 28, 1863.



Messrs. Sanford & Mallory have sent us the above illustration of their flax and hemp dresser, noticed at page 245 of this Journal. A machine capable of dressing 2,500 pounds of flax straw in ten hours, can be sold at the factory, ready for shipment, at $355; and the second size, capable of dressing 1,500 pounds of straw, at $255; a third size, capable of dressing from 600 to 800 pounds of straw per day, at $155. The smallest size weighs about 300 pounds, and can be run by hand; the largest size weighs not over 1,100 pounds, and occupies a space of only four feet square.

The machine can be seen in operation any day, at their rooms, corner of White and Centre Streets, New York.

The Suez Canal.

Mr. Hawkshaw's report to the Egyptian government on the Suez Canal has been printed, and is favourable to the scheme. When the late Viceroy of Egypt was in England last year, he requested Mr. Hawkshaw to visit Egypt and examine the site of the proposed canal, and report his opinion. Accordingly Mr. Hawkshaw proceeded to Egypt last October, and was occupied twenty-seven days in examining the district traversed by and adjacent to the canal, and of so much of Lower Egypt as appeared likely to throw light on the question under consideration. Mr. Hawkshaw is of opinion that "as regards the engineering construction there are no works on the canal presenting any unusual difficulty of execution, and there are no contingencies that he can conceive likely to arise that would introduce difficulties insurmountable by engineering skill;" and further, as regards the maintenance, he is of opinion that "no obstacles would be met with that would prevent the work, when completed, being maintained with ease and efficiency, and without the necessity of incurring any extraordinary or unusual yearly expenditure."

ALPHABETICAL LIST OF THE PRINCIPAL ENGLISH PUBLICATIONS FOR THE MONTH ENDING JULY 31.

Adams (W. H. D.) Famous Ships of the British Navy, fcap. 8vo	0	3	6	*Hogg.*
Alexander (Sir. Jas. E.) Salmon-Fishing in Canada, cr. 8vo, red to	0	8	6	*Bohn.*
Annual Register (The) for 1862 (Vol. 104), 8vo	0	18	0	*Rivingtons.*
Cambridge School Class Books: Todhunter (I.) Algebra for Beginners, 18mo	0	2	6	*Macmillan.*
Cassell's Handbook of Chess and Draughts, fcap. 8vo	0	1	0	*Cassell.*
Cooke (C.) Curiosities of Occult Literature, cr. 8vo	0	4	0	*A. Hall.*
Domenech (Abbé) Great Deserts of North America, 2 vols. 8vo, red. to	0	12	0	*Bohn.*
Draper (John Wm.) History of the Intellectual Development of Europe, roy. 8vo.	1	1	0	*Low.*
Fitzwygram (Lieut.-Col.) Notes on Shoeing Horses, 2nd edit., 8vo	0	7	6	*Smith & Elder.*
Heisch (Chas.) Elements of Photography, fcap. 8vo	0	1	0	*Murray & Heath.*
Index (An) to the Times, and to the Topics and Events of 1862, roy. 8vo	0	7	6	*Freeman.*
Kirkaldy (David) on Tensile Strength of Wrought Iron, &c., 2 edit., 8vo	0	18	0	*Simpkin.*
Lawson (Henry) Manual of Popular Physiology, fcap. 8vo	0	2	6	*Hardwicke.*
Lord (W. B.) Sea Fish and How to Catch them, 2nd edit., fcap. 8vo	0	1	6	*Bradbnry.*
Maling (E. A.) Flowers for Ornament and Decoration, new edit., fcap. 8vo	0	1	0	*Smith & Elder.*
———— Song Birds and How to Keep Them, new edit., fcap 8vo	0	1	0	*Smith & Elder.*
Miles (Wm.) Horse's Foot, and How to Keep it Sound, 9th edit., with Appendix, imp. 8vo	0	12	6	*Longman.*
Popular Science Review (The), edited by James Samuelson, Vol. 2, 8vo	0	12	0	*Hardwicke.*
Russell (C.) The Tannin Process, 2nd edit., fcap. 8vo	0	2	6	*Davies.*
Stephens (Jas. F.) Manual of British Coleoptera, or Beetles, Post 8vo, red to	0	7	6	*Bohn.*
Sullivan (Robert) Papers on Popular Education and School-keeping, fcap. 8vo	0	2	6	*Longman.*
Tate (Thos.) Treatise on the Higher Rules and Operations of Arithmetic, 12mo	0	8	6	*Bohn.*
Three Essays, Learning and Science, Science and Language, &c., 8vo	0	5	0	*Smith & Elder.*
Waterston (Wm.) Cyclopædia of Commerce, &c., new edit., with Supplement, 8vo.	0	16	0	*Bohn.*

BOOKS RECENTLY PUBLISHED IN THE UNITED STATES.

Disturnal (J.) The Great Lakes or Inland Seas of America; Rivers, Cities, Towns, &c., with Maps &c., 16 mo	$1 00.	*Chas. Scribner.*
Dole (F. C. de) Blues and Carmines of Indigo; a practical treatise on the fabrication of every commercial product derived from Indigo, 12 mo	2 50	*H. C. Baird.*
Isherwood (B. F., C. E. U. S. Navy) Experimental Researches in Steam Engineering; the whole being original matter composed of extensive experiments made by the U. S. Navy Department, Vol I., 4to, 27 plates, ½ mor.	10 00	*Wm. Hamilton.*
Ulrich (M. Louis) A Complete Treatise on the Art of Dyeing Cotton and Wool, as practised in Paris, Rouen, Mulhausen, and Germany, with Important Receipts, 12 mo	3 00.	*H. C. Baird.*
Whittlesey (C.) Ancient Mining on the Shores of Lake Superior, 4to		*Smith's Institute.*

Board of Arts and Manufactures

FOR UPPER CANADA.

THE NEW YORK COACH MAKERS' MONTHLY MAGAZINE.

Among those periodicals which represent special departments of trade, the *Coachmakers' Magazine* has long enjoyed a high position. It is an illustrated monthly, very well printed, and embellished with numerous engravings of coaches, sleighs, and in fact every kind of vehicle, and whatever pertains to the class of conveyances used on common roads, as distinguished from railroads.

The September number contains an excellent woodcut, on toned paper, of Canadian sleighs, after the design of Mr. C. F. Hall, of this city.

The Editor gives a description of his tour through Canada; and although he may be a most excellent coachmaker, it is clear that descriptive narrative is not his forte.

He devotes a long paragraph to a "trick played on us, which outdoes any thing charged to Yankeedom." What do our readers think this trick was? "The fare is one dollar, for which we offer a two-dollar Canadian bill. Instead of handing us change in kind, as we had a right to demand, we were put off with silver, because the tricky ticket vender—or his masters—could get 40 cents premium on the paper, by selling it." This is a sorry mistake on the part of our traveller. A single question from any one on the cars would have satisfied him that silver and Canadian paper were at par on this line, at the time; and the greatest difference, even in Toronto, has been 8 per cent. on American silver. But as for selling Canadian paper money in Canada at 40 per cent. premium is simply nonsense, and such a statement should not have appeared in print.

The American rebellion is, according to our traveller, ruining the business prospects of Upper Canada. We shall see.

THE SCIENCE OF COLOUR.—SCARLET AND GREY.

It has been found, while firing at the running-man target at Wimbledon, which is scarlet on one side and grey on the other, that the scarlet dazzles the eye, and is hence the most difficult to hit, from leaving a red streak behind it, in its advance, which unsettles the aim. The grey side was struck 74 times, and the red only 42 times. It is a curious fact, too, it seems, that those with grey eyes hit fairer than those with eyes of other colors.

British Patents.

ABRIDGED SPECIFICATIONS OF BRITISH PATENTS.

(From the Mechanics' Magazine.)

3363. R. **Schomburg** and A. **Baldamus**. *Improvements applicable to all kinds of oils used for illuminating purposes, whereby combustion thereof is rendered more perfect, smoke prevented, and the purity of the light increased.* Dated December 16, 1862.

This invention consists in leading the vapour from water to all kinds of oils while burning in lamps, whereby combustion is rendered more perfect and the purity of the light increased. The heat generated when the wick is lighted causes the vapour of water to ascend in a hollow cone or conical chamber round the wick-tube, and issue in contact with the flame about or above the point of its generation. A thin film rises from the water vessel up a narrow channel or space between two cones or conical caps with apertures through or between which the flame passes. The water vessel is by preference surrounded by another vessel or chamber between which a passage is formed through which air passes to the flame.

3443. E. **Stevens**. *Improvements in machinery for preparing dough, and paste suitable for making bread, biscuits, pastry, cakes, and similar articles.* Dated December 24, 1862.

For the purposes of this invention, the patentee employs a mixing vessel, made by preference of sheet metal, galvanized or enamelled, or cast iron may be employed. The vessel is mounted on wheels, so that it can readily be moved from place to place. One of these wheels is a pivot wheel, and has a handle connected with it, by means of which the vessel can be drawn from place to place and readily guided. The bottom of the mixing vessel is made semicircular interiorly, and double, to contain in the space between the two parts warm water to facilitate fermentation. It should be fitted with a guage and thermometer. In place of using water to warm the mixing vessel, it may be warmed by steam, hot air, or otherwise. In hot climates the mixing vessel will need to be cooled in place of heated. In addition to this mixing vessel he employs a fixed frame, consisting of a bed plate and two standards suitably tied together, and of such a distance apart as to receive the mixing vessel betwen them, and suitable turn buttons or clamps are provided for securing the mixing vessel in this position. To effect the mixing of the dough or paste when the materials have been placed in the mixing vessel, a horizontal cranked axis or bar, with inclined toothed stirrers upon it, is employed. The toothed stirrers may be made either round or rectangular in cross section, and may be much varied in form. The cranked axis or bar is of such a length as to be able to be placed in the mixing vessel, and it is of such a form that, when caused to revolve, it passes just clear of the sides and bottom of the mixing vessel.

44. J. **Leigh**. *Improvements in the treatment of gas produced by the distillation of coal, cannel, bituminous shale, boghead, mineral oils, petroleum, or other combustible substances, and for the obtaining certain products therefrom.* Dated January 6, 1863.

This invention consists in the subjection of the gas that is obtained in the distillation of coal, cannel, bituminous shale, boghead, mineral oils, petroleum, or other combustible substances to the action of nitric acid, or of a mixture of nitric and sulphuric acids, by which nitrobenzole and certain other compounds are obtained, and in the course of which certain substances are removed from the gas employed.

50. G. **Turner**. *Making leather from waste pieces of leather.* Dated January 6, 1863.

In carrying out this invention, leather cuttings or parings, or other waste pieces of leather or skin, are first converted into pulp by any of the processes already known. This pulp—which may then be washed or left unwashed—is thereupon digested in warm water in suitable vessels. When it is sufficiently digested, the pulp is treated with a caustic akaline solution, such as is formed by the oxides of alkaline metals, the alkaline earths, the hydrates of such oxides, the subcarbonates of these, or other substances having an alkaline reaction. If desired, animal or vegetable gelatinous matter may be added to, and digested with the pulp. After the pulp, with or without the addition of animal or vegetable gelatinous matter, has been treated with the caustic alkaline solution, it is pressed or rolled into sheets or bands of the desired thickness. These sheets or bands are then immersed in tan liquor, or other acid astringent solution, which arrests the action of the alkali, combines with the organic matter dissolved by the alkali, and converts the gelatinous matter into tannate of gelatine.

Selected Articles.

A FEW REMARKS ON BLEACHING POWDER.

BY MURRAY THOMSON, M.D., F.R.S.E.

This substance is so largely used in paper making, that it may form a subject of considerable interest to many. We have in the following paper treated the subject in such a way, that it will be simple and instructive to those who may be ignorant of chemistry.

This widely used substance, as many of our readers may know, was first prepared by Mr. John Tennant, the founder of the St. Rollox Works, Glasgow. And though it has now been in use for upwards of sixty years, it is still as highly esteemed as ever as a bleaching agent. At one time a difference of opinion existed as to what its active constituent was; but now most chemists believe its bleaching power to be due to hypochlorous acid, a compound of chlorine and oxygen. It may be regarded as a mixture of hypochlorite of lime, hydrate of lime, and chloride of calcium, but it is only the first-named substance which is available for bleaching. Another circumstance, not to be lost sight of in this view of the composition of bleaching powder, is that hypochlorous acid is destructive of colour, not only on account of the chlorine it contains, but also on account of its oxygen. Indeed it is estimated that this acid has a bleaching power twice as great as the elementary gas chlorine itself. To understand this, our readers should remember that before chlorine and its compounds were employed to effect bleaching, the oxygen of the air, in one or other of its forms, aided by the sunlight and moisture, were the agents used to destroy colour. Keeping this in mind, it is now not difficult to see how a compound like hypochlorous acid should be more energetic as a bleacher, than either of its constituents separately. The method of the action of hypochlorous acid may be, perhaps, best understood by saying that its elements, the chlorine and the oxygen, are apt to separate from each other. The tie that keeps them together as a compound is a feeble one, and once unloosed, they are not only free to combine with other substances, but in a state of greater inclination to do so. They are in what the technical language of the chemist calls the *nascent* state. And when in this condition, they are presented to compounds that they can combine with, such as colouring matter, they readily unite, and a new, but now colourless substance, is the result.

But although it be true that bleaching powder owes its efficacy to both chlorine and oxygen, it is not necessary in estimating its value, to take into account anything more than the amount of chlorine present; because the more of it the sample contains, the more oxygen will it also contain, and its bleaching power will be the greater; and if these follow by equal steps, it is sufficient to know the amount of either elements;—and as it is the easiest to ascertain the amount of chlorine, it is always chosen as the element to operate on.

Moreover, as the processes used in estimating the strength of bleaching powder bring the functions of the chlorine into play, much in the same way as these are exercised in the act of bleaching, it is clear that we have in these processes a complete index to the purity on the one hand, or sophistication on the other, of any sample of bleaching powder.

The processes which have been recommended from time to time for estimating the strength of chloride of lime, are nearly equal in point of accuracy, but they are not all equally easy of performance. The method which we would recommend the papermaker to adopt is one which, with a little care and nicety in its execution, may be employed by almost any one, however little he may have been engaged in chemical pursuits.

The only instruments that need be provided are a small common balance which will turn with half a grain. The small beams and scales used by the apothecaries will answer quite well. The other instrument is a glass tube closed at one end and open at the other, this open end having a small spout. It may be about 8 inches long, and nearly 1 inch in diameter, and should hold, when filled to near its top, a little over two fluid ounces. There should be a mark about an inch from the top, and the space between this mark and the bottom should be divided into 100 equal divisions. Such graduated tubes may be bought from almost any optician or philosophical instrument maker, at a small cost.

The chemicals which are needed are very few, some tolerably clean crystals of green vitriol (sulphate of iron), some solution of red prussiate of potash (ferridcyanide of potassium) and some weak sulphuric acid.

Provided with these, we may now proceed to test the strength of any sample of bleaching powder in the following way:—78 grains of the green vitriol crystals are weighed out and dissolved in water, to which a drop or two of the weak sulphuric acid is subsequently added. While this solution is making in a tumbler or cup, 50 grains of the sample of bleaching powder are weighed out, and then thoroughly stirred up and mixed with water (this is best done with a small mortar and pestle), and then transferred to the graduated tube, and the mortar or other vessel in which the mixture has been made, is now washed, and the washings also added to the graduated tube until it is filled up to 0 or zero. A few drops of the solution of the red prussiate of potash are now sprinkled on a common white plate. If the crystals of sulphate of iron are now dissolved, then the mouth of the graduated tube should be closed with the palm of the hand, and its contents thoroughly shaken together, a creamy fluid being thus formed. This mixed-up fluid should now be transferred little by little to the vessel with the sulphate of iron solution. 30 or 40 measures may be added at once, but after this the additions should be smaller. The effect of adding the chloride of lime solution to that of the iron salt, is to throw down a red powder (sesquioxide of iron). If, after the first addition of chloride of lime solution be made to the iron, one drop of the mixed solutions be now withdrawn on the end of a glass rod and brought in contact with the drops of the red prussiate on the white plate, there will immediately be formed a dark blue precipitate (Prussian blue). This indicates that the iron solution has not had enough of the chloride; A further small addition of the solution of bleaching powder is now made. Another drop of the mixture is withdrawn and laid on the prussiate solution as before—if there is still a dark blue precipitate produced, a further addition of the chloride of lime is needed. During the process this solution should be shaken up. The estimation of the chlorine is known to be complete when a drop of the mixed solutions no longer gives a dark blue precipitate with the prussiate drops on the white plate, but gives, instead, a green colour with little or no precipitate. When, after cautious additions of the chloride solution, this point is reached, the number of measures which it has taken to effect the change are now read off from the graduated tube. A very simple calculation now follows, which is based on the fact that the portion of the 50 grains of the sample now used in oxidising the solution of iron (for it is a process of oxidation), contains exactly 10 grains of chlorine available for bleaching purposes. The first step in the calculation is to divide the number of measures now used by 2. The reason of this step is obvious: because, as the 50 grains of the sample were diffused through 100 measures, each measure corresponds to half a grain of the sample. The quotient of dividing by 2 will, therefore, give the number of grains of the sample, containing 10 grains of chlorine. This number is now made the first term in a simple proportion; 10 the second, and 100 the third; and the result of this calculation is the percentage of chlorine in the sample. If the steps in this simple calculation be reflected on as they are worked out, it will be seen that the several steps might be combined into this one formula. Divide 2,000 by the number of measure of chloride solution used. An example will now make it all clear. If, in any sample, it takes 70 measures to oxidise thoroughly the iron solution, the half of 70 is 35, and as 35 is to ten, so is 100; the answer is, 28·57 per cent. A result which would be more easily deduced by dividing 2,000 by 70; when, as before, 28·57 would be shown to be the percentage amount of available chlorine in the sample supposed.

Though a description of this really excellent and trustworthy process cannot be well condensed into fewer words, yet it must not be thought tedious in its execution; because four or five times trial of it, by way of practice, is enough to render one sufficiently expert to overtake the testing of half-a-dozen samples in an hour or two; and, we may add, that the information gained by the process must be coupled with the satisfaction of having performed it all oneself.—*Paper Trade Review.*

SHOEMAKING BY MACHINERY.

The employment of machinery in the manufacturing of boots and shoes is of but recent date, but it has effected a wonderful revolution in this important industrial art. On this subject the Lynn (Mass.) *Reporter* says:—

Comparatively few people are aware of the quiet but steady revolution that is going on in the buisness of shoemaking, and particular as that buisness is conducted in Lynn. Previous to the introduction of the original sewing machines, which are now universally used for the binding and stitching of the uppers, but little or no imrovement or even change had been made in the manufacture of shoes. The awl, the bristle, and thread, the lapstone and hammer, with plenty of "elbow-grease," were, as they had been for years, the main appliance of the shoemakers, and little was known or thought of labour saving machinery. After a time woman's nimble fingers were found inadequate to the demand and sewing machines soon transformed the old-fashioned "shoe-binders" into a new and more expansive class of "machine girls" whose capacity for labour was only limited by the capabilities of "machine girls" whose capacity for labour was only limited by the capabilities of the machines over which they presided. Iron and steel came to the aid of wearied fingers and weakened eyes. This was the beginning of the new era, which is destined to produce results big with lasting benefit to our flourishing city.

It is scarcely ten years since the first introduction of machinery of any kind into the manufacture of shoes in this city. Everything was done by hand even to the cutting out of the soles, which was a slow process and required the expenditure of a large amount of physical force. The introduction of sole-cutting and stripping machines, although sparingly, was the first indication that a change was to take place in the business of shoemaking; but no one, even ten years ago, would dare to have prophesied that the change was to be so immediate and so great. The rapid progress that has been made during that time, and especially within the last year or two, in the introduction of machinery in shoemaking has been beyond all previous calculation. It may almost be said that hand-work has already become the exception, and machinery the rule. The little shoemaker's shop and the shoemaker's bench are passing rapidly away, soon to be known among us no more; and the immense factory, with its labouring steam-engine and its busy hum of whirling wheels, is rising up in their place, to change the whole face of things in this ancient and honoured metropolis of the "workers in the gentle craft of leather."

The problem as to how best to bring in and concentrate the vast army of men and women employed in the shoe manufacture of Lynn is one that has attracted the attention of many thinking minds among our business men, but it has never been satisfactorily solved until now. Machinery, and particularly the sewing machine, has done in a few short months what years of theorizing and speculation could not do. It has demonstrated that the factory system can be successfully and profitably introduced into the shoe business; in fact, that, with the rapid strides which the business has made within a few years, it is the only system that can be made available for its successful application in future. Of course the new system is yet in its infancy—the business is yet in a transition state; but the wheels of revolution are moving rapidly, and they never move backward. Operatives are pouring in as fast as room can be made for them; buildings for "shoe factories" are going up in every direction; the hum of machinery is heard on every hand; old things are passing away, and all things are becoming new. Could the disembodied spirits of some of our old-time inhabitants visit the scenes of earth once more, how great would be their astonishment at the change which has taken and is taking place in this once quiet town, which claimed them as citizens!

THE MISSION OF BIRDS.

Mr. Paull, in rising to move the second reading of "the Poisoned Grain Prohibition Bill," said that the mission of birds was of the utmost utility, and that their destruction was exceedingly injurious, both to vegetation and to agriculture. He trusted also to be able to prove that the means used by some persons to destroy small birds by poisoning seed wheat, &c., was highly dangerous to society at large. The value of small birds to the agriculturist was well understood in France and Germany, where a war of extermination had been too long carried on. In France, in consequence of petitions from the agriculturists, the French Senate appointed a commission to inquire into the utility of small birds and the danger of destroying them. The commission instituted a minute and scientific inquiry, and made a report to the French Senate, which occupied from 30 to 40 octavo pages. In Germany, also, inquiries were made, which showed the great injury caused to vegetation by the extermination of birds. He would first show, as briefly as possible, how enormous was the increase of insect life in countries where birds were exterminated, and at what cost steps were then taken to reduce the amount of insect life. He would then point out the means which he proposed to take for the preservation of small birds. It was not his intention to interfere with the Game Laws, or to make them more stringent. It was solely in the interest of the farmers themselves, and of agriculture, that he asked the House to prevent the indiscriminate slaughter of birds not now protected by law. (Hear, hear.) In the report presented by the French Commission in 1861, it was stated that in the vine-growing communes and in France, during 10 years, (1828-37) the loss from the ravages of the caterpillar was estimated at 852,000*l.* The value of the cereals destroyed in only one of the eastern departments of France in a single year was estimated at 16,000*l.* An interesting article on destructive insects and the immense utility of birds appeared in the *Journal of the Royal Agricultural Society*, vol. xxiii, published last year. This article contained extracts from a work by M. Tschudi, President of the Agricultural Society of Canton St. Gall, Switzerland, in which it was stated that some of the Governments of Germany expended several thousand thalers for the destruction of caterpillars. In one year an area of 860 acres of fir forest was entirely stripped of its leaves by the caterpillars of the *Noctuæ*, and the Government paid more than 1,000 thalers for the destruction of 94,000,000 of the above dangerous insects. In Franconia, the caterpillars, during 1839, devoured the produce of 2,200 acres of Government forest. A calculation had been made of the different orders of birds—viz., those which were insectivorous and those which consumed grain and vegetables. In Germany and Switzerland—and the calculation would apply to England—there were about 150 species, and only only one-twelfth of the number were purely granivorous. All the rest consumed insects. He had now shown the great increase of insect life where birds were destroyed. The destruction of small birds abroad was much to be lamented. In one day in Lombardy, 15,000 birds were captured, and in one district, on the shores of the Lago Maggiore, between 60,000 and 70,000 small birds are annually destroyed. It might be said that English sportsmen were not addicted to the destruction of small birds like the sportsmen of other countries. (Hear, hear.) At the same time the destruction of small birds was going on at a very alarming rate in this country. (Hear.) A country clergyman stated that a birdcatcher estimated that 13,848 goldfinches were annually sent from Worthing alone. He had received letters from various parts of the country complaining of the great destruction of birds that was going on, and the injury caused to gardens from this cause. Some years ago in Hampshire a war of extermination was waged against them, and rookeries were destroyed. The natural consequence soon showed itself in such an increase of various hurtful insects, and especially of the cockchafer (which is three years in the grub state, and all that time does an immense amount of injury to the roots of grass and corn) that women and children were obliged to follow the plough to pick up these grubs, which the rooks would have devoured had they not been murdered. This practical proof of the utility opened the eyes of the Hampshire farmers, and rookeries were again established, and rooks protected. The same thing happened in America, where one time the State offered rewards for their destruction, and in consequence, they so much decreased, and noxious insects so greatly increased, as to induce the State to offer a counter reward for their protection. Various letters had appeared in the public journals on this subject. Among them was one which stated that three or four sportsmen belonging to a single Sparrow Club had destroyed nearly 13,000 birds. Agriculturists had hitherto used some description of brine for destroying the ova and smut that might attach themselves to the seed of cereal crops in the course of growth. Of late years, however, a system of using poisoned wheat had been introduced. He need scarcely point out the danger of the indiscriminate sale of an article which would cause almost immediate death on the part of the animals eating it, and if those animals were good for food the analytical chemist would tell them it was impossible to say where the injury would stop.—*Times.*

THE REPUBLIC OF LIBERIA.

Liberia (the land of the free), on the west coast of Africa, is a place of refuge for those poor negroes who, not comfortably situated in their native country, have migrated from Virginia, Ohio, the Carolinas, Pennsylvania, Maryland, and other States of the Union. These negroes have been aided by the benevolence of the American Colonization Society, at Washington, to remove to the coast of Guinea, where, after undergoing a variety of hardships and afflictions incident to settling in a savage region, they have formed themselves into a respectable commonwealth, numbering some 500,000 souls, of whom about 484,000 are aboriginal inhabitants of the country, and about 16,000 Americo-Liberians. Their form of government is that of a Republic—having an elected President, and two houses (Senate and House of Representatives)—of the legislature. The Vice-President and President are elected for two years, the House of Representatives for two years, and the Senate for four years. There are 13 members of the Lower House and 8 of the Upper House; each county sending two members to the Senate. Hereafter, as the population augments, each 10,000 persons will be entitled to an additional representative. The Vice-President must be 35 years of age, and have real property of the value of 600 dollars; and, in the case of the absence or death of the President, he serves as President. He is also President of the Senate, which, in addition to being one of the branches of the Legislature, is a Council for the President of the Republic, he being required to submit treaties for ratification and appointments to public office for confirmation. The President must be 35 years of age, and have $600 of real property. The judicial power is vested in a supreme court, and such subordinate courts as the Legislature may from time to time establish.

Liberia is situated on that part of the coast of Guinea called the Grain Coast (most fertile in rice), having for its south-eastern boundary the San Pedro River, 78 miles east of Cape Palmas, and running along the coast to the mouth of the Shebar river, 125 miles north-west of Monrovia; it has about 600 miles of coast line, and extends back about 100 miles on an average, but with the facility of almost indefinite extension into the interior, the natives everywhere manifesting the greatest desire that treaties should be formed with them, so that the limits of the Republic may be extended over all the neighbouring districts.

The original settlers landed in Liberia and hoisted the American flag on the 25th April, 1822, at Cape Mesurado, where Monrovia, the capital, was established, and they continued under the fostering care of the American Colonization Society until the 24th day of August, 1847, 25 years, when they were proclaimed a free and independent State, with the sanction of the parent Society, and were regularly installed as the Republic of Liberia. England and France soon welcomed this small state into the family of nations by making treaties of amity, commerce, and navigation with her. These friendly examples being imitated by other powers, it follows that Liberia is acknowledged and has treaty relations with some of the most respectable States of the world situated in Europe and America. It is deeply to be regretted that the United States, the fatherland of the Liberians, has not yet acknowledged the young Republic. It is to be hoped that since the power has passed out of the hands of the pro-slavery party in America, that Liberian independence will soon be acknowledged by the 12th nation of the world. The little Republic of Africa will soon be acknowledged by the mighty Republic of America.

Liberia has every advantage of climate and of fertility of soil, and of variety of production, to make it a rich and powerful nation. Every species of tropical produce thrives in this country. Rice is abundant, and is cultivated on the high lands as well as on the low grounds near the coast. Indian corn, sweet potatoes, cassada or cassava root, beans, peas, water melons, pine apples, oranges, lemons, guavas, mangoes, plantains, bananas, pawpaws, tamarinds, pomegranates, and a great variety of other edibles, afford ample supplies for the tables of the inhabitants and for the demands of shipping. Among other articles which already yield valuable exports, or are likely soon to do so, are coffee, sugar, cotton, ginger, pepper, indigo, ground nuts, arrowroot, palm-oil, ivory, camwood, and other woods for dyeing purposes, as well as for ship and house building, &c. Nearly all these productions are indigenous in this country. The wild coffee tree may frequently be met with in the woods. It is the same species as that ordinarily reared in other parts of the world, but may be much improved by cultivation. Several of the inhabitants have applied themselves to this branch of agriculture, which may be carried on with smaller means than are required for the cultivation of sugar or cotton, though both of these articles, particularly sugar, have been produced with success. Liberia is already prepared to receive 7,000 or 8,000 American negroes per annum, and every year will give it increased ability to receive comfortably additional thousands, until 25,000 or 30,000 emigrants per annum will not be inconvenient. The United States has four millions of slaves, and half a million of free negroes. Liberia could receive all of these in the next 25 or 30 years with great advantage to both the American and the African Republics.

For political and judicial purposes, the Republic is divided into counties, which are further subdivided into townships. The counties are four in number, Montserrado, Grand Bassa, Sinoe, and Maryland. The townships are commonly about eight miles in extent. Each town is a corporation, its affairs being managed by officers chosen by the inhabitants. Courts of monthly and quarter sessions are held in each county. The civil business of the county is administered by the four superintendents appointed by the president, with the advice and consent of the senate. The county system of government is capable of indefinite extension over new districts of territory that may be acquired, giving all the advantages which local self-government affords to the inhabitants, added to the conservative and effective metropolitan governmental benefits of the central power of the entire republic. The system has thus far worked well, and it may be in time worthy of imitation by other countries, provided the experience of a few more generations shall prove its efficiency.

Monrovia, the capital of Liberia, so named after Mr. Monroe, the fifth President of the United States, a great friend to the settlement of Liberia, is beautiifully situated on Cape Mesurado, about 75 feet above the level of the Atlantic Ocean, in 6.19 North latitude, and 11 deg. West longitude, has a population of about 3,500 souls. Its position is most happy, having, by means of the Mesurado and Stockton, and the St. Paul's and the Junk rivers, the greatest facilities for navigable communication with the interior. Besides being the executive, judicial, and legislative seat of government, it is well furnished with schools, churches, missionaay establishments, a newspaper called the *Liberia Herald*—dating back to 1826—a college, and other evidences of advancing civilization and refinement.

The new college just completed is a magnificent edifice, situated on a most commanding site, on a 20 acre field for play-grounds granted by the Government, and is due to the liberality of the people of Boston, United States, who not only furnished the funds for the construction of the building, but have also presented a library, geological cabinet, and otherwise endowed it. The Government has also granted 4,000 acres of land, of which 1,000 acres are in each of the four counties of the Republic. This land will become valuable in the course of time, Mr. Ex-President Roberts, of Liberia, is the president of the college, and is a Professor of Jurisprudence and International Law. The Rev. S. Alexander Crummell, a graduate and M.A. of Queen's College, Cambridge, England, is a Professor of Moral and Intellectual Philosophy, the English language and its literature. The Rev. W. E. Blyden, a young man of great energy, talents, and usefulness, now the Principal of the Alexander High School for Boys, in

Monrovia, and an experienced teacher, is the Professor of Greek and Latin languages and their literature.

Sectarian principles are disregarded in Liberia, Mr. Roberts is a Wesleyan Methodist; Mr. Crummell is an Episcopalian; and Mr. Blyden a Presbyterian; and there is a prospect of their acting harmoniously together in the advancement of true religion, and the civilising influences of science and literature which may be expected to flow from the teaching of these excellent men. The greatest benefit to the rising generation is expected from this college, particularly as it will prevent the necessity of sending the youths to England and the United States for instruction. Measures are being taken for a superior education of girls, which has hitherto been neglected, to the injury of the State, for women, as mothers and sisters, exerting a great influence over society, particularly in attending to the youth of both sexes, are, when they are competent, the greatest social improvers. I hope some liberal Englishmen will emulate the liberality of the Bostonians towards the boy's college by supplying the means for the High School for girls at Monrovia, which should be liberally endowed and made as effectively useful as possible.

The inhabitants of Monrovia are great Sabbatarians, they go constantly to church, and so closely do they respect the Sabbath, that when Prince de Joinville, the captain of the French frigate *Belle Poule*, camd into their port on Sunday, and offered to salute the flag, it was declined, because of their unwillingness to have the Sabbath desecrated. So also when Captain Eden, of Her Majesty's ships, happened to arrive on Sunday morning, and communicated to the President that he wished to salute the Liberian flag, provided it would be returned, when he was informed that it could not be done on that day, being Sunday, but it would be returned on the following day (Monday). Captain Eden, being pressed for time, saluted on Sunday, with the understanding that the salute would be returned to the first English cruiser that should come into port.

It is the policy of the Liberian Government to induce American immigrants to settle in the interior—some fifteen, twenty, or thirty miles from the coast—where the surface of the country is undulating and hilly, and more healthy for those freshly arrived than the coast country. Carysburg, White Plains, and Clay Ashland—are some of these interior settlements from which good results have been experienced. When a new settlement is formed, it is customary for some five, six, seven, eight or ten families of the old residents of Monrovia, or other old towns, to accompany and guide the strangers, and indoctrinate them into the mysteries of their newly commencing Liberian life. This is a wise course. Each settler, on his arrival in the Republic, is entitled to draw a town lot, or plantation. If a town lot be drawn, he is required to build a house, of brick, stone, or other substantial materials, sufficient for the accomodation of all the family of the proprietor within two years, and he receives a fee simple deed. If a plantation be drawn, two acres must be cultivated within two years to get a fee simple deed. Every man may have a town lot, or five acres of farm land, together with two more for his wife, and one more for each child that may be with him, provided that no family shall have more than ten acres. Women, not having husbands, may each have a town lot, or two acres of farm land, on their own account, one acre on account of each child. Unmarried men of the age of 21, arriving from abroad, on taking the oath of allegiance, shall be entitled to draw a town lot or five acres of farm land the same as family men. There is a penalty of five dollars for cutting down palm trees, except by the fee simple proprietor. Each proprietor of farm lands must show his boundaries by erecting posts at the angles of the same.

The English is the mother tongue of the Liberians, and they are extending its use along the coast and into the interior. Nothing is more common than for the native chiefs and the head men and other important persons among the tribes within the jurisdiction of Liberia, and even far beyond, to place their sons at an early age for three four, or five years in the family of the Americo-Liberians expressly to learn English and to acquire civilised habits. Among the natives, to understand English is the greatest accomplishment and advantage; and with some of the coast tribes, a knowledge of English is beginning to be regarded as a necessary qualification for the ruling men of the chief towns. Our language has become the commercial medium of communication throughout not only the African Coast, but other parts of the world where ships and steamers carry the civilizing influence of commerce, and in time it will become universal.

There is no standing army, but all males between the ages of 16 and 50 are compelled to serve in the militia, except clergymen, judges, and a few other privileged persons. This force is well drilled, and has 1,500 muskets kindly presented by the present Emperor of the French, and it has proved itself to be eminently qualified to defend the country, and to make the government respected among all the neighbouring tribes and nations of the Coast of Guinea.

The navy consists of one vessel, a schooner of five guns, kindly presented by Her Majesty's Government, and of an advice boat, the steamer *Seth Grosvenor*. These vessels are most usefully employed in suppressing slave trade, and in acting as "Guarda Costa."

The revenue of the republic for the year ending the 30th of September, 1861, was 149,550,11 dollars. The expenditure was for same time 142,831,11 dollars.

A portion of the receipts and expenditure arose from the recaptured Africans landed at Liberia, and supported by the Government until they can be placed out to take care of themselves.

The Liberians are under great obligations to the British Government and British people for their kind regards and useful efforts to encourage and aid them in the great task of building up a negro nationality on the coast of Savage Guinea. The British Government were the first to acknowledge the independence of Liberia, were the first to present them with a small vessel-of-war to act as "Guarda Costa" and to aid in suppressing the slave trade, and have for many years done all in their power to countenance and foster the growth of this youthful state.

The American Liberians, in their Declaration of

Independence, use the following language to describe their fortunate change of circumstances by migrating from the United States to this new and improving country. They say:—"Liberia is already the happy home of thousands who were once doomed victims of oppression, and thus far our highest hopes have been realized. Our courts of justice are open equally to the stranger and the citizen for the redress of grievances and for the punishment of crime. Our numerous and well-attended schools attest our efforts and our desire for the improvement of our children. Our churches for the worship of our Creator, everywhere to be seen, bear testimony to our piety and to our acknowledgment of his providence. The native African, bowing down with us before the altar of the living God, declares that from us, feeble as we are, the light of Christianity has gone forth; while upon that curse of curses, the slave trade, a deadly blight has fallen as far as our influence extends. Therefore in the name of humanity, virtue, and religion—in the name of the Great God, our common Creator and our common Judge, we appeal to the nations of Christendom, and earnestly and respectfully ask of them that they will regard us with the sympathy and friendly consideration to which our condition entitle us, and will extend to us that comity which marks the friendly intercourse of civilised and independent communities."

Then follows the Constitution one section of which declares, "That there shall be no slavery within this Republic, nor shall any citizen or any person resident therein deal in slaves; either within or without its bounds either directly or indirectly."

RAIN.

We take the following article, which bears unmistakeable evidence of the authorship of Mr. Gerald Massey, from the *Daily Telegraph*:—

The Orientalism of the Scriptures lurks throughout them like the perfume of flowers; and, though Christendom has laid them on her heart these nineteen hundred years, she often admires their beauty, without catching all their fragrant force of meaning. Who feels, for example, without an effort of thought, the strength of that comparison where the Divine Teacher likens God's bounty to the falling showers, "He sendeth his rain upon the just and upon the unjust." The words strike the ear, but in this moist and watered West of ours convey little but a sense of equitable distribution for the favours of Providence. The rain to us is not so much an object of desire as the sunshine; of the first we are accustomed to receive and expect a rather overwhelming share; the last is far more frequently in our thoughts as something to be longed for, and accordingly it is the earlier part of the passage, "He maketh his sun to shine upon the evil and the good," which impresses an English mind more forcibly. Drought, indeed, and parched up pastures and corn fields languishing as they lately did for the refreshing shower, enable us at least, to appreciate the second comparison, but to know how it would come to an Eastern listener, we must remember what rain is in the East. We must picture to ourselves those arid and grassless plains where the simile was spoken; or such a scene as the land of the monsoon rains presents, when the season for their coming is over-due, and the yellow earth sickens with thirst. Slowly at last the heavy clouds, charged with the welcome water, roll up from seaward; the air grows sultry and still; the creatures of the grove and jungle keep their coverts, as if expectant like the surface of the soil; there is a hush over all things, as though nature herself were faint; till presently the lightening flashes and the thunder rattles, and down as if really from heaven and from the hand of God, comes the thick and fresh rain. Then there rises from the ground a cool and penetrating aroma, the scent of the dry soil saturated; the birds and beasts resume their activity; the green leaf and blade shoot as if by magic from what was just now yellow and lifeless stubble, and men go out to their seed sowing and husbandry. At such a time, when those welcome waters are seen to fall on all fields alike—for rich and poor, for great and small, for just and unjust—the Oriental can comprehend the passionless equity of Providence, and does comprehend it, though he thanks Indra, and not the Christian's God for the priceless boon. Or transfer imagination to the deck of the drifting ship, or the raft upon which castaways dying of thirst are striving to reach the land; when rain falls, and fills the spread sails, and restores life and hope—no matter whether the sufferers are cut-throats or honest men pirates or traders—must not the verse we have quoted have a meaning which we seldom give to it? Or picture those words recurring to the mind of a traveller or hunter who has stretched himself to die upon a plain all dry and glowing in the sunset, and who starts from his fainting-fit in the night to hear the cool drops pattering on the leaves, and in the morning sees the pools brimmed and the streams flowing. Not lightly was that emblem chosen to express the impartial goodness of Heaven, the emblem of the falling rain, which—like all the good gifts of nature, and unlike man—judges none but descends for the slave and for his tyrant; for the strong and for the weak; for him with many fields, and for him with one: for man and for beast sublimely indifferent except to benefit all. There are spots upon the map, indeed, like the Peruvian guano islands, and others in the Red Sea, where rain never falls; and there, perhaps more than anywhere, the truth and tenderness of that verse which resembles the bountifulness of Providence to the rain might be realised. Accursed lands they seem without it, even as some natures seem outlawed from the love of God.

What is this rain then? for there is no fear of spoiling the parable by curiosity as to the works of Him whose benevolence it teaches. They most affront the sentiment of religion who pretend that that which is innate to man, and so immortal, can be endangered by bold, searching, and fearless inquiry. It is as much the faculty and duty of man's intellect to seek, as of his heart to worship; and science must push her discoveries if she can to the very footstool of the Most High. To this question, then, what is the rain, "Some very curious and important replies have just been given, thanks to the courage and observation of our aeronauts—sailors with a new chart and a boundless ocean, whose logs have appeared from time to time in our columns. Mr. Glaisher and his companions recently made another scientific ascent, with the express purpose of studying the rain "in the place where it comes from." Their observations confirm very curiously the guesses which science had made upon the subject. The hitherto established theory may be briefly stated without invading any scientific province. The air is constantly charged with moisture in such quantities as can be maintained in suspension at its existing temperature. But the power of the atmosphere to hold moisture in suspension decreases more rapidly than the temperature; so that if two volumes of atmosphere of different temperatures meet and mix, the mean temperature produced will not serve to suspend the conjoined moisture. Hence vapour, or perhaps rain, is produced, and sinks to the earth, the more rapidly as the particles of moisture run together and grow in weight.

Starting in a rain-storm then, Mr. Glaisher ought to have found confluent currents of air up above, according to this theory; and he ought also to have passed from the region of large drops to that of small drops, and thence to mist, and cloud, if this view of the descent of rain were correct. Partly indeed it was already verified, for Dr. Heberden long ago found that the annual rainfall on the top of Westminster Abbey was little more than half of that in a garden at its foot—the rain drops borrowing all the difference from the lower and moister stratum; and subsequently the veteran aeronaut, Green, hastily noted the specific mode of formation. Mr. Glaisher had, then, to make a voyage of discovery in rain-land for confluent air-currents — for strata of rain-drops, and in connection with the theory of the cause of them, for a band of clouds above the overcast sky of a July afternoon. He found them one after another, just as surely as a sailor makes his ports when his compasses have been adjusted and his charts and look-out are good. On the ground the rain-drops were as large as fourpenny pieces upon his note-book, a little higher they merely dotted it like pin-points; higher still it was a Scotch mist, or wet fog; yet higher, the fog was dry; and at 3,500 feet the balloon was out of rain though it was falling on the earth. Above them even at that elevation, was the stratum of cloud which science, without ever having seen, had daringly predicted as always above "the overcast" of a rain-sky; and at the height of 1,100 feet in descending, the balloon was in a current of wind from one quarter, and the car in another from one nearly opposite—south-east and south-west respectively—in other words, the Columbus of the clouds had sailed into the eddy between the confluent currents of atmosphere which were mingling their temperatures, and thus disengaging some of their moisture for the behoof of the corn-fields and pic-nic parties below. We have the fear of the Royal Philosophical Society before our eyes, and dare not pursue in these columns a subject so tempting and full of interest. But when we signalise voyages of discovery, and justly welcome terrestrial Spekes and Grants, it will never do to pass over the courageous navigators who launch their silken ship upon the wind itself, and bring us out of the clouds secrets and assurances like these. It is not too much to say that we *know* more of "the rain" to-day, thanks to Mr. Glaisher, than all that past philosophy could tell us; for he has tracked this thin trickling Nile to its source in the internubilar lakes in the air. Nor, as we thus come nearer and nearer to His presence who "sendeth the rain," need any thought arise of lessened reverence. Beyond the rain—the currents of air; beyond them—the wild wind; beyond the wind—the heat; beyond the heat—the sun; beyond the sun—or were "the primal cause" removed ten times further back still beyond that—a Power we cannot fathom or define, the Eternal Mystery and Mercy, Omega of the alphabet of life as well as its Alpha.

LEATHER CLOTH.

The recent continuous increase in the price of leather has naturally directed the attention of practical chemists to the best methods of perfecting the imitations which, under the name of leather cloth, are now so largely used as substitutes for leather itself. The improvement in this branch of manufacture has been so steadily progressive that the original standard taken for imitation—the American leather cloth—has been long since surpassed, and it is, perhaps not too much to say that the art of making artificial leather has now attained a perfection which promises to make the imitation a better, and, though cheaper, a more valuable article than that which it imitates. Among the many new processes and inventions shown in the late Exhibition there was no lack of English representatives of this rising branch of manufacture striving to displace the American fabrics. Nearly all these, however, were too much like the Transatlantic article to be perfectly successful. With its merits they produced its grave defects—the liability of the varnish to crack, the colours to fade, and the material itself to wear out fast as compared with real leather. One series of specimens, however, in this class attracted a great deal of attention, though they failed to attract a medal. These specimens were shown by Mr. Szerelmey, a gentleman well known for his most curious chemical discoveries in hardening stone, wood, and paper, and up to the present time the most successful of all the many competitors for preserving the Houses of Parliament from further decay by indurating the surface of the stone with a fluid silica, which, it is asserted, renders the stone beneath perfectly indestructible. The leather cloth of Mr. Szermeley has, since then, grown in reputation till it now promises to become a most important manufacturing discovery, since while the cloth thus prepared possesses all the best attributes of leather in great strength and durability, it has other and special advantages of its own which even the advocates of the famous virtues of leather have never claimed for it—namely, complete impermeability to water, a flexibility and softness equal to a woollen fabric, and a cheapness which makes its cost scarcely one-third that of real leather. Thus, a good calf-skin costs from 10*s.* to 14*s.*, and yields leather for three or three and a half pairs of boots whereas six square feet of the calf-skin leather cloth yields materials for five or six pair of boots, and costs only about 4*s.* 6*d.* Such an important difference and saving as this ought to satisfy any inventor; but even more than this is claimed for the "pannonia" in its capability of being produced in any quantity at a few days' notice, and in sizes only limited by the size to which the fabric can be woven on which the composition is laid. The nucleus of a factory has been established at Clapham, where the leather is now made, and where a company is about to construct large works and carry on the manufacture on a most extensive scale. The fabric used in manufacture is entirely according to the kind of imitation leather wished to be turned out. Thus "moll" a very thick soft kind of cotton fabric made at Manchester, is preferred for calf-skin; fine calico or linen for waterproof material for macintoshes, siphonias, &c., as perfectly waterproof as india rubber itself; the alpaca, silk, cloth or common cotton for boots and shoes, bookbinding, harness, carriage furniture, and all the thousand purposes to which real leather is applied. What the composition of the pigment is which in a few hours changes common cotton into a substance like enamelled leather, and only to be distinguished from the real article by its non-liability to crack, and its greatly additional strength, is, of course, a strict trade secret. The mode of manufacture, however, is simple. The fabric to be converted into leather, silk, alpaca, or whatever it may be, of any length or width, is merely wound on rollers beneath a broad knife-blade, which, by its weight, presses in and equally distributes the pigment previously placed upon it. A hundred yards may thus be done in a single minute, and in the most simple application the whole manufacture begins and ends, except that three coats of the pigment are necessary to perfect the leather, and an interval of twenty-four hours must elapse between the application of each. During this period the sheets are carried to a drying-house heated to a temperature of 94 degrees, and where they are hung like oil-cloth, according to the order in which they arrive, the last comers displacing those which have completed their time and are ready for their second coat. Thus the manufacture never stops, and three days suffice to complete "hides" of any length or breadth to which fabrics can be woven. For imitations of morocco or other grained leathers the long sheets are simply passed, when finished, through iron rollers, which indent them in any pattern required. For enamelled leather the enamel is applied after the third coat, by hand labour, which, though slower, of course, than that of machinery, is, nevertheless, rapid enough to cover the sheet in a very short time. The enamel, when dry, is infinitely superior to any description of patent leather. It is, perhaps, scarcely necessary to state that the pigment which transforms the cotton into leather is capable of being tinted to any shade that may be wanted of red, green, brown, black, blue, yellow, &c., and that whatever are the ingredients of the composition no admixture of india rubber or gutta percha forms part of it, inasmuch as the leather cloth when complete, even when left folded and exposed to a considerable heat is entirely free from the tendency to stickiness, which has been the great objection to all waterproof materials.—*The Ironmonger.*

THE MAIN DRAINAGE OF LONDON

The Main Drainage works were visited on Saturday last by a large number of distinguished persons. The *Times* shortly describes Mr. Bazalgette's scheme in the following words;—This great plan may best be briefly described as consisting of three gigantic main tunnels or sewers on each side of the river. These completely devide underground London from west to east, and cutting all existing sewers at right angles, intercept their flow to the Thames, and carry every gallon of London sewage, under certain conditions, into the river on the north side below Barking, and on the south to near Erith. These main drains are called the high, middle, and low level sewers, according to the height of the localities which each respectively drains. The high level on the north side is about eight miles in length, and runs from Hamstead to Bow, being at its rise, only 4ft. 6in. in diameter, and thence increasing in circumference, as the waters of the sewers it intercepts require a wider course, to 5 ft., 6 ft., 7 ft. 10ft 6in., 11 ft. 6in., and at its termination, near Lea river, to 12 ft. 6 in., in diameter. This drain is entirely finished, and in full work. Its minimum fall is 2 ft. in the mile; its maximum at the beginning nearly 50 ft. a mile. It is laid at a depth of from 20 ft. to 56 ft. below the ground, and drains an area of fourteen square miles. The middle level, as being lower in the valley on the slope of which London is built, is laid at a greater depth, varying from 30 ft. to 36ft., and even more below the surface. This is nearly complete, and extends from Kensal Green to Bow. The low level will extend from Cremorne to Abbey Mills, on the marshes near Stratford. At Bow the low level waters will be raised by powerful engines at a pumping station to the junction of the high and middle level ducts, thence descending by their own gravity, through three tunnels to the main reservoir and final outfall below Barking. These three tunnels are each 9 ft. 6 in. diameter, and nearly four miles long. Great engineering difficulties existed in the construction of these main arteries, as, from the height at which they all meet it was necessary to take them above the level of the marshes leading to Barking. For a mile and a-half the embankment which encloses the three tunnels is carried on brick arches, the piers going 18 ft. below the surface, and being based on solid concrete. In the marshes at Barking the reservoir for the reception of the sewage of the north side is formed. This reservoir is a mile and a-half long by 100 ft. wide, and 21 ft. deep. It is made of this great length in proportion to width to allow of its being roofed with brick arches, which are again covered with earth to a considerable thickness, so that not the slighest smell or escape of miasma can take place. This is capable of containing more than three times the amount of sewage which can enter it whiles the pipes are shut, and thus, when all is complete, the works will not only be large enough to take off all London's sewage now, but its sewage when in London is double its present size. While the sewage is in the reservoir we have spoken of, it will be completely deodorised by an admixture of lime. When the tide is at its height the sluices which pass from the bottom of the reservoir far out into the bed of the river will be opened, and the whole allowed to flow away. It takes two hours thus to empty the reservoir, by which time the tide will be flowing down strongly, and will carry its very last gallon a distance of thirteen miles below Barking, which, being itself thirteen miles below London, will place the contents of the sewers, every twelve hours, twenty-six or more miles distant from the metropolis. Thus, instead of letling loose the rankest of this great city's abominations in the very midst of London, and leave it to stagnate, or still worse, to be agitated backwards and forwards in a small body of water, it will all be carried away a distance of thirteen miles, then deodorized, then suffered to escape into a body of water into which it now crawls and thus disinfected and dilated, so as to be without either taste or smell, swept still further down the stream, till every trace of it is lost. On the south side the three great sewer arteries are constructed on similar plans—the high level from Dulwich to Deptford; the middle from Clapham to Deptford; and the low level from Putney to Deptford. At this point is a pumping station, which raises the water from the low to the high level, whence it flows away through a 10 ft. tunnel to Crossness Point. One part of this tunnel, passing under Woolwich, is a mile and a half in length, without a single break, and driven at a depth of 80 ft. from the surface. At the outfall will be another pumping station, to lift the water to the reservoir. The southern reservoir is only five acres in extent; that on the north is 14. In the reservoir it will be deodorized and discharged in a similar way to that we have already described.

It was over these last named works, amid an inextricable labyrinth of culverts, arcades, chambers, and columns, that the visitors were conducted, first inspecting the channel for the overflow of storm water, next the two culverts, as large almost as railway tunnels, which carry the sewage to the east and west pumping stations. Before the entrance to the pumps are massive iron strainers, which keep out all the coarse refuse brought down the sewer, and which is afterwards dredged up by the filth-hoist into the filth chamber, which is flushed into the river at low water. The pumping-house is nearly finished, and the iron work of the engines begun. The pumping stations will each consist of an engine-house, containing ten boilers calculated to work up to 500-horse power nominal. This power working through eight pumps of 7 ft. diameter and 4 ft. stroke will daily raise 19,000,000 cubic ft. of sewage from 19 ft. below low water to the level of the outfall; but in case of necessity, the pumps can raise 25,000,000 ft, per day. The reservoir into which it will all flow is not yet finished, but when roofed in with brick will hold 20,000,000 gallons of sewage. After inspecting these works on Saturday the visitors were taken across the river to the Barking outfall, where the works are larger, simpler, and much more advanced for on the north the sewage is brought at such a a level as to discharge into the reservoir by its own gravitation. The reservoir here is far advanced, a great deal of it being roofed in, so that it will all be completed in a few months more. Close to this the contents of the high level sewer were turned on into the river direct, and not as they will in future flow, through the reservoir. The inspection of this murky Niagara of sewage, as it came tumbling down, seemed to be not at all unpleasant to members who are accustomed to legislate in hot weather on the banks of the largest sewer in the world—the Thames. After gazing on this unsavoury volume of dirt for some time, by way of an appetiser, the whole party returned to the great reservoir to lunch. In the afternoon visitors returned to town, having enjoyed an agreeable, and we may add, an instructive excursion.

The total strength of the three rows of intercepted sewers, the course of which we have sketched on each side of the river, will be fifty miles, and before all the works are completed 800,000 cubic yards of concrete will be consumed, upwards of 300,000,000 of bricks, and 4,000,000 cubic yards of earthwork.

HORIZONTAL ENGINES.

There is an unaccountable prejudice on the part of cotton spinners, corn millers and brewers, against horizontal steam-engines. This prejudice is derived from no experience, for engines of the kind in question have not been put upon anything like a sufficient trial in cotton mills, corn mills, or breweries. Nor is the objection founded in reason, for the balance of fact and argument is decidedly against beam engines. They are heavy and costly, require costly foundations, and occupy a great deal of room, and for all this they present no compensating advantages. In respect of weight, which is a tolerable index of cost, we may compare the non-condensing beam engine exhibited last year in the International Exhibition, by Messrs. Mirlees and Tait, with a horizontal engine of the same power, by the same makers, and intended for the same purpose, viz., driving a large sugar mill. The beam engine had a 22 in. cylinder and a 4 ft. 6 in. stroke, while the horizontal engine has a cylinder of the same diameter, with a stroke of 4 ft., making a somewhat greater number of revolutions with the same speed of piston and same total power. In the case of the beam engine, the bed plate weighed 7 tons 14 cwt., the 6 columns 5 tons 2 cwt., and the entablature 3 tons 5 cwt., making 16 tons 1 cwt. of framing. The bed plate of the horizontal engine weighs 4 tons 13 cwt., or but little more than one-fourth as much, while its actual stability is even then greater than that of the other arrangement of framing. The working beam of the beam engine weighed 2 tons 5 cwt., the whole of which is saved in the horizontal engine. The cylinder of the beam engine being supported upon its end, and being, also, 6 in. longer, weighed 17 cwt. more than that of the horizontal, which, with covers, weighs 1 ton 13 cwt. The 20 ft. fly wheel of the horizontal engine weighs 9 tons; that of the beam engine, working slower, weighing 13½ tons, altho' we cannot charge any difference in this respect to the mere arrangement. The whole weight of the beam engine was 44 tons 9 cwt., while that of the horizontal engine is less than 20 tons. The excess of weight fairly attributable to the beam arrangement may be set down as at least 15 tons, and the proportionate cost may be pretty correctly inferred from this difference alone. The difference in the space occupied would be chiefly one of height, which in this case would not perhaps be of great consequence. With a still larger single cylinder engine, the beam would occupy from 2000 to 4000 cubic feet more space than the horizontal. The difference in foundations is also against the beam. The supposed advantages of the beam engine are, that the cylinder and piston wear better, and that the parallel motion may be more conveniently applied, and thus economise power supposed to be wasted in friction on the guides of a horizontal engine. If there are any other advantages we are not aware of them. Examining the points of objection against the horizontal engine, we will first consider the cylinder. In point of fact, the wear is little, if any, greater than in the beam engine, and the seat of wear, instead of being at the bottom of the cylinder, as most of those who object to the arrangement conclude, in view of the weight of the piston, that it must be, is confined almost entirely to the upper part of the cylinder. The side of a cylinder next to the ports is always somewhat softer than elsewhere, owing to the greater mass of metal there; the lubrication is not so abundant at the top as at the bottom; and if the piston chance to blow a little steam, the abrasion thereby caused in a horizontal cylinder will necessarily be on the upper side. A cylinder of good metal is a long time, however, in wearing, whatever may be its position, unless, of course, it is under the care of a careless engine-man. It is not, however, every kind of pig iron that will serve for a cylinder. Those of Messrs. Penn's engines are of Madeley-wood No. 3 iron, and several of the locomotive makers have found an advantage in mixing a moderate quantity of wrought iron turnings with their pig metal, the result being an iron of great hardness, while, except in very large cylinders, the mixture will run very uniformly. The great cylinders, from 70 in. to 112 in. in diameter, employed for screw engines, wear very slowly indeed. In the horizontal engine the piston is much more convenient of access, and the packing is likely, therefore, to be looked after with more care. When, too, the cylinder does become worn, it may be easily and quickly bored anew without moving it from its bed, the portable boring apparatus now largely adopted in railway workshops being employed for that purpose. As for the parallel motion, that might be applied to a horizontal as well as to a beam engine, and indeed a Wiltshire agricultural engineer has actually adopted radius rods for the horizontal piston rods of portable engines. We do not, however, approve of "parallel" motions. In the first place, the motion thus given to the piston rod is not mathematically rectilinear, and cannot possibly be made so. But, more than this, with the least inaccuracy in original adjustment, or, what is more likely, that resulting from slight wear, the radius rods throw a heavy strain upon the piston rod. With a horizontal engine, if the crank is made to turn in the proper direction, the pressure of the cross-head is always upward upon the guides; and as the upward pressure due to the angularity of the connecting rod is not great, relatively, where the rod is long, its weight and that of the cross-head tend materially to diminish the friction upon the guides. The main inclination of the connecting rod to the guides should not, and need not, exceed 1 in 10 throughout the stroke, and the friction due to this pressure should not exceed, and probably would not be as much as, one-tenth of this pressure, or the one-hundredth part of the actual steam pressure on the piston. This is without making allowance for the weight of the connecting rod and cross-head, which might diminish the upward pressure due to angularity to an amount which would not probably involve a loss in friction of the guides amounting to one-half of 1 per cent. of the whole power of the engine. The whole friction, however, upon the guides of a horizontal engine can hardly be as much as that brought upon the crank pin and main bearings of a beam engine, in consequence of the worse than useless strain exerted upon them, at every stroke, by the momentum of a heavy and rapidly vibrating beam. A moment's reflection must show the loss of power in changing the motion, sixty times a minute, of a beam many feet in length, and weighing several tons. Indeed, the presence of the beam prevents the adoption of that speed of piston at which, all things taken into account, steam-engines work most economically. This remark applies, of course, to both beams and side levers, the latter typifying the worst form of beam engine. It would be useless to consider the working of a beam engine with 22 in. cylinders and 40 ft. stroke, at 60 revolutions per minute. The strain caused by putting the beam into motion and bringing it abruptly to rest 120 times in a minute would be very great. It is this impracticability of rapidly vibrating a heavy beam that has retained the old standard of 220 ft. to 250 ft. of piston per minute so long in use. Remove the beam, and the other parts of the engine are perfectly adapted to work at twice that speed, the heaviest engine in the navy working regularly and constantly at nearly 500 ft. per minute, while there is really no difficulty in working at an even higher speed. It is because of the necessity for slow speeds imposed by the beam, that such absurdly heavy masses of machinery are to be found in our cotton mills, flour mills and breweries, and sometimes, we regret to say, in the factories of engineers who should know better. Other things being equal, and provided only that the supply of steam is sufficient, the same engine may exert 100 or 400 horse power, according as it may be driven at, we will say, 20 or 80 revolutions per minute, and conversely, a quick working engine may give off the same power as a slow moving engine, and with a saving of from one-half to two-thirds of its weight. Quick speeds require, at most, only a moderate extension of the bearing surfaces, the work in any case being supposed to be carefully done.

That the preference for a heavy rather than a light job, has had something to do with the recommendation of the beam engine by so many constructing engineers, we may reasonably suppose. There are other engineers, however, not less well informed, nor less successful in the character of their work, who prefer horizontal engines, and are able to assign good and sufficient reasons for their preference. As more generally constructed, there is no doubt that horizontal land engines have not had the advantage of the same workmanship which has been expended upon beam engines; and this circumstance is unfortunate, as tending to the prejudice of the most mechanical arrangement of the steam engine, instead of being interpreted, as it should be, to the disgrace of the workman. Excellence of material, design, proportions and workmanship, should be accorded alike to beam and horizontal engines, and it will then soon appear that the latter are the most deserving of preference.

Some of the principal Scotch paper-makers have adopted, or are about to adopt, horizontal single-cylinder engines, and we find that, with either one or two cylinders, horizontal engines are slowly working their way into flour mills. Even setting aside their great advantage in point of first cost, we are convinced that, with first-class workmanship, they will ultimately prove themselves superior in every respect to beam engines.—*Engineer.*

PHOTOELECTRIC ENGRAVING.

One of the most remarkable, if not important results of modern science, is the power of producing an engraved copper-plate without the direct use of instruments—a plate, in fact, which is really an admirable photograph, capable of producing thousands of copies, which resemble ordinary sun pictures in nothing save minute beauty of detail.

It is needless to say that the attempt to cause the image cast by a lens within a camera to register itself on metal or wood in such a manner that impressions in ink might subsequently be obtained, is by no means new; and judging from a specimen engraving taken by Dallas's process, which has been laid before us, this desirable end has been obtained at last with considerable success.

Mr. Dallas has addressed a letter to the Society of Arts on the subject:

"In consequence of the very questionable protection afforded by the patent laws, I deem it advisable at present not to publish the details of my process.

"I can produce, in a period varying from one to three weeks, an engraved plate from a photograph. In this plate, that which constitutes the essence of the photograph and the despair of hand labour—*fac-simile* even to minute and almost microscopic detail—shall be present. To attain this result, all that I require is a good reversed negative (easily produced by reversing the glass), and a positive print merely fixed with 'hypo,' not toned.

"The methods which have hitherto given most promise are the bitumen process, photoglyphy and photogalvanography. The other processes of photolithography and photozincography, from their very nature, cannot rival the richness of plate printing. The bitumen process and photoglyphy are essentially etching processes, and involve much hand labour and consequent loss of fidelity. Photoglyphy is the least satisfactory of the two, as the etching ground employed is of a very delicate nature, and the photographic chemical, bichromate of potash, has the unfortunate quality of destroying detail, the longer it is submitted to actinic influence.

"The most important step in advance was photogalvanography. This process came into my hands when in a most crude and impracticable condition, and after it had been given up as useless by others. By much patient labour, I succeeded in making it practical, and the process has ever since been worked with the improvements which I effected. I was not permitted to reap the fruit of my labours, and after a considerable sum had been expended by my then partners to develop the process in a direction to which it was wholly unsuitable, the process has been almost abandoned.

"Photogalvanography, like photoglyphy, depends on the peculiar action of bichromate of potash, in combination with gelatine. In this lies its weakness. It loses detail—the more so as it requires a very long exposure, sometimes upwards of six hours, and then without any certainty that the right exposure has been attained. There are constantly numerous failures from this one cause alone.

"I experimented long with this process, and found that the result was due to chromic acid—in other words, that with a composition merely of chromic acid and gelatine, a raised image with granulation could be produced. From this raised image the electrotype plate was subsequently made. Independently of the loss of detail, and the uncertainty in the exposure—both defects inherent in the process—the granulation was of a peculiar zigzag and wiry character, which was of great value in the vigorous parts of the picture, but became broken or unconnected in the half-tones and fine details. This led to a pretty free employment of the graver and roulette, just in the very parts which made hand labour expensive. The process, indeed, was never capable of the high flight which was attempted, and, as I predicted, it broke down. Where expense was no object, the graver was a great assistance, but it lessened the value of the *fac-simile.*

"In photoglyphy and photogalvanography, the results are obtained from a positive impression.

"It was after experimenting some time with photogalvanography that it occurred to me to strike out in a different direction. Any one acquainted with engraving is aware that acquatint and chalk, or stippling, produce fine grain, half-tones and detail. The problem I set myself was how to imitate this combination. The acquatinter employs common resin dissolved in spirits of wine. This poured over his plate evaporates, and leaves numerous globules of resin attached to the surface. The size of these globules depends on the proportion of resin to spirit. When the acid is put on the plate, the resin dots as a resist, and a tint is produced in the intermediate parts. If the plate were now electrotyped before the removal of the resin, and a print taken from the electrotype, the resin parts would give a kind of stipple or 'chalk' marks, interspersed with tint. It is something similar to this which I have succeeded in imitating, with peculiarities *sui generis,* by photography and the electrotype. I can also, as it were, modify the size of the dots, obtaining them so fine as to carry almost microscopic detail; but if too fine, there will be deficient depth in the dark. In this as in all things there is the happy medium, and this I believe I have secured. I commence with the negative. This should be reversed. From the negative a positive proof is taken. This I prefer not toned, but merely fixed in the sepia colour by the 'hypo.' I cover the negative, which must be varnished with a material from which I obtain the latent positive. This latent positive I turn by a simple process into a suitable negative, and it is with this negative that I subsequently manipulate. I can time the exposure to a nicety, a few seconds over or under making an inappreciable difference. The excess or deficiency must not, however, extend to minutes. If necessary, I can electrotype direct upon my material; but as this might lead to the discovery of part of my process, I prefer to make a different kind of matrix."—*Mechanic's Magazine.*

THE MAGNESIUM LIGHT.

The *Photographic News* says:—We have on several occasions drawn attention to the metal magnesium, and have expressed a hope that some day it could be obtained in sufficient quantity, and at a sufficiently low price to render it available for the uses of the photographer. The wonderfully brilliant light which is produced by its combustion, the absolute innocuousness of the evolved products, and the ease with which the light can be obtained at any time, with no more trouble than is required to light a candle, all tend to shew that the perfection of artificial photographic light would result from the burning of this metal in a properly arranged lamp. Many attempts have been made, with varying degrees of success, to introduce an artificial light sufficiently powerful to enable photographs to be taken by its means at night, or in dark caverns, where no photography would otherwise be possible; and, in many cases, fair success has been met with. The light evolved by all such pyrotechnic mixtures is, however, very feeble, as compared with sunlight, unless an inordinate amount of material be employed; and, in this case, the fumes evolved are difficult to remove readily from the place where the light is produced; but unless they are perfectly removed their poisonous character makes them very dangerous. The magnesium light would be superior in both these respects. A thin wire simply held between the fingers can be lit as easily as a piece of paper, and burns like a candle; producing a light which is, according to Bunsen's estimate, only about thirteen times less intense than actual sunlight. No injurious fume is evolved during the combustion. A light white smoke is seen rising from the metallic flame; but this is nothing but magnesia, and is quite harmless. Moreover, the greater portion of the magnesia remains behind, as a friable solid, retaining somewhat the shape of the original wire.

We believe an arrangement of lamp for the magnesium light has already been devised. A spool of wire is gradually unwound, the end being pushed horizontally into the flame of a spirit lamp, where it ignites and continues to burn as long as it is fed with wire. It is in this feeding that the great difficulty has resided. Although it has long been well known—thanks to the labors of Deville and Caron—that magnesium could be procured even easier and at a less price than aluminum, by a slight and obvious modification of the apparatus used to prepare the latter metal, no one cared about risking the necessary outlay requisite to procure the metal in large quantities, when there was a doubt as to whether there would ever be sufficient demand to make the manufacture pay. In the *Comptes Rendus* for Feb. 23, 1857, Messrs. Deville and Caron give a detailed paper on the preparation of magnesium, in which they say that it can be prepared by the process employed for aluminum, which, however must be slightly modified, as magnesium is lighter than the scoria from which it is produced. A mixture of chloride of magnesium, chloride of sodium, and fluoride of calcium is made, and finely powdered. Sodium, in fragments, is then added and intimately mixed with the chlorides, and the whole is thrown, by means of a little iron spatula, into a red-hot earthen crucible, which is then closed with its cover. In a short time the reaction takes place. When all noise has ceased, the crucible is uncovered, and the mixture is stirred with an iron rod until the globules of magnesium are distinctly seen. The crucible is then allowed to cool, and when the saline mass is ready to solidify, it is again stirred with the iron rod, which collects the separate lumps of magnesium into one mass. The metal is then distilled in a current of hydrogen, and then fused in a flux composed of chloride of magnesium, chloride of sodium, and fluoride of calcium. The latter is added to increase the fusibility of the bath.

Messrs. Deville and Caron still worked at the subject, and more recently gave an improved process for the preparation of the metal, in which they recommend the omission of the alkaline chloride, and only use chloride of magnesium mixed with fluoride of calcium for the reduction by sodium, although they state that good results were also obtained by using a mixture of chlorides of magnesium and sodium. They give improved methods of separating the metal from the flux, and for melting and casting it into an ingot. Respecting the properties of magnesium, they describe it as a silver white metal, melting at about the same temperature as zinc, and like it boiling and distilling at a higher temperature. Like zinc it also takes fire and burns at a temperature a little above its melting point. The density of magnesium is 1·75. In the crude state it is brittle, but by distillation it is rendered pure and ductile.

SUBSTANCES FOR PREVENTING AND REMOVING BOILER INCRUSTATIONS.

The following is a list of substances which have been used, with more or less success, in preventing and removing the incrustations which are formed by using hard water in boilers:—

Potatoes.—By using about one-fiftieth of potatoes to the weight of water in a boiler, scale will be prevented, but not removed. Their action is mechanical; they coat the calcareous particles in the water, and prevent them from adhering to the metal.

Extract of Tannin.—A mixture has been used of 12 parts chloride of sodium, 2½ parts caustic soda, ⅛th extract of oak bark, ½ of potashes, for the boilers of stationary and locomotive engines. The principal agent in this appears to be the tannin of the extract of oak bark.

Pieces of Oak-wood, suspended in the boiler and renewed monthly, prevent all deposit, even from waters containing a large quantity of lime. The action depends principally upon the tannic acid.

Ammonia.—The muriate of ammonia softens old incrustations. Its action is chemicu; it decomposes the scale. In Holland it has been used with satisfaction in the boilers of locomotives. About two ounces placed in a boiler twice per week have kept it clean, without attacking the metal.

Fatty Oils.—It is stated that oils and tallow in a boiler prevent incrustations. A mixture composed of 3 parts of black lead, and 18 parts tallow, applied hot, in coating the interior of a boiler, has given great satisfaction in preventing scale. It should be applied every few weeks.

Molasses.—About 13 pounds of molasses, fed occasionally into a boiler of eight horse-power, have served to prevent incrustations for six months.

Saw dust.—Mahogany and oak saw dust have been used to prevent and remove scale; but care must be exercised not to allow it to choke up pipes leading to and from the boiler. Catechu contains tannic acid, and as also been used satisfactorily for boilers. A very small amount of free tannic acid will attack the iron; therefore a very limited quantity of these substances should be employed.

Slippery Elm Bark.—This substance has also been used with some success, in preventing and removing incrustations.

Soda.—The carbonate of soda has been recommended by Professors Kuhlman and Fresenius, of Germany, and Crace Calvert, of England. It is now employed with satisfaction in the boilers of engines in Manchester.

Tin Salt.—The chloride of tin is equal to the muriate of ammonia; and is similar in its action in preventing scale.

The *Extract of Tobacco* and *Spent Tanners' Bark* have been employed with some degree of satisfaction. The sulphate (not the carbonate) of lime is the chief agent in forming incrustations. By frequent blowing off, incrustations from carbonate of lime in water will be in a great measure prevented.

A NEW PORTABLE GAS FURNACE.

We have lately had an opportunity of witnessing the action of a new portable gas furnace, invented and patented by our townsman, Mr. W. Gore. As this furnace appears to us far to exceed anything that has previously been done in this direction, we cannot doubt that a description of it will prove interesting to our readers, to whom the invention is likely to be of more practical value than to any other community in the kingdom, and probably in the world.

The general features of the furnace are as follow:—It produces a "white heat" by means of ordinary coal gas and atmospheric air, without the help of bellows or tall chimney, and the melted substances are at all times perfectly accessible without chilling them or interfering with the action of the furnace; and if the crucible breaks the melted substances fall, without loss or injury, into a dish beneath. This is an important advantage to workers in gold and silver. The furnace is simple in construction, safe in use, portable, requires no brickwork erections, and may be used in any situation where gas is available. It is set in action simply by lighting and adjusting the gas, exactly as in an ordinary gas-lamp, and requires no further attention. It consists essentially of two open cylinders of fire-clay, one within the other, the outer one being much thicker and a little taller than the other; and a gas burner of very peculiar construction placed at the bottom of the interior cylinder. The crucible is supported inside the interior cylinder, near the top, by three projecting pegs of fire-clay forming part of that cylinder. The outer cylinder is covered by a moveable plate of fire-clay, which has a hole in its centre for the introduction of the crucible and materials, that hole being closed by a clay plug, with a small hole in it for stirring or examining the melted substances. The burner consists of an upright metallic tube, open at both ends, deeply corrugated at its upper end, so as to present the appearance of a star of numerous radiations, and the corrugations diminish gradually to nothing at about half the length of the burner downwards. Gas is admitted into the lower end of the burner by a common gas tap; it there mixes with a large quantity of air, and the mixture rises upwards; the flame commences at the top of the burner, and burns with great intensity within the inside cylinder to the height of the crucible; the heated products of combustion pass over the top edges of that cylinder, then downwards between the two cylinders, and into the chimney through a hole in the side of the outer cylinder near the bottom. The outer cylinder is enclosed within a sheet-iron casing, which has a chimney 6ft. high attached to it, and is supported upon three iron legs, making the whole apparatus portable, and capable of being used either in a workshop or in the open air, as may be desirable. The various clay portions of the furnace may be used without injury to the action of the furnace until they are completely worn out, and the arrangement is such that they may then be replaced by new ones with perfect facility.

Several sizes of the furnace are manufactured. The first and smallest size consumes 33 cubic feet of gas (value seven farthings) per hour, and is suitable for assayers, jewellers, analytical chemists, experimentalists, dentists, and others. It is capable of fusing eight ounces of copper or six ounces of cast iron; copper begins to melt in it in about twelve minutes from the time of lighting. The second-sized one consumes about twice that quantity of gas, is suitable for manufacturing jewellers generally, and for a great variety of practical persons who require to melt small quantities of gold, silver, copper, german silver, brass, cast iron, glass, and other substances, or require a small crucible heated to high temperatures. It is capable of melting 45 ounces of copper, or 40 ounces of cast-iron, and with its heat up it melts one pound of copper in eight minutes; copper begins to melt in about twenty minutes from the time of lighting. We understand that a still larger size, estimated to fuse upwards of 500 ounces of copper is being constructed.—*Birmingham Post.*

ICE.

It is not unpleasant at this season of the year to revert to the Polar seas, and the icebergs which slowly circle and drift therein, impelled by the resistless force of the tides. Viewed from this distance, the imagination lends them a charm which a nearer approach, or sudden contact in a vessel, would rudely dispel. If—instead of breeding fogs by drifting down into warmer latitudes, or creating terror in the heart of the mariner as he sees one of them in the grey dawn slowly bearing down upon his becalmed ship—in the place of these perils some enterprising person should boldly make fast to one of them, and tow it down off our harbor, he would find himself the possessor of a handsome sum of money though in a somewhat awkward form; for all ice, whether from salt or fresh water, is fresh, or sufficiently so for use. The value of the ice-trade in this country is something important, considering the nature of the article, and the universality with which it has been adopted. Indeed from being at one time a luxury which only the rich could afford to use, it has taken place as an actual necessity, and the procurement of it, in winter, gives employment to a large amount of capital, and a great number of individuals. Of old, the nations of the world who were celebrated for their luxurious tastes, cooled their beverages with frozen snow obtained from the peaks of the mountain ranges running through their several territories; and even to this day, in some of the South American States, the scantily-clad Indians or mestizoes, bear to the homes of the wealthy the frozen snows of the mountains. Of course this is a laborious process, and the refrigerant of itself necessity must soon waste away. With us the case is different, and in our cities the canvas-covered carts, richly freighted with the huge blue blocks, go from house to house to deliver their burden, and are eagerly welcomed. For many centuries the annual frost and snow has covered the earth, and acres of water, changed by the subtle chemistry of nature into sparkling ice, have melted again upon the approach of warmer suns, and no one seemed to have conceived the importance of storing it up for use during the sultry portion of the year. At length, Mr. Frederick Tudor, of Boston, conceived the idea that ice might be made a source of profit; and in 1805 he shipped a cargo of it to Martinique. The ice was cut from the lakes with axes, and shipped at once. As in nearly every commercial enterprise, where the field is novel and untried, and experience has not suggested a proper method of procedure, the venture proved a failure, as did also several succeeding ones, until the war put an end to all trade whatsoever. Mr. Tudor was not, however, disheartened; and with an energy and determination sufficiently remarkable, considering the nature of the case, immediately resumed the business in 1823; and at length, extending his shipments to the West Indies, found his scheme successful. Of course, so long as it was a losing business, mercantile men kindly permitted him to enjoy the field undisturbed; but so soon as it was clearly shown to offer profitable employment for capital, a number of disinterested persons gave it immediate attention. Up to 1832, Mr. Tudor was alone in the ice trade; but he then began to ship to Calcutta in addition to other ports.

Such was the rise of the ice trade in this country as compiled from good authority. The progress of it may be noted in the fact that while in 1832 the amount shipped was but 4,352 tuns, cut from Fresh Pond; in 1854, it had increased to 154,540 tuns. The annual domestic consumption of ice since then is stated to be 70,000 tuns in New England, and in New York nearly 285,000 tuns. It is said that all of this vast quantity is obtained from lakes along the water-course of the Hudson River. The large cities in the Northern and Western part of the State also lay up vast quantities in addition to these enormous amounts, and tuns untold are sent abroad to various parts of the globe. The price, of course, varies with the supply; the demand is unlimited. The average price is stated to be, in good seasons, at from $2 to $6 per tun for shipping; and for families, by the season—May to October—$5, at the rate of 9 pounds per day; 15 pounds are served for $8, and 24 pounds for $12. The pounds of the iceman are, however, an algebraic expression, or unknown quantity; and the general supposition is, that they deliver at the weight with which they started from their depots, without making any allowance for loss by waste. Out of three weeks that we, as a matter of curiosity, weighed ice that was delivered and paid for as 100 pounds per week, we obtained upon an average 65 pounds. During the present year the price of this necessary has been greatly enhanced by the avarice of the companies which monopolise the trade, and they are doubtless making money rapidly.—*Scientific American.*

MOTIONS OF CAMPHOR.

When small bits of pure camphor, cut and separated from a larger lump with a clean instrument, not permitting the contact of the fingers, are dropped into a glass containing very clean and clear water, they will begin immediately to rotate and move about more or less rapidly, and with strange and erratic energy. This experiment is not new, but it constitutes in itself one of the most interesting and mysterious exhibitions with which we can entertain a social circle.

Being convinced that minute and close observation of natural phenomena always rewards our curiosity and enlarges our preceptions, I carefully studied and repeated this hitherto neglected experiment, and I noticed some additional new and striking features. Thus I found that, if instead of using the torn or cut fragments from lumps of camphor, I detached with a clean needle point one or two of those fine crystals which attach themselves to the cork of the wide mouth phial where camphor is kept, and let them fall on clean water, they at once begin to move about with wonderfully increased rapidity, darting away in various directions, as if shot from some miniature engine of propulsion, or as if endowed with life and a will of their own; they feared the searching eyes and the magnifying lens of the observer, in their endeavours to find a hiding-place; each crystal quivering and rocking on the water with an apparent high degree of indignation at their forced contact with the humid medium. This fury gradually diminishes, and a regular dance begins with the various additional particles that may be introduced to the company; they select partners, to some of which they will seem to cling with pertinacity, whilst others will either remain indifferent, or, if attracted, will only stay a very short time in their embrace, detaching and wandering again in search of more congenial floating associates. This sight is pleasing from its variety, interesting from its elegance and the manifestation of an invisible power.

Careful observation demonstrates this power to be a force of reaction, as it is called, such as we see exemplified in the recoil of a gun, or in the flight of a rocket; and, indeed, in all those cases where the removal of a certain resistance at one point of a body under the influence of some internal force or pressure causes that portion of the pressure opposite to the freed point to manifest itself. In the experiment described above, the primary cause of motion is the emanation of a vapour from the volatile camphor; this vapour has a very low tension, the water upon which it floats being capable of dissolving and diffusing this vapour more readily in certain directions of the crystalline axes, thereby removes sufficient vapour-pressure at those points for the opposite side to drive about (by recoil) the nicely suspended particle.—*Chemical News.*

Miscellaneous.

USEFUL RECIPES.

Dyeing of Woollen Stuffs.

(Continued from page 220.)

21. *Brown drab.*—To the dye bath add two ounces of ground madder, one ounce peachwood, two ounces of logwood, six of fustic, and work in this for thirty minutes; lift up, and add three ounces of copperas in solution; mix well, and work the goods in this for other thirty minutes; wash and dry.

22. *Stone drab.*—Into the proper proportions of water add one ounce of peach or limewood, two ounces of logwood, half an ounce of fustic; work in this for twenty minutes, and then lift out and add to the dye bath, one ounce of sulphate of iron in solution; stir well, and work in this for another half hour; lift out, and expose to the air for a short time; wash and dry.

A diversity of shades may be dyed, by altering the quantities and the proportions of the dye stuffs.

23. *Slate.*—Work for half an hour in a bath, with eight ounces of logwood, one ounce of fustic; lift, and add to the bath a solution of one ounce of alum, half an ounce of copperas; work in this half an hour; wash, and dry.

Different tints of this color can be obtained by varying the stuff; if more blue be required use less alum and more copperas; if more to the purple, less fustic and more alum; and so by a very little practice any particular hue can be dyed.

For dyeing woollen blue in vats, which serve both for woollen and silk, the operation is simply dipping or working in the vat, and then exposing to the air.

The article "VATS, THEIR CONSTRUCTION AND WORKING," was misplaced in the last number, page 237, and should be read as preceding the following:

Pastel Vat.—The first care of the dyer, in preparing the vat, should be, to furnish the bath with matters capable of combining with the oxygen, whether directly or indirectly, and of giving hydrogen to the indigo. These advantages are found in the pastel and the woad. The dyer must, however, be careful to employ those substances only which are incapable of imparting to the bath a hue which might prove injurious to the indigo. Madder is used along with the woad; and as this substance furnishes a violet tint when brought into contact with an alkali—hence, by the addition of indigo, it yields a still deeper shade.

The pastel vat, when prepared on a large scale, ordinarily contains from eighteen to twenty-two pounds of indigo. Eleven pounds of madder might suffice for this proportion; but the large quantity of water which one hus to charge with oxidizable matters, must be taken into consideration. Even twenty pounds to a vat of this size have been employed, invariably with the best results. Bran is apt to excite the lactic fermentation, and should, therefore, not be employed in too large a quantity; seven to nine pounds will be found amply sufficient.

The weld is rich in oxidizable principles; it burns, sours, and passes into the putrid fermentation with facility. Some dyers use it very freely; but in this bath, an equal quantity of it to that of the bran is commonly employed. Sometimes weld is not added at all.

In most dye-houses the pastel is pounded before introducing it into the vat. Some practical men, however, maintain that this operation is injurious, and interferes with its durability, and such an opinion deserves attention. The effect of the dye-stuff, when reduced to coarse powder, is more uniform; but this state of division must render its alteration more rapid. When the bath has undergone the necessary ebullition, the pastel should be placed in the vat, the liquor decanted, and, at the same time, seven or eight pounds of lime are added, so as to form an alkaline lie capable of holding the indigo in solution. The whole having been well stirred, it should be allowed to repose for four hours, so that the little pellets may have time to become thoroughly soaked, and thus be prepared for fermentation. Some thick coverings are to be spread over the vessel, so as to preserve the menstruum from contact with the atmosphere. After this lapse of time, it is again to be agitated. The bath at this moment presents no decided character; it has the peculiar odor of the vegetals which are held in suspension and solution, and it has a yellowish-brown hue.

Ordinarily, at the end of twenty-four hours, but sometimes after fifteen or sixteen, the fermentation process is well marked. The odor becomes ammoniacal, while, at the same time, the peculiar smell of the pastel is easily perceived. The bath, hitherto of a brown colour, now assumes a decidedly yellowish-red tint. A blue froth, which results from the newly-liberated indigoferous matter of the plant, floats on the liquor as a thick scum, being composed of closely agglomerated small blue bubbles. A brilliant pellicle covers the bath; and beneath, blue, or almost black, veins may be distinguished, owing to the indigo of the pastel having an ascendant tendency. If the menstruum be now agitated, the small quantity of indigo which is formed floats on the surface of the bath. On exposing a few drops of this mixture to the air, the golden yellow hue quickly disappears, and is replaced by the blue tint of the indigo. This phenomenon is due to the absorption of the oxygen of the air by the indigo-white of the pastel. Wool might be dyed even at this juncture without any further addition of indigo; but colours furnished at this period are devoid of brilliancy and vivacity of tone, while the bath becomes quickly exhausted.

The signs above described announce, in a most indubitable manner, that fermentation is established, and that the vat has now the power of supplying to the indigo the hydrogen which is required to render it soluble—that contained in the pastel having already been taken up—and this, consequently, is the proper moment for adding the pulverised indigo.

It was stated above, that the liquor of the vat should be previously charged with a certain quantity of lime; ammonia generated by the pastel is also found in it, but a portion of these alkalies becomes saturated by the carbonic acid gas along with the acid principles of the madder and of the weld, as, also, by the lactic acid produced by the bran during fermentation. The ordinary guide of the dyer is the odor, which, according to circumstances, becomes more or less ammoniacal. The vat is said to be either *soft* or *harsh*; if the former is the case, it is requisite to add a little more lime. The fresh vat is always soft; it exhales a feeble ammoniacal odor, accompanied with the peculiar smell of the pastel, and lime is, therefore, introduced along with the indigo—from five to six pounds are usually employed—and after having stirred the vat, it is to be carefully covered. The indigo, being incapable of solution except by its combination with hydrogen, gives no sign of being dissolved until it has remained a certain time in the bath. It may be remarked, that the hard indigoes, as those of Java, require more than six hours for their solution. The vat should be again examined three hours after adding the indigo. The odor is, generally, by this time, weakened; a further quantity of lime is again added, something less, but mostly about equal in amount to the first portion; it is then to be re-covered, and again set aside for three hours.

After this lapse of time, the bath will be found covered with an abundant froth, and a very evident pellicle of a cupreous hue; the veins which float upon its surface are larger and more distinct than they were previously; the liquor becomes of a deep yellowish-red tinge. On dipping the rake into the bath, and allowing the liquid to run off at the edge, its colour, if viewed against the light, is a well-marked emerald green, which gradually disappears, in proportion as the indigo absorbs oxygen, and leaves, in its place, a mere drop, rendered opaque by the blue of the indigo. The odor of the vat at this instant, is strongly ammoniacal, but the peculiar scent of the pastel is, at the same time, discernable. When so obvious a character as this is found in the newly-formed vat, the stuff intended to be dyed may be fearlessly plunged in; but the tints given during the first working are never so brilliant as those subsequently obtained. This is owing to the yellow tinctorial matters of the pastel, which, aided by the heat, become fixed on the wool at the same time as the indigo, and thus communicate to it a greenish tint. This accident is common both with the pastel and the woad vats, though it is less marked in the latter.

When the stuff has been immersed for about an hour in the vat, it should be withdrawn—it would, in fact, be useless to leave it there for a longer time—inasmuch as no more of the colouring principle could be taken up. It is, therefore, to be removed from the bath and hung up to dry, when the indigo-white, by attracting oxygen, will become insoluble, and acquire the well known blue colour. If the stuff be now again plunged into the vat, the shade will immediately become deeper, owing to renewed absorption of indigo by the wool. By repeating these operations, very deep shades may be communicated. It must not, however, be imagined that the cloth seizes only on that portion of indigo contained in the liquor required to soak it. Far from such being the case, experience shows that, during its stay in the bath, it appropriates to itself, within certain limits, a gradually increasing quantity of indigo. Here, then, is an action of affinity, or, perhaps, a consequence of porosity on the part of the wool itself.

◆

Pressure at the bottom of the Atlantic.

Several experiments have been tried during the last few days, at the Wharf-road, to determine what effect the pressure of the Atlantic sea has upon a submarine cable laying on its bottom at a depth of 2¼ miles. The experiments were made in Reid's large press, capable of resisting a pressure of above 10,000 lbs. on the square inch. The specimen of cable used is known as the Persian Gulf standard, having a coating of gutta-percha ⅜ of an inch in diameter. It was subjected to a pressure equal to two miles and one quarter of a mile deep, and the pressure kept on for one hour, first having been carefully tested by what is known as Professor Thompson's reflecting galvanometer.

Some people who call themselves electricians were of the opinion that this enormous pressure—about 5,000 lbs. on the square inch—would force the water into the copper core, and by this means deteriorate the cable, if not quite destroy it.

These experiments have completely demolished this theory. On the contrary, when the pressure was removed the cable was found to be considerably improved, and gave with the same instrument several degrees of improvement. These experiments will be continued during the course of next week, upon a more extended scale, and carefully recorded.

At the same time several gentlemen wished to ascertain the truth of an old anecdote current at sea, that was said to be performed by an old salt, viz., he sunk a bottle of wine to a great depth in the Atlantic, securely corked, and when pulled up all the wine had dissappeared and was replaced by salt water. Another story of the same kind has been long in circulation—that if you take an empty bottle, securely corked, and sink it to a great depth it will come up filled with salt water, while the cork remains undisturbed.

In order to test the first of these theories, six quart bottles of Bass' pale ale were submerged securely corked and wired down, then covered with Betts' patent capsules; there were also several bottles of lemonade and ginger beer all properly secured in the same way.

To test the second theory of the empty bottle, one was securely corked and wired, one was corked after another fashion, having a large knob left on the cork in the form of a champagne cork, to prevent it being driven in. The third bottle had a wood cylinder put inside, resting on the bottom, and reaching the cork to give another form of resistance to the cork. The pressure was the same as before, and the time under pressure the same, viz., one hour.

The results were as follows;—The Bass's ale came out all sound and good, the same with the lemonade and ginger-beer. The small space left by the bottler between the cork and the liquor was filled up. With this exception all was the same. The first empty bottle the cork was driven in, and as a matter of course the bottle came up filled with water. The second bottle with the large knob was also driven in, and the bottle came up full. The third, that had the wood cylinder inside, on which the cork rested, was driven in to a certain extent not whole, and this bottle came up also full, showing that at these great depths no corking however secure, will prevent the water from getting into an empty bottle, and when you send the bottle down filled and well corked, there is no danger of the liquor making its escape and being filled with another; so that the sailor must have drank the wine first, and sent the empty bottle down afterwards.

Another interesting experiment was tried to test the accuracy of Dr. Wallich's statements as regards living creatures at great depths in the ocean.

It is a generally received opinion that no living creature exists at the bottom of the Atlantic—that in these dark and silent regions of the great deep eternal silence and solitude reign, the bottom being a fine deposit of diatomates too minute for the naked eye of man.

To demonstrate this, some live carp, lobsters, ells, &c., were put in the cylinder; the same pressure (Atlantic depth) and the same time—one hour. The whole perished and came out quite stiff, thus proving that the general opinion on this subject is correct, and that Dr. Wallich's statement wants confirmation.—*Engineer.*

Oiling Wool by Machinery.

We have had an opportunity of inspecting an invention by Mr. Leach, of the firm of Messrs. Littles, Leach, and Co., Britannia Mills Leeds, which appears effectually to meet a requirement long felt in the woollen trade. In order to render wool more workable than in its native state, it is customary to oil it, a process which has the effect of causing the fibres to slip more readily and evenly and assures more perfect cording and regular yarn. Hitherto the oil has been distributed by hand from a syringe, watering can, or similar instrument; and the result has been that the oil has been diffused very irregularly, in some places the wool being saturated and clotted, and in others escaping altogether. This equality in the oiling of the wool produces similar inequality in the yarn, and the defects of the process are discernible in the various stages of manufacture. It is to obviate this difficulty that Mr. Leach's invention is intended. The invention has the advantage of being readily attached to willies, teazers, pluckers, burring, and other machines employed in the manufacture of wool, and is so constructed that it can distribute oil to any given extent, the machine measuring and distributing the liquid with unerring accuracy. As the wool passes along the feed-sheet of the preparing machine, the oil is, by means of the apparatus invented by Mr. Leach, scattered over it in the form of a spray or mist; and on examination afterwards we found that the wool was thoroughly oiled, a fact which could be detected by feeling the wool; but the oil having been so evenly and accurately distributed, was not perceptible to the eye. The quantity of oil can be varied at pleasure, and, by a simple arrangement, it can be conveyed to the machine in pipes from the cask or cistern, thus saving much labour and preventing waste. An invention of so much importance to the woollen trade, notwithstanding that it is said to be slow in adopting improvements in machinery, cannot fail to be universally acceptable.—*Leeds Mercury.*

Best Time to Cut Timber.

A writer in the *Scientific American* says:—

"I have found the months of August, September and October to be the three best in the year to cut hard-wood timber. If cut in these months the timber is harder, more elastic and durable than if cut in winter months. I have, by weighing timber, found that of equal quality got out for joiners' tools, is much heavier when cut and got out in the above named months than in the winter and spring months, and it is not so liable to crack.

"I have walnut timber on hand which has been cut from one to ten years—with the bark on—which was designed for ax-helves and ox-bows, and not a worm is to be found therein. It was cut between the first of August and the first of November. I have other pieces of the same timber cut in the winter months, not two years old, and they are entirely destroyed, being full of powder-post and grub worms. Within the last ten or twelve years I have stated the result of my observation on, and experience of, cutting timber in different seasons of the year, to many of my neighbours and others; and all who have made the trial are satisfied that the above statement is correct."

Photo-lithography.

A communication has been read before the Academy of Sciences, Paris, from M. Meorvan, in which he describes his method for obtaining direct photographic impressions upon stone, which he can afterwards print off. He first gives the stone a coating, applied in the dark, of a varnish composed of albumen and bi-chromate of ammonia. Upon this he lays the right side of the image to be reproduced, whether it be on glass, canvas or paper, provided it be somewhat transparent. This done, he exposes the whole to the action of light, for a space of time varying between 30 seconds and 3 minutes, if in the sun; and between 10 and 25 minutes, if in the shade. He then takes off the original image, and washes his stone, first with soap and water, and then with pure water only, and immediately after inks it with the usual inking roller. The image is already fixed, for it begins to show itself in black on a white ground. He now applies gum water, lets the stone dry, which is done in a few minutes, and the operation is complete; copies may at once be struck off by the common lithographic process. The varnish has been fixed and rendered insoluble by the action of light wherever it could penetrate; but all the parts of the varnish protected by the dark portions of the image still retain their solubility, and are removed by the soap.

Increase of Population in France.

The late Census, which is taken at the end of every five years, shows that the population of the 89 French departments amounts to 37,382,225 inhabitants, to which are to be added 90,000 troops employed in foreign countries. The previous census set down the population for the 86 departments of which France was then composed, at 36,039,364 inhabitants. Deducting 669,052 inhabitants for the provinces annexed to the Empire, the increase of the population since the previous census 673,802 inhabitants, or 1·96 per cent. The increase from 1846 to 1851 was only 382,684, or 1.8 per cent. This may be accounted for by the revolution of 1848, which produced an unfavourable effect on the general prosperity of the country. The deficient harvests likewise during that period were unfavourable to the increase of population.

The Inside of a London Sewer.

The *Daily News* furnishes the following description of the remarkable works now in course of completion for carrying off the sewage matter of the metropolis:—The grand reservoir, which is in course of construction, is six acres in extent, and connected with it are three series of channels, one above the other, the lowest one bringing down sewage from the sewer to the pumping well; the upper channel conveys it, after being pumped up, into the reservoir, and the middle one carries the sewage from the reservoir into the river. The visitors were first conducted down many steps to a long arcade of brick, well lighted with candles, and this is intended to carry off the storm waters, in the event of an overflow, direct into the river. It is eight feet below low water. Passing from this another arcade was reached; this is the main culvert; taking the sewage to the east pump, and there is a similar one going to the west pump. These culverts, as they are called, are sufficiently large for a railway train to run through, and a regiment of Life Guards might canter through them easily. Following the labyrinth we next come to an immense portcullis of iron, which opens on massive hinges secured in solid masonry. These are to act as sieves or strainers for the sewage before it reaches the pump well. Dead dogs and cats, and all the coarse and miscellaneous kind of refuse which find their way into the large sewers, will be arrested at these massive portals, and will be deposited in a large stone prison, the bottom of which is scooped or curved. Within these stone wells a huge wheel filled with buckets, will constantly revolve, acting as a dredging apparatus to drag up out of this dark abyss, called the "filth hoist," all the sediment and arrested particles brought down by the sewer. They will be deposited by the revolving buckets in the "filth chamber," whence they will pass into the river at low tide. Passing the gates we enter the pump-room, the bottom of which is 17ft. below low-water mark. Here will be four engines of 125-horse power each, which will pump continuously into the reservoir. A portion of iron work for the reception of these engines is placed in position. Following the course of the culverts, we next pass into the reservoir which is to hold the sewage water until it can be discharged into the river. This, as we have just stated, covers an area of six acres. It will have a roof formed of brick arches, resting upon brick piers, and its floor is Portland stone. These six arches of immense cellarage, when full, will contain twenty millions of gallons. It is not yet roofed in, but the piers are nearly all completed, and they stand in long rows, crossing and entersecting each other, a perfect forest of brick-work. Twice in the day the outlet from this vast receptacle will be opened to the river, and for two hours at the ebb after high water the contents will flow into the river. Though the pumps will send in continuous streams of sewage, the reservoir will only be cleared out twice in the day. With a view of preventing any sediment accumulating in the bottom, there is a large tunnel on the land side, which, when the reservoir is full, will also be filled with water, and as soon as the reservoir has poured its contents into the river, the flood-gates of this tunnel will be opened, and its waters rushing out will wash away the deposit. We may add that the reservoir will be divided into three compartments, so fitted with sluices, and penstocks, and other contrivances, as that each may be used separately as well as together, and afford facilities for repairs when needed. Passing to the next stage, we proceed along another road of similar size to that already traversed, brick sides with iron girders carrying the brick roof, and which forms the main culvert delivering the sewage from the reservoir into the river, through a series of arched openings of about four feet in height.

Uninflammable Stuffs.

On this important subject the French Academy of Sciences have received a report from MM. Payen, Velpean, and Rayer, in which M. H. Chevalier's Paper sent into the Academy on the 25th of January last, is discussed. From this report it appears that only three salts have hitherto been found that may be successfully applied to the purpose in question, viz., that of preventing ladies' dresses from catching fire. There are many other salts that would do the same, but not without spoiling the dye, or the gloss, or the texture of the stuff, &c. Of the three in question, the sulphate and phosphate of ammonia have the inconvenience of being decomposed by the heat of a smoothing-iron; but they are applicable in those manufactures where stuffs are stiffened by the action of hot air or cylinders heated by steam. They exercise no action upon either the thread or the colour of the stuff. The phosphate of ammonia may be mixed with half its weight of hydro-chlorate of ammonia. To obtain an efficacious solution, 20 per cent. of this mixture must be dissolved in water. A solution of 7 per cent. of sulphate of ammonia produces the same effect, and is therefore the most economical salt that the trade can employ. But in those cases in which the smoothing-iron cannot be dispensed with, as in linnen, for instance, a solution of 20 per cent. of tungstate of soda should be preferred. To obtain the desired effect, all these solutions must be applied to the stuffs after they have been stiffened and dried, because starch is always used in a weaker solution than that required for these salts. Acid tungstates destroy the thread of cotton stuffs, like borax, alum, and other substances previously recommended. The tungstate of soda is prepared in Cornwall, where the tin mines yield a large quantity of wolframe. It costs from £12 to £18 per ton. The sulphate of ammonia costs about £14 per ton, and has hitherto been used for manure.

M. Sauvageon, a French investigator, has discovered that cotton cloth which has been exposed for a certain time to the vapour of burning sulphur, assumes such an amount of incombustibility, that although it will char and become brittle when held over the flame of a spirit lamp, it cannot be made to take fire, while under like conditions similar cloth, but unprepared in this way, is flamed immediately. If the alleged facts be borne out in practice, the problem is solved, for the simplest domestic means may be devised for subjecting, after being washed, all white clothing to the vapour of sulphur, which will tend to make it still whiter. Moreover, it may not prove necessary to repeat the exposure so often.

Uses of Coal Tar Pitch.

M. Kuhlmann has found a new use for burnt pyrites, which, he says, made into a mass with a quarter of its weight of coal-tar pitch, forms, when cold, a material of remarkable hardness and sonoreity. He states, too, that when hot pitch is applied to plaster, it drives out some of the water of hydration, and penetrates some distance into that porous material. The author thinks that pitch will effectually preserve the exterior decorations of buildings from the action of water and the consequences of frosts,—which we are as willing to believe as that the appearance of the building would not be at all improved by the application.

Flat Bottom Barque.

On Friday last a barque named the "Virginia" was launched at Liverpool from the building yard of Mr. John Robinson, south side of Duke's Dock. The launch, though attended with some apparent difficulty, consequent on the marked difference between the level of the building yard and the river, a height of ten feet, was accomplished in perfect safety. The "Virginia" is a ship of somewhat peculiar construction, the principle having been patented. Her bottom is flat, and she has three keels, in addition to which only straight timber is employed in the building. Her length is 115 ft., beam 23 ft., and depth of hold 12 ft. Her registered tonnage is 200 tons, but has carrying capacity equal to 500 tons, and is classed for seven years at Lloyd's. The time occupied in building the "Virginia" was only 40 days and 40 nights, and she was launched with her masts and a portion of her rigging fitted.

New Turbine.

An improved turbine has been provisionally specified by Professor Charles Fink, of Berlin, Prussia, which is constructed with a fixed outer ring of adjustable direction vanes, contained between two parallel horizontal annular surfaces, between which adjustable vanes the actuating water passes, and is directed by them into and through a series of buckets or openings formed with or attached to a ring or wheel attached to a shaft or spindle, and free to revolve within the ring first mentioned. The actuating water, after passing through the buckets of the inner ring or wheel (and thereby giving a rotary motion to the same, and to the shaft or spindle upon which it is fixed), passes downward through a suitably formed pipe or tube, from which it is ultimately led away in any convenient manner. The necessary movement for adjusting the vanes to any required angle may be imparted to the annular ring by leavers or other convenient or suitable means.—*Builder*.

A New Material for Ceramic Manufactures.

Dr. Muspratt, Principal of the Liverpool College of Chemistry, is of opinion, from an analysis he has made of a sample of phosphate of lime from Estremadura, the almost inexhaustible supplies of which have lately been made available by the concession of the right of working the quarries to Mr. F. K. Dumas, of London, that it is admirably adapted, on account of its purity, for the manufacture of porcelain and Parian. It contains 93 per cent. of phosphate of lime, nearly 4 per cent. of silica, a little phosphate of magnesia, and a trace of carbonate of lime. The phosphate worked at the island of Sambrero, of which Mr. Dumas is the consignee, is of analogous composition to that of Estremadura.

Mr. Glaisher's Balloon Ascents.

Among the most prominent results of Mr. Glaisher's balloon ascents, the following have been noticed:—

1st. That the temperature of the air does not decrease uniformly with the height above the earth's surface, and, consequently, the theory of a decrease of 1 deg. of temperature for an increase of elevation of 300 ft. must be abandoned. In fact, more than 1 deg. declined in the first hundred feet when the sky was clear, and not so much as 1 deg. in 1,006 ft. a height exceeding 5 miles.

These experiments are the first to yield any definite information on the subject; more experiments are required to settle the law satisfactorily, but its effect on the laws of refraction will be great; all the elevations of the balloon are, to a certain extent, erroneous, for it has never happened that the mean of the extremities has given the mean of the whole column of air.

2nd. The degree of humidity decreased wonderfully with the height, till at above 5 miles there was scarcely any aqueous vapour at all.

3rd. That an aneroid barometer can be made to read correctly, to the first place of decimals certainly, and to the second place of decimals probably, to a pressure as low as 7 inches.

4th. That a dry and wet bulb thermometer can be used effectively up to any height on the earth's surface where man may be located.

5th. That the balloon does afford a means of solving, with advantage, many delicate questions in physics.

In a recent lecture on the Soils of England, Dr. Augustus Voelcker stated the result of certain experiments to be as follows:—

1. That the calcareous clay soil absorbed about six times as much ammonia from the liquid manure as the sterile sandy soil.

2. That the liquid manure in contact with the calcareous clay soil becomes much richer in lime;

whilst during its passage through the sandy soil, it becomes purer in lime.

3. That the calcareous soil absorbed much more potash than the sandy soil.

4. That the chloride of sodium, in conformity with the results of other observers, was not absorbed to any extent by either soil.

5. That both soils removed from the liquid most of the phosphoric acid.

6. That the liquid, in passing through the calcareous soil, becomes poorer; and, on the other hand, in passing through the sandy soil, becomes richer in soluble silica.

Petroleum.

Up to the 13th of last April no less than 7,402,339 gallons of petroleum had been shipped from New York to foreign ports. London and Liverpool are the two great receiving ports of American petroleum, over 1,000,000 gallons having been sent to each of these places at the date stated. In addition to the above, 3,353,608 gallons have been shipped from Portland, Boston, Philadelphia, and Baltimore, making a total of 10,755,947 gallons. The petroleum trade with foreign nations has already attained to gigantic proportions.

Petroleum Exports.

Since the first of January last, up to the 1st. inst., no less than 10,110,810 gallons of petroleum have been exported from New York to foreign ports, against 2,920,08,9 in 1862. In addition to the above, 5,180,762 were expected from Baltimore, Philadelphia, Boston and Portland, making a grand total of 15,291,572 gallons. Our petroleum trade is one of the wonders of modern commerce —fifteen and a quarter millions of gallons sent abroad in five months, and in all likelihood as great a quantity has been consumed at home! The growth of the foreign demand has been unprecedented in rapidity, as only one million of gallons were exported in 1861. At present the stock of petroleum in the oil region is much less than it was at this period last year, and the yield of the wells is said to be less. The amount is about 5,000 barrels—200,000 gallons—per day. At 25 cents per gallon for crude oil, the value of the above quantity, exported this year, amounts to $3,822,893. —*American Paper.*

English Soils.

Conclusive proofs can be given, showing that so far from being in a progressive state of exhaustion, the productiveness of the soils of England has wonderfully increased during the last fifty years; and that the deplorable but hitherto unavoidable loss which the sanitary laws of a civilized country necessitate, is perfectly insignificant in comparison with the immense amount of mineral riches in the great majority of soils, and with the abundant restoration of fertilizing matters to naturally poor land.

Silkworms Fed upon Oak-leaves.

An interesting communication from M. Guerin-Menneville, on "Silk Culture," was read at the last meeting of the French Academy. This gentleman has succeeded in habituating silkworms, hatched from Japanese eggs (*B. yama-mai*), to feed on oak-leaves, and his paper was accompanied by some cocoons produced by worms so fed. He expressed hopes that the discovery might lead to the extension of silk culture in France, and we may add that it affords some hope that it might be profitably carried on in England.

Discovery of an Ancient Town in France.

The French papers contain a curious account of a town, the remains of which have lately been discovered, imbedded in the sand at the mouth of the Garonne. A church, supposed to be of the date of the decadence of the Roman Empire, has already been laid bare, and numerous capitals and ecclesiastical architectural ornaments have been brought to light. The district, like our Perranzaduloe, or *Perran in Sabulo*, on the Cornish coast, is desolated by sand which has accumulated, in some localities, in vast heaps.

Petroleum in Bulk.

We learn that Mr. D. L. Miller, jr., of Philadelphia, is loading a cargo of crude petroleum, in bulk, for Liverpool, which is the first ever carried in that way. The vessel is fitted up with an exclusive view to carrying oil in bulk (of which it is expected she will take 50,000 gallons), and provided with twelve immense iron tanks, most of which are divided into two compartments, the lower of which may be filled and secured first. The barrels of oil are emptied directly in the tanks, and when unloaded it is pumped out. Of course the peculiar construction of the vessel unfits her for any other than the petroleum trade, and necessitates her returning from Liverpool in ballast, for which the tanks are partly filled with water. We understand that in case this experiment proves successful, it is the intention to build other and larger vessels, on the same plan; but the fact that they cannot carry return freight will, in our judgment, render them unprofitable.—*Scientific American.*

Petroleum for preserving Wood.

The oil wells near Prome, in Burmah, have been in use from time immemorial. Wood both for shipbuilding and house-building, is invaribly saturated or coated with the product of those wells. The result is entire immunity from decay, and the ravages of the white ants that in that country are generally destructive. M. Crepin, a Belgian Government engineer, who has tried experiments upon the relative advantages of creosote and sulphate of copper for the preservation of timber in marine constructions from the attacks of worms, &c., says that creosoting is the only process he has found to succeed for this purpose. He states that sulphate of copper affords no protection whatever against the action of salt water and marine insects. The Belgian Government now require that all wood sleepers used in the State railways should be creosoted; and the Government of Holland have also made the same resolution; and upwards of 300,000 sleepers per annum are now being creosoted by the Dutch Government, and more by the Belgian Government.