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CULTIVATION AND MANUFACTURE OF FLAX AND HEMP IN CANADA.*

The natural history and commercial value of Flax and Hemp are so little known, and, consequently, so little appreciated in Canada, that the farmers in the Province will receive the statement that next to cotton, flax is the most important and the most extensively used textile fabric in the world, with some degree of cautious reserve and perhaps, incredulity. But if the assertion that flax, as a material for textile fabrics, can be shown to occupy a position of paramount national importance, provokes surprise, surprise may grow into astonishment, and doubt be transformed into absolute unbelief, until removed by those stubborn things, facts, when it is added that the seed of flax, in the refuse form of oil cake to be used as food for cattle, commands such an enormous sale in Europe that its value there is represented by tens of millions of dollars annually, with a rapidly increasing demand.

Now that "King Cotton" has been dethroned amidst one of the most heartrending and stupendous struggles between contending millions of one and the same people, and the most wide-spread suffering, arising from the mere arrest of one branch of human industry, that the world has ever seen, flax is re-asserting her claim with unrivalled pretensions, to be considered the first in importance of all the countless gifts of God won from the vegetable kingdom for the use of mankind, not included within the class of food products.

This claim does not rest alone on the fitness of the material for the purposes of a textile fabric which shall supply the place of cotton, it appeals, as an instrument for increasing indefinitely the industry and wealth of the country, to the fostering careof philanthropists, statesmen and governments, in a manner and with a force which cannot be urged by any rival claimant.

Cotton has gained its supremacy at the expense of the unrequited toil and hopeless life of the slave. Now that the dawn of a brighter day for the slave is at hand, slow coming but surely advancing, there is every reason to believe that the beautiful and delicate exotic, which has attained its marvellous preëminence by the unhallowed toil of millions of human creatures, will be compelled gradually to assume its place among the productions of free labour, and surrender the proud position it has usurped, at the cost of inexpressible suffering and sorrow, to its rival flax, which accommodates itself to all the climates of the temperate zone, and does not refuse to yield profitable harvests within the limits of sub-arctic and sub-tropical climates.

* This article, by the Editor, was published in the *British American Magazine* for August: it will be concluded in the September number.

Flax has been cultivated and manufactured in various parts of the world throughout historic times. Those wonderful records of Egypt's civilization, the tombs and catacombs in the neighbourhood of Thebes and other great ruined cities in the valley of the Nile, show how extensively flax was cultivated by the Egyptians more than four thousand years ago; and since the time when Isaiah Ezekiel and Solomon recorded the praises of the "spindle" and "distaff" down even to modern times, flax has always been one of the most prominent and powerful sources of human industry and progress.

It may excite some surprise that this beautiful plant should have taken such wide-spread root from the frigid zones to the tropics, adapting itself apparently to all vicissitudes of climate, and flourishing under the burning sun of India as well as in the sub-arctic provinces of European Russia and Norway. In order to understand this apparent anomaly it is essential to bear in mind that flax is cultivated either for its fibre alone or for its seed alone, or for both of these products; and the special object of its extensive cultivation is mainly determined by climate.

Flax is cultivated for the seed alone in Turkey, India, and until recently, in many parts of the United States.

It is cultivated for the fibre alone, or chiefly for the fibre, in Ireland and some parts of Belgium.

It is cultivated for both fibre and seed in Great Britain, Continental Europe, Egypt, the United States, and to a small extent in Canada in both divisions of the Province.

Historical Notice of the Cultivation of Flax and Hemp in Canada.

The earliest reliable notices of the cultivation of flax in Canada are contained in the Paris Documents.*

In 1719, or nearly a century since, a long period, by the way, in the history of Canadian agriculture, the quantity of flax produced in Lower Canada was 45,970 lbs.. Two years later, the returns, according to the same documents, give 54,650 lbs. of flax as the produce of the country. In 1734 the number of pounds of flax seed produced was 92,246,

* Documents relating to the Colonial History of the State of New York.

and in 1754 (?) there were stated to be fourteen mills in operation for the production of flax or linseed oil. In 1827 Bouchett gives the quantity of flax raised in Lower Canada as 11,729 cwts., or 1,313,648 lbs.

Hemp.

Among the instructions given by the King of France in 1665 * to Sieur Talon on his appointment as Infendant of Justice, Police, and Finance in New France (Canada), he was desired to report whether the country would grow hemp, and in reply M. Talon stated that "at least as much hemp can be expected from these lands as is procured in those of France."

The cultivation of flax and hemp in the French and English Colonies was a favourite subject with several of the British and French governors previous and subsequent to the conquest.

Governor Moore wrote to Lord Shelburne in 1767 on the encouragement which should be given to the culture of hemp on the borders of New Hampshire. But long before that period, the French had entered upon its cultivation in Lower Canada. In 1719, 5,080 lbs. of hemp were produced, but in 1721, or two years later, the quantity returned was only 2,100 lbs. It was not until about the year 1800 that any great efforts were made to introduce the general cultivation of this important fibre in the British Provinces.

In the Transactions of the Society of Arts for the year 1802, we find the following premiums offered for the cultivation of hemp in Upper and Lower Canada:—

"To any person who shall sow with hemp the greatest quantity of land in the Province of Upper Canada, not less than six arpents (each four-fifths of a statute acre), in the year 1802, and shall, at the proper season, cause to be plucked the summer hemp (a male hemp bearing no seed) and continue the winter hemp (or female hemp, bearing seed), on the ground until the seed is ripe—

THE GOLD MEDAL, OR ONE HUNDRED DOLLARS."

Second	Prize—The	Silver	Medal, or	Eighty	Dollars.
Third	"	"	"	Sixty	"
Fourth	"	"	"	Forty	"
Fifth	"	"	"	Twenty	"

* The population of New France, or Canada, at this time was very small. The following statistics are interesting records of the early history of the Province; they are from the "Paris Documents"

CENSUS OF CANADA.

	1666.	1667.	1668.	1679.
Families	......	749	1,139	......
Persons	3,418	4,312	5,879	9,400
Arpents cultivated	......	11,174	15,642	21,900
Horned Cattle	......	2,136	3,400	6,983
Horses	......	......	......	145
Sheep	......	......	......	719

The Society of Arts did not limit their awards to Agriculturists, but they offered "To the master of that vessel which shall bring to this country the greatest quantity of marketable hemp, not less than one hundred tons, in the year 1803, the produce of Upper or Lower Canada, the Gold Medal," and a second prize of a Silver Medal to whoever shall bring not less than fifty tons.

In 1802 the Government of the Province voted £1200 for the encouragement of the culture of hemp, and much interest was excited on the subject in the colony. Various letters and papers from Canada appear in the London Society of Arts Journal, for the year 1803, on this subject. A Hemp Society was established under the immediate patronage of His Excellency Lieutenant Governor Milnes in Lower Canada and did good service by distributing seed and publishing useful information respecting the culture of that important plant.

In 1802 the Gold Medal of the London Society of Arts was awarded to Isaac Winslow, Esq., of Montreal, for his culture and preparation of hemp in Lower Canada. In Upper Canada, the Gold Medal of the Society was awarded to Mr. Jacob Schneider, of the Township of York, for his culture of hemp in the Province.

The letter containing Governor Hunter's certificate on account of Jacob Schneider, is dated York, Upper Canada, 18th November, 1802, and signed W. Allan. The Silver Medal was awarded to Mr. Daniel Mosher, of Kingston.

Mr. Allan, in his communication to the Society of Arts, states "that there is every probability that the culture of hemp for exportation from this country, more particularly from the Province of Upper Canada, will eventually have the desired effect; and the more support it receives in its infancy the sooner will this be ascertained. There has been a very considerable quantity exported this present year, and many affidavits state its being cultivated at a small expense."

In 1803, thirty-five dollars was awardee to Mr. William Hughes, of Yonge Street. In 1804, Silver Medals were awarded to Mr. J. Cornwall, and Mr. P. Wright.

Mr. Philemon Wright,* who, in the year 1800, invaded the wilderness in the immediate neighbourhood of Ottawa, early turned his attention to the cultivation of hemp. One year Mr. Wright raised a considerable quantity, and sent a very fine

* Mr. Philemon Wright, an American Loyalist, emigrated from Woburn, in the State of Massachusetts, to Canada in 1800. Bouchette says, "Through hardships, privations and dangers that would have appalled an ordinary mind, he penetrated an almost inaccessible country, and where he found desolation and solitude he introduced civilization and the useful arts, By his almost unaided skill and indefatigable industry, the savage paths of a dreary wilderness have been changed into the cheerful haunts of man."—*Bouchette's Topographical Dictionary of Lower Canada.*

specimen, measuring fourteen feet in length to the Hemp Committee at Montreal. He also sent two samples of the seed with two bundles of the hemp to the Society of Arts, and was complimented in return, as before remarked, with a Silver Medal. From a certificate which he received from the Hemp Committee it appeared that he raised that year eleven parts out of thirteen of the total raised in the Province. Mr. Wright was obliged to discontinue growing hemp on a large scale on account of the expense of preparing it for market, the hemp-peelers charging him one dollar a day, or one bushel of wheat.

In 1806 the British Government offered a bounty for the importation of flax and hemp from the North American Colonies, but the effect does not appear to have been sufficient to have induced an extended cultivation. This may have arisen from the habits and prejudices of the Lower Canadian *Habitans* not being understood, as explained by Bouchette, who was a warm advocate for the cultivation of flax and hemp in Lower Canada. In the appendix to his "British Dominions," he published, in 1835, an article on the probable causes which have counteracted the cultivation of hemp in Lower Canada, together with observations on the most effectual means by which its culture might beencouraged in British North American Provinces.

Among the causes which rendered the cultivation of hemp abortive in Lower Canada was the want of a market where it might be disposed of as raw material. Hemp found no market but in a prepared state. Bouchette recommended the formation of a Company whose agents should receive hemp from the farmer, weigh it, and pay prices fixed upon by the Company. The hemp thus purchased was to be prepared in the agent's mills, packed and stored ready for shipment. In order to innovate as little as possible upon the customs of the *habitants*, Bouchette proposed that they should be allowed to dispose of their hemp in bundles or sheafs weighing 15 lbs. Mr. Greu, quoted by Bouchette, states as the result of his experiments that the native hemp-seed produces better crops than that imported.

The following tables show what has been done hitherto in the cultivation of flax and hemp in the Province:—

LOWER CANADA.

Year.		Flax produced.	Linen manufactured.
1717	....	45,967 lbs.	—
1721	....	54,650 "	—
1734	..(Flax Seed)	92,246 "	—
1827	........Flax,	1,068,698 "	1,058,696 F. Ells.
1851	Flax or Hemp,	1,189,018 "	929,249 Yards.

UPPER CANADA.

Year.		Flax or Hemp.	Linen.
1851	....	69,680 "	. . 14,711 Yards.
1861	....	1,225,934 "	... 37,055 "
1862	...(estimated)	1,500,000 "	... —

The last edition of the *Encyclopædia Britannica* has the following on the cultivation of Hemp in Canada, which, although the evil alluded to has passed away, still the argument for the cultivation of this valuable fibre in Canada remains in force, and the evil may soon return if the present signs of the times in Europe are correctly interpreted:—"The growth of hemp in Canada assumes a position of great national importance at the present time, when British supplies have been so seriously checked by the war with Russia. * * * Were our own dominions in North America to supply hemp for our manufacturers in future, instead of our being, as hitherto, so wholly dependent upon Russia for such supply, the change would be attended with signal advantage to both countries."

Flax Fibre.

The worth of the annual production of flax fibre throughout the world was estimated three years ago at one hundred million dollars, and of the seed twenty million dollars; but since the outbreak of the Civil War in the United States the price of the raw material has suddenly risen, its production has greatly extended, and its cultivation has received a sudden impetus, so that the entire value of the crop in the old world may now be safely estimated at one hundred and fifty million dollars per annum, with every prospect of a rapid increase.

Russia is the great flax producing country of the world. The cultivation of this plant has been fostered in that empire by successive governments for many hundred years, and in modern times it has won the careful attention and fostering care of the Emperors Nicholas and Alexander. The reward of these wise efforts to establish so valuable an industry as the culture of flax has resulted in the present overwhelming predominance of Russia among the fibre producing countries, since cotton recently received such fearful and calamitous checks.

At the close of the last decade, Russia produced about one-third of the entire amount which came into the markets of the world, and while in 1859 the quantity of flax imported by the United Kingdom amounted to 160,388,144 lbs., of which three-fourths, or 120,340,752 lbs., were supplied by Russia: Egypt, the natural soil of this plant, sent to the United Kingdom only 1,921,696 lbs.; and yet Egypt had her purple and fine linen, and swathed her mummies in almost endless bands of that fabric, when Russia and England were peopled by Nomadic races clad in the skins of beasts.

In Ireland in 1859 there were 139,282 acres under flax, yielding 27,000 tons. In 1860, although the area under crop was less by 8,000 acres than in 1859, yet the yield amounted to 5,000 tons more.

In the production of flax in Europe, different countries take the following rank: 1st, Russia; 2nd, Austria; 3rd, France; 4th, Ireland; 5th, Prussia; 6th, Belgium; 7th, Holland.

In the United States flax has never been a favourite crop as a fibre producing plant. "It is to be regretted," says the Superintendent of the United States Census for 1860, "that the manufacture of flax has not attained greater magnitude in a country where the raw material is so easily and cheaply grown. Farmers throughout the West have raised the crop simply for the seed and thrown out the fibre as useless." The census of 1860 shows that there were produced in the States north of the Cotton States, 4,547,071 pounds of flax. This quantity would require, at 200 lbs. an acre, about 23,000 acres for its growth. But in the same States, there were grown, in the same year, 484,779 bushels of flax-seed, which, at eight bushels to the acre, would require a little over 60,000 acres, showing that nearly two-thirds of the fibre was thrown away.

The Austrian Catalogue of their Department at the late International Exhibition is printed on Indian corn paper; samples of maize fibre paper, dipped unbleached, and having the whole of its gluten retained, are bound up with the work. The paper is strong and presents a good surface, but in the "Remarks on the Maize Paper here present," we find a statement possessing a great degree of interest in connection with the cultivation of fibre-producing plants. It is as follows: "As to the cost of production of maize-straw paper, it would exceed that of paper manufactured of rags if there had not recently been discovered a quality in the maize fibre securing to it a far better means of converting it to use than by working it up into paper, *i. e.*, that it can be spun and woven like flax and hemp. This discovery has already passed the experimental stage, for there exist already establishments in Vienna and Schlögmühle, near Gloggnitz, where maize-flax, as it is called, is spun and woven in considerable quantities. The process of producing maize-flax is the inventor's secret and patented in all the great States of Europe; but all patents not being in his hands, productions of his new invention could as yet not be sent to the Exhibition. What renders maize-flax weaving highly advantageous, is that the worst waste of maize-straw yields excellent paper, which is sufficiently proved by the paper manufactured of such waste, and made use of for printing the present Catalogue on."

Whatever can be said in favour of this new discovery applies equally to flax and hemp, and although it may be found a valuable and profitable material for certain kinds of paper, of an enduring or almost indestructible character, yet even supposing "maize-flax" should be successfully introduced in Europe the expense of its manufacture will prevent it from being generally adopted, and it can never compete with the grand staples flax and cotton for the purposes of clothing. But its chief value will be in the fact that those countries which have hitherto been dependent upon foreigners for their supply of cotton and linen, can, in an emergency like the present cotton dearth, clothe themselves with fabrics made from maize-straw if the supply of flax should not be equal to the demand Its adoption will be, however, altogether a question of political economy, supposing maize-flax to be susceptible of general introduction. The special necessities of a country, other things being equal, will soon establish the relative commercial values, on the one hand of Indian Corn, Maize-Flax, Maize-waste Paper, and on the other hand of Flax Fibre, Flax Seed, Oil Cake, Linseed Oil, and Linen Rag Paper.

Where food is cheap, as in Canada, Flax will carry the day; where food is dear, Indian corn will probably prevail.

Notwithstanding the admirable fitness of the climate and soil of Canada for the cultivation of Flax and Hemp, and the encouragement in a certain direction which has been given to it, it appears that the importations are very considerable and last year reached the imposing sum of $150,000. The following tables will show the nature and extent of our importations of a natural product which might be grown with the best results to the producer and consumer if proper means were devised to give a definite direction to that encouragement which is by no means wanting either on the part of private enterprise, or public liberality.

Imports.

Year.	Flax, Hemp, and Tow, undressed. Value.	Flax Seed.	Oil Cake.
1857	$96,034	—	$83
1858	56,261	—	97
1858	64,182	—	—
1860	98,426	—	—
1861	91,793	—	1,381
1862	151,096	—	8,705

Exports.

1857	—	11,050	16,169
1858	12,901 flax	2,344	15,593
1859	—	2,482	22,945
1860	—	5,634	32,835
1861	6,452	4,570	41,011
1862	5,530	27,783	41,733*

FLAX SEED.

Two very important articles of commerce are

* Given in the Trade Returns under the head of "Oil Cake," as distinguished from Linseed Cake.

obtained from Flax Seed, namely linseed oil and oil cake. The value of linseed oil chiefly arises from the property it possesses of absorbing oxygen from the air and becoming tenacious, like india-rubber or gutta percha, and to increase this property it is submitted to a process which gives it preëminently the qualities of a "drying oil." The object of boiling the oil with a small quantity of litharge or oxide of lead is to separate the vegetable albumen and mucilage which impair its drying properties. Oil cake, it is almost unnecessary to state, is used for feeding cattle. The oil is obtained from the seed with or without the aid of heat. Cold drawn linseed oil is better than that pressed by heat, but the quantity yielded by the seed is not so large.

The value of linseed cake for feeding stock deserves to be widely known in this country in connection with the advantages and disadvantages of cultivating flax.

Assuming the weight of a bushel of flax seed to be 53 lbs., the actual average quantity of oil cake made in the United Kingdom exceeds 140,000 tons, which, at the average price of forty dollars a ton, reaches the enormous sum of five millions six hundred thousand dollars. It appears again in the form of beef and mutton, and who can estimate the value of an abundant supply of oil cake of native manufacture to Canadian farmers during the long winters of this country, which involve the housing and feeding of cattle from five to six months in the year.

"Each year our farmers," says Professor John Wilson of Edinburgh, "have to rely more and more on the important substances (oil-cakes) for the manufacture of the beef and mutton we require for our consumption, and for the supply of manure they require for their crops; for even in a manurial point of view alone, the fertilizing nature of the imported food would follow very closely on that assigned to the purely manuring substances themselves." Linseed cake is the staple of all the oil cakes used as food for animals, and some idea of the importance attached to this substance by British farmers may be formed from the ascertained fact, that notwithstanding the importation of nine million bushels of flax seed annually, they still require about eighty thousand tons of linseed cake and are crying out for more. The total quantity of cake consumed in the United Kingdom for the purposes of feeding and fattening cattle exceeds two hundred and fifty thousand tons, valued at ten million dollars annually.

The prices in 1863 in the London markets are less than in 1862. The following are the London quotations:

Linseed oil cake in February,	1863,	£10 10 to	£10 15
" " "	1862,	11 00 to	12 00
Flax Seed, per quarter....	1863,	0 62 to	0 74
" "	1862,	0 72 to	0 76

The value of Linseed for oil purposes is greatly dependant upon the climate of the producing country. The following London quotations for February, 1863, show this in the most practical way.

English Linseed, per quarter.....	62s.	to 74s.
Calcutta " "	65	to 68
Bombay " "	71	to 72
St. Petersburg "	66	to 67
Riga " "	40	to 52

Public and Private Encouragement in Canada.

Much has been done of late years by private and public enterprise to assist the cultivation of this important plant.

The Canada Company some years since placed forty dollars at the disposal of the Agricultural Association to be given in premiums for flax and hemp, and the Association itself has offered other prizes and diplomas for the same object.

In Oct., 1854, a voluminous report was submitted by Mr. Kirkwood to the Minister of Agriculture, "On the system of cultivation and preparation of flax, as practised in Belgium and the British Islands," and published in the parliamentary reports of that year.

Mr. Donaldson's letters, (the Government emigration agent) published in different newspapers in Canada, furnish an excellent summary of the attempts which are now being made to introduce the cultivation of flax and the promising results already attained.

Private individuals (Hon. W. Alexander of Woodstock and others) have offered prizes to stimulate farmers to grow this product. Associations have been formed in Upper and Lower Canada, (Elgin Flax Association, Upper Canada, and Sherbrooke Flax Association, Lower Canada,) to effect the same purpose; and recently the Government has imported flax scutching machines from Europe and distributed them throughout the Province.

In 1862 the Government caused public lectures to be delivered on the importance and advantages of cultivating textile plants in Canada, and the Department of Agriculture and Statistics is importing first-rate seed from Europe for distribution. Extensive factories are in course of construction for the manufacture of flax,* and the Board of Agriculture of Lower Canada has imported new machinery from Europe for a similar purpose. The wide field open to this branch of industry may be seen at a glance by an inspection of the following table of imports of the most important flax and hemp manufactures during the past seven years.

* "Report of the Minister of Agriculture and Statistics."

Imports.

1857 ..	$334,974 ..	$188,989 ..	$75,291 ...	$599,254
1858 ..	138,110 ..	80,535 ..	36,030 ...	354,675
1859 ..	203,671 ..	44,452 ..	41,437 ...	289,560
1860 ..	261,824 ..	64,150 ..	63,776 ...	389,750
1861 ..	341,942 ..	75.544 ..	55,592 ...	473,178
1862 ..	322,844 ..	107,181 ..	116,757 ...	546,783

The Minister of Agriculture after a brief recapitulation of what has been done to promote the cultivation of flax and hemp in the Province, concludes his report for 1862 with the following words:—" The Legislature should, therefore, vote a SPECIAL AMOUNT this year for this purpose."

In a subsequent number we shall venture to advert to the form which that legislative encouragement should take, as suggested by a review of the impediments which have hitherto checked, and the discouragements which, it is alleged, have thwarted the best efforts to promote these important but neglected branches of home industry and enterprise.

IMPORTANCE OF THE STUDY OF DESIGN.

BY W. SMITH WILLIAMS. *

Ornamental value consists in its being used to add beauty to common things, and to relieve the blankness of bare walls, floors and ceilings. Since the Puritans banished color from English churches until the present time, decorative art has performed perpetual penance in a sheet of whitewash, and our national ecclesiastical architecture has been mutilated and deformed, not only by tasteless church-wardens, but by accomplished architects, who, in respect of English architecture, were as ignorant as their employers. But let us not forget what we owe to Wren; nor that to his discerning encouragement we owe the development of the genius of the greatest ornamentist this country has seen, Grinling Gibbons, whose wood carvings have been so well appreciated and emulated in our own day by Mr. W. G. Rogers.

In entering upon the wide field of ornament, it becomes necessary to draw a distinct line of demarcation between the several branches of ornamental design; namely the ornamentation of architecture, of vessels, utensils, and implements, and of textile fabrics. Each of these is governed by different principles, but in all the practice of illusory imitation is alike objectionable. True art repudiates shams. The great blank space of raw white plaster that shocks the sense as well as the taste, in almost every room we enter, from the poor man's garret to the gilded saloons of the wealthy, is a relic of puritanical aversion to color, and the drab hues that make dreary our parlour and dining-rooms are only a quakerish compromise.

In painted decoration, and in the patterns of paper-hangings, curtains, or carpets, form ought to be regarded chiefly, if not wholly, as a vehicle of color. How tiresome and tantelizing is the reiteration of patterns in a paper-hanging, especially when great blotches of red or some other powerful color is scattered over it, or cutting lines of positive blue divide the walls into strips. Intense colors ought to be used sparingly and distributed skilfully, so as to enliven the mass of secondary tints; for a room is made to seem smaller by strong contrasts of color or harsh outlines, as ceilings are apparently lowered by deep mouldings or powerful hues. Indeed, vivid colors are not essential either to the elegance or cheerful aspect of a room; the walls should form a chaste but not dull background to the furniture, pictures and occupants. Gaudy carpets of large patterns are therefore objectionable; if positive colors are used, these should be subdivided by the intricacies of a small and undefinable pattern, like the Persian or Turkey carpets, which have never yet been equalled for richness and sobriety combined.

In designing patterns for textile fabrics, the uses to which the drapery is to be applied, requires to be more considered than is commonly the case. Obviously the pattern for a dress should not be so large as that for a curtain, yet one sees silks and satins in the mercer's windows, the wearers of which would certainly appear as if robed in window curtains or wall hangings. The elaborate imitation of flowers in dresses is wrong upon principle, because the effect is to direct attention from the *ensemble* presented by the dress and the wearer; the nondescript patterns of India shawls in which the effect is seen in the mass, are still superior to modern designs. A great nosegay of flowers on a shawl, or a dress sprinked with bouquets, is only a degree less absurd than the horns and trumpets which decorate the dressing gown of Signor Lablache in " Il Fanatico per musica." The effect of harmonious combinations of color is what the designer should rely upon; and of these the variety is endless. Form is the medium for displaying color; in draperies that hang in heavy folds, like curtains, it is evident that the shape of the pattern is not seen truly; its effect as shown in the play of color is infinitely varied by the folds, and therefore a large bold pattern, as in damask, is preferable. In dresses where the folds are smaller, and especially in scarfs, angular patterns are not only admissible, but pleasing, because the multitude of cross folds not only destroys the formality of pattern, but gives rise to an infinity of piquant combinations.

Form and proportion are paramount; no ornamentation, however rich or fanciful, can redeem

* From the *Universal Decorator*.

bad proportions or ungraceful form, while a beautiful form unadorned is itself ornament of the most refined and pleasing description. Neither should ornament be so prominent as to overlay or prevent the full development of form; while neither form nor ornament ought to interfere with utility. The shape of Greek and Etruscan vases, beautiful as they are, are not more adapted to modern pottery or hardware than is the decoration of the fictile wares. We do not want to convert lachrymatories into scent bottles, funeral urns into tea-pots, vases into flower-pots; nor are the forms of amphoræ suitable for decanters, or of pateræ for candle-cups. The material and uses of the vessel should determine its form; tea-pots that will not draw, jugs that can never be washed clean, glasses and cups that one cannot drink out of comfortably, however elegant their form, are essentially defective; and the adaptation of the thing to its purpose, so far from producing ugliness, tends to beauty, and it also induces new forms. The problem to be solved is simply this,—"Given the use and material of the article, to find a beautiful shape." In the commonest, rudest, and oldest implements of husbandry —the plough, the scythe, the sickle—we have examples of simple yet beautiful curves. The most elementary and simple forms, if well proportioned and of graceful contour are the most pleasing.

There are other points that need to be touched upon, and those that have been adverted to need fuller investigation, but enough has been said, I trust, to prove the importance of a knowledge and observance of the principles of Art by designers; and perhaps to show also that these principles are easily ascertainable by studious attention and rational reflection.

TITANIFEROUS IRON ORE, OR ILMENITE.

Titaniferous iron, or Ilmenite is very abundant in Canada, at least in one locality. At St. Urbain, Bay St. Paul, there occurs a bed of Ilmenite ninety feet thick, exposed for about 300 feet on the strike and traceable for about a mile.* It contains:

Oxide of Titanium	48·60
Protoxide of Iron	46·44
Magnesia	3.60
	98·64

We are indebted to the *Mechanics' Magazine* for the following on Titaniferous iron ore:

The reduction of the titaniferous iron ores—found in the form of sand on the shores of the Black Sea, the Bay of Naples, and also along the shores of New Plymouth, in New Zealand—has lately engaged the attention of practical metallurgists to a considerable extent. Several companies have been formed in the City with a view of working these deposits with profit; and considerable sums of money have been spent in experiments conducted with a view of arriving at some means of converting this rich and valuable ore on a large scale.

We have examined different specimens of this peculiar metallic sand; from the shores of New Zealand; from Poti, in Asia Minor; and from Naples. They have all a similar appearance, that of fine steel filings, and they are strongly attracted by a magnet. The Italian specimen is somewhat mingled with common sea-sand or silica. The great value of these ores is due to their large percentage of iron, to their freedom from sulphur, phosphorus, &c., and to the presence of titanium itself in the form of an oxide. There is little doubt that steel is considerably improved by a mixture with titanium; and it is not improbable that the presence of this metal would also raise the quality of cast iron. The wonderful temper and tenacity of the sword blades of the Japanese are said be partly due to the presence of titanium in the steel of which they are manufactured. It is stated by recent travellers in Japan that all the iron of that country is made from this peculiar sand. The sword blades used by the Circassians are also made from the titaniferous iron ores of the country, and according to well authenticated accounts their temper and durability is something marvellous. Of course, the mere presence of titanium does not wholly account for excellent quality of the iron manufactured by these semi-barbarous nations; the ore itself is pure, and it is always smelted with charcoal.

The most common mineral containing titanium is this titaniferous peroxide of iron. It is very similar in appearance to the magnetic oxide of iron, and it is, indeed often mistaken for the latter mineral. Titaniferous iron ore is found in small small quantities in Cornwall. Its scarcity has prevented its adoption up to the present in practical metallurgy; and this is also the reason that the metal titanium has been only discovered within a recent period. The titaniferous oxide of iron of the secondary formations has always the appearance of black-grained sand, the particles of which are attracted by the magnet. For a long time the titanium was only known in the form of an oxide. It has been found united with nitrogen and carbon in the slag from the blast furnaces of the Merthyr Tydvil iron works, in the form of well-defined prismatic crystals, of a copper colour. The various titaniferous iron ores contain from 13 to 52 per cent. of oxide of titanium in union with oxide of

* Minerals of Canada—Descriptive Catalogue.

iron. Metallic titanium is somewhat similar in appearance to brass. Up to the present the principal application of titanium has been in the form of titanic acid for painting porcelain. It is used to produce a pale yellow colour.

It will be at once seen that the great obstacle to the reduction of these peculiar ores on a large scale consists in their being generally found in a state of minute subdivision. It would be impossible to feed a blast furnace with such a material. Although a large amount of capital has been spent in experiments, we believe that, up to the time we write, no ready means have been found to make the sand cohere in masses large enough for the free passage of the blast. The experiments have been conducted by several eminent metallurgists, but the investigations have been necessarily secret. It is not improbable that bricks of the necessary tenacity might be formed of this material by the use of a "high-pressure" brick-making machine. A process of baking with an appropriate flux might also arrive at a similar result. Mr. Mushet has made some first-class steel from this ore; but the process was carried out in crucibles with their attendant expense. The steel was shown in the Sheffield Court, and in the New Zealand Court, of the late Exhibition.

Should the hopes prove well-founded that an admixture of this ore with our English makes of iron would improve the quality of the product, this fine sand could be injected through the tuyeres into the furnace by means of the blast. This process has been already carried out with powdered charcoal, and also with pulverized iron ore. It is evident that the attainment of a profitable means of reducing this rich and pure ore is merely a question of time and well-directed capital. It may buoy up the hopes of those who have spent large sums in, as yet, unfruitful experiments, to remember that the ordinary processes of manufacturing —flowing on with the ease due to long practice and experience—have themselves been evolved from a costly process of trial and error.

CHROMIC IRON IN CANADA.

It has been long known, through the labours of the geological survey, that Chromic Iron exists, to a considerable extent, in Lower Canada,—as, for instance, in Gaspe, and in the townships of Ham, Bolton, and Melbourne. In the last named locality, on the property of Benjamin Walton, Esq., the deposit of chromic iron has been reported on by Messrs. Wilson and Robb, mining engineers, and we have pleasure in producing the report of those gentlemen, as follows:—

53 St. François Xavier Street,
Montreal, 5th Sept., 1862.

Benj. Walton, Esq., Melbourne.

Sir,—In accordance with your instructions, our Mr. Wilson, on the 3rd inst., visited and inspected the bed of Chromic iron on lot No. 22, in the 6th Range of Melbourne, which we understand is held by you in fee simple.

The chromic iron occurs in a band of Serpentine subordinate to the stratification of the slate rocks of the country, and is associated with soapstone, which appears to constitute the gangue of the ore. The vein or bed of chromic iron can be traced for a distance of over 50 fathoms, by irregular branches of ore in places on the surface, but there is good grounds for believing that it extends to a much greater distance than that specified.

A crop trial has been made by excavating a pit about fifteen feet in length on the strike, and from two to four feet deep. At the bottom of this opening and at either end, a vein of very rich chromic iron is displayed; the vein is of irregular thickness, being at the widest part from eight to ten inches thick. The ore consists chiefly of the hard, dark, compact, and highly chrystalline variety, which, we understand, is much valued in the market; a considerable quantity of the sand ore was, however, found in the pit.

We have subjected a large sample (about 30 lb.) of the lump ore to a careful analysis, and find that it contains not less than fifty-three (53) per cent. of sesqui oxide of chromium, equal to 69·6 per cent. of chromic acid.

This will probably be worth in the English market about fifty dollars per ton. It is of considerable better quality than the Baltimore ore, which has been largely imported into England, but which is now in a great measure excluded from the market in consequence of deterioration in the quality and the high prices demanded.

The average thickness of the ore in your deposit as disclosed by the single opening yet made may be fairly estimated at four inches. This would give a little over one ton to the fathom of vein stuff, which, in a rock so full of joints as that in which the vein occurs, may be quarried out for twelve dollars. The expense of cabbing and barrelling (including cost of barrels) four dollars; transportation to shipping port, say four dollars; total cost, prepared for shipment, twenty dollars per ton.

As so little has been done in developing the deposit as to quantity of ore contained in a given space, this estimate must be regarded as only approximate; all metallic ores, as a general rule, improve both in quantity and quality at a moderate depth, say from ten to fifty feet, and those of Eastern Canada, so far as yet developed, form no exception to this rule. In the present case, the improvement in both respects, within the limited ground opened up, was very marked in tracing the ore in depth, and gives strong grounds for the belief that the deposit may be worked to a profit.

As a mining operation, however, that is by shafts and underground workings being required, it should be borne in mind that the vein must yield at least double the amount specified per fathom of ground broken in order for permanent and profitable working.

From the appearance on the surface, and the extent already developed, we regard it as quite probable that this amount may be obtained.

But as no beds of chromic iron have been worked to any extent in Canada, we have no data for their persistence, but regard the appearance of your bed as highly favourable.

An open drain, four or five rods in length, will drain the quarry to the depth of about 6 feet from the surface of the ground.

We remain, yours respectfully,
(Signed) WILSON & ROBB.

I hereby certify the above to be a true copy of the report sent to me, as above, by Messrs. Wilson & Robb.

BENJ. WALTON.

Toronto, *Nov. 24th*, 1862.

NEW BRANCH OF MANUFACTURE IN TORONTO.

A new and beautiful branch of manufacture has just been introduced into Toronto by Messrs. Hurd & Leigh, dealers in china and glassware, Yonge street—the gilding and enameling of porcelain. When Mr. Hurd returned from England a short time ago, he brought with him from the Staffordshire potteries, a very clever enameller and gilder, with his family, who act as burnishers and finishers. The eldest, a little girl not long into her teens, can dash off a flower or ornament very prettily. The father is a very clever workman, and with equal facility imitates the delicate tints of the virgin blush rose, or runs a narrow gilt border round a tea cup. He possesses the taste and touch of a real artist, and his work is really beautiful. The porcelain is imported from England in its white state, and is ornamented and gilded on Messrs. Hurd & Leigh's premises. The gold is specially prepared in Staffordshire, and sells at a higher premium than in New York. It is put on like paint and has a dark brownish appearance. The colors for enamelling present a similar aspect. When several sets have been painted and gilded they are placed in a patent kiln or oven erected in rear of the premises on the most approved principles. Iron plates are introduced into grooves in the sides and each separate piece rests on a *petite* triangular earthenware stand, so that it may not come into contact with the metal. The front of the kiln is then securely bricked up, the air completely excluded, and the fire in the furnace lighted. A great degree of heat is necessary to bake the preparation thoroughly into the porcelain, and test pieces are from time to time taken out, one of the bricks in front being displaced for the purpose. When the "baking" is thoroughly done the fire is quenched and the goods taken out. The colours on the enamelled goods have a brilliant appearance; but the gold is of a dull yellowish appearance; but after being subjected to the action of the bloodstone burnisher it rivals a sovereign newly issued from the mint in brightness. The process is a very beautiful one, and we dare say Messrs. Hurd & Leigh will be glad to shew it to any of the citizens of Toronto who are interested in the introduction of new manufactures into Canada.—*Globe.*

CANADIAN ROOFING SLATE.

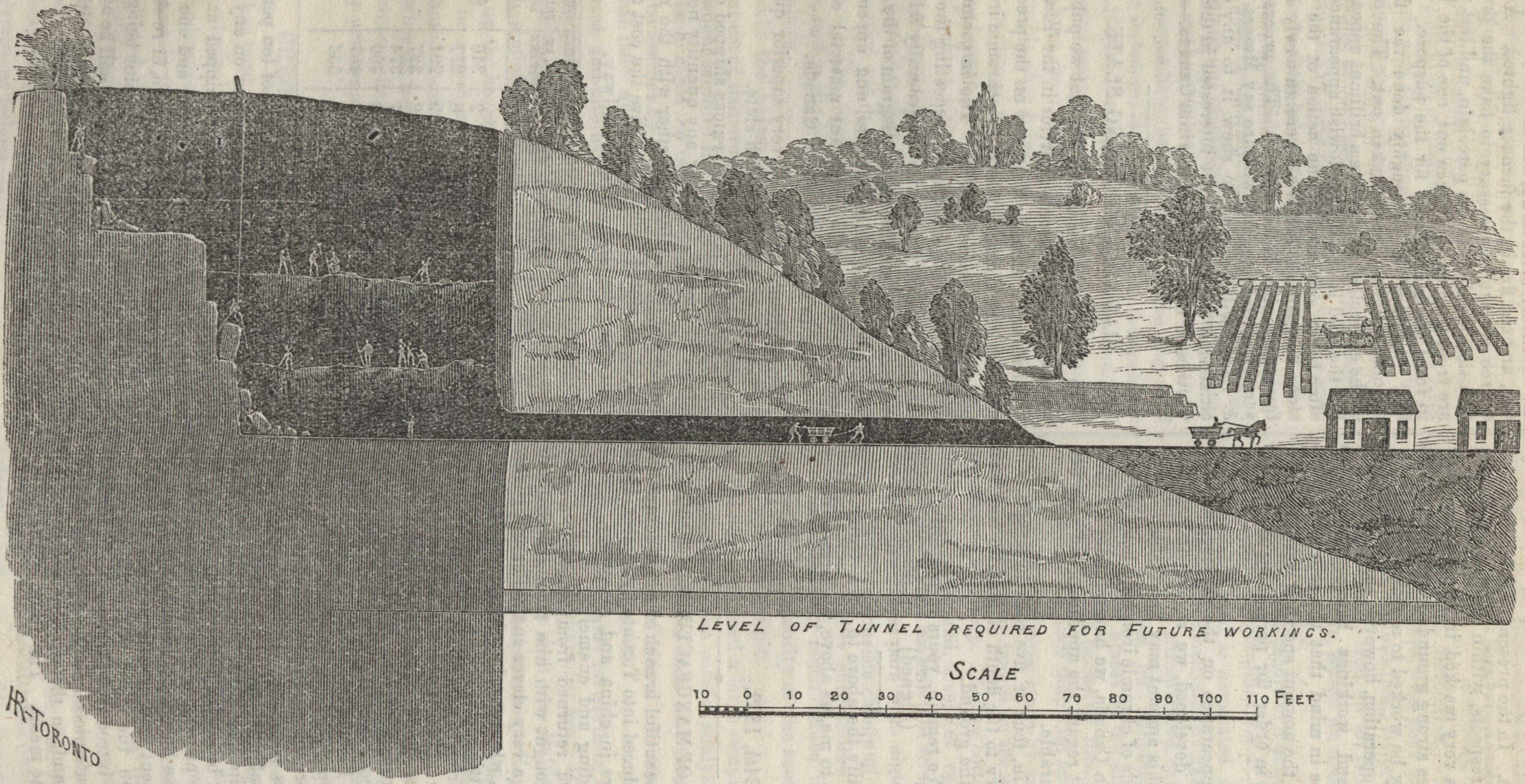
In the last number of this Journal we published a notice of Mr. Walton's quarries in the Township of Melbourne, Canada East, and on the preceding page we give a description of the chromic iron deposits in the same locality. The importance of diffusing accurate knowledge respecting the mineral resources of Canada is so generally felt, that we have added an illustrative diagram of the actual condition of the slate quarries, and append the prices at which this important material can be furnished in different parts of Canada.

Mr. Walton's slate is of very superior quality, not inferior to the best Welsh slate.

The following is a list of PRICES shipped on the cars at Richmond, C.E., for any quantity not less than a car load, which, together with the rate of freight, as stated below, will give the cost at any point along the Grand Trunk Railway.

SIZE OF SLATE.	NO. IN SQUARE	PRICE PER SQUARE.	SIZE OF SLATE.	NO. IN SQUARE	PRICE PER SQUARE.
24 × 14	98	$4 00	16 × 9	246	$3 50
24 × 12	114	4 00	16 × 8	277	3 50
22 × 12	126	4 00	14 × 9	291	3 00
22 × 11	138	4 00	14 × 8	327	3 00
20 × 11	154	4 00	14 × 7	374	2 50
20 × 10	169	4 00	12 × 8	400	2 50
18 × 10	192	3 75	12 × 7	457	2 25
18 × 9	213	3 75	12 × 6	533	2 00

We understand that an advance of ten per cent. will be charged on the above prices on any quantity less than a car load, when shipped at Richmond to any place east of Toronto, and one dollar and fifty cents in the yard at Toronto, or re-shipped on the cars there, freight to that point being paid. Also that a discount of ten per cent. will be allowed for cash, from the above prices, if paid within 30 days from date of invoice.



PERSPECTIVE VIEW AND SECTIONAL PLAN OF THE "WALTON SLATE QUARRIES," TOWNSHIP OF MELBOURNE, CANADA EAST.

(*See June No. of Journal, page 195; also Vol. I., page 210; and Vol. II., page 202.*)

PROVINCIAL EXHIBITION.

(From the Kingston Daily News.)

Preparations for the Exhibition.

To Kingston belongs the honor of erecting the first permanent buildings for the purposes of the Agricultural Association of Upper Canada. Previous to the Exhibition of 1856, the Government of the day granted a license of occupation for the term of twenty years, of an area of about twenty acres on a portion of the Penitentiary farm lot, and on this the Local Committee raised a handsome and substantial cruciform structure of wood and glass; also ranges of commodious buildings for cattle, horses, pigs, sheep, &c., and a Mechanics' Hall for machinery and agricultural implements; the whole costing about sixteen thousand dollars. The main building, or "Palace," though not so extensive as its heavy, ungainly rival at Toronto, is a light and elegant structure, and well adapted for the purposes for which it was erected. The transept is 190 feet long and 56 feet wide; the general height of the building 34 feet, and that of the cupola about 60 feet. There is in the whole structure about 24,000 feet of fluted glass, being more than double the quantity in the Toronto Palace. The building is undergoing various repairs and improvements, and additional room will be secured by the removal of the unsightly and useless orchestra, which now occupies a large space in the nave. The repairs to the woodwork, under the superintendence of Mr. George Brown, are rapidly approaching completion, and Mr. William Robinson has made good progress in the painting and glazing. In the interior the roof has been colored a pale yellow, the ribs vermillion, and the elliptic sweeps and posts a bright blue—the contrast being exceedingly lively and pleasing. The coloring of the outside is blue and white, and, when finished, the exterior of the building will present a clean and attractive appearance. The Mechanics' Hall, a neat and substantial two-story structure, lying to the south-east of the Palace, is being extended by an addition of sixty feet to its length, its original dimensions being 108 feet by 26. It, also, will be colored, outside and in—the interior red, white and blue—which will greatly improve its appearance. The old cattle sheds have been thoroughly repaired and strengthened, and the accommodation for this class of animals has been largely increased by the erection of a new range of buildings on the west side of the grounds. The old range is 428 feet long by 32 broad, and the new 300 feet by 12, both being capable of housing comfortably upwards of two hundred head of cattle. On the west side have also been erected new sheep and pig sheds, and a capacious carriage house. The dimensions of the former are 300 feet by 12, the capacity being sufficient to accommodate about 500 animals. The carriage shed is 400 feet long by 16 wide, and will, no doubt afford ample room for the class of manufactures which it is intended to accommodate. The old horse stables at the south end of the grounds are in pretty good condition, and will require but few repairs. The range is 660 feet long, and can house comfortably about two hundred animals. The ventilation, however is very imperfect, but the evil will be remedied to some extent by cutting an aperture in each door and inserting therein a strong wire grating, which will also increase the facilities for viewing the horses. Another old range of stables on the east side, is in a very dilapidated condition, and extensive repairs and alterations are needed to render the stables serviceable. It is believed, however, that they will not be required; but it is the intention of the committee to have them thoroughly repaired in case the other stables should prove insufficient to accommodate all the horses entered for exhibition. This second range is 300 feet long, and when put in order will house about one hundred animals. On either side of the Mechanics' Hall are two tiers of poultry coops, each 108 feet long, and containing 54 compartments—the whole four tiers being capable of holding upwards of two hundred pairs of fowls. These coops are in a fair state of preservation, and need very few repairs to render them secure. In addition to the buildings already noticed, it is intended to erect another, to be devoted to various purposes. It will be 55 feet long and 20 wide, and will comprise, among other apartments, a refreshment room and a retiring room for the ladies. All the buildings on the ground are substantial permanent structures, and when the repairs and improvements they are now undergoing are completed, will compare favorably with any similar buildings in Upper Canada. Mr. Power, the architect, and the contractors, Messrs. Brown, Robinson and R. M. Horsey, are pushing forward the work in their respective departments with great vigor, and in a few weeks everything—so far as the buildings and ground are concerned—will be in readiness for the coming Provincial Exhibition.

Flax Cotton

A Flax Cotton Manufacturing Company has been organized in Oswego, in the State of New York. It occupies a stone building one hundred and forty feet long, and five stories high. Fifty looms for flour sack sheeting are ready for operation; also several knitting machines. The farmers have begun already to reap a profit from this movement. The culture of flax, in some instances, in that vicinity has paid a net profit of $175 per acre.

Board of Arts and Manufactures

FOR UPPER CANADA.

MEETING OF SUB-COMMITTEE.

The Sub-Committee held its regular monthly meeting on Thursday, July 30th. Present, the President (Dr. Beatty), Prof. Hincks, Messrs. J. Shier, W. H. Sheppard, and E. A. McNaughton.

Minutes of former meeting being approved of the Secretary read a letter from the Institution of Mechanical Engineers, with donations of proceedings of the Institution for 1862; a letter from Messrs. Browning & Hitchins, Beauharnois, C. E., with specimens of native Terre Sienne, for examination by the Board; and also a letter from W. Wagner, Esq., on matters already attended to by the Secretary.

Other routine business being transacted, the Committee on *final examinations* presented their report, (the particulars of which have already been published in the June number of the Journal, page 169). The report of the Committee was adopted, and the several certificates ordered to be presented to the successful candidates, in accordance with said report; a Silver Medal was also awarded to Richard Lewis, jun., as the most successful candidate; and the sum of ten dollars ($10) to the Toronto Mechanics' Institute;* in accordance with the offers of this Board, as per Journal for November, 1862, page 334.

Moved by Mr. McNaughton, seconded by Mr. Sheppard, and

Resolved—"That the Secretary be instructed to convey to the several gentlemen acting as Examiners (see Journal for June, page 169), the thanks of the Board for their valuable and gratuitous services."

Moved by Mr. Sheppard, seconded by Mr. McNaughton, and

Resolved—"That Professors Hincks, Hind and Buckland, be constituted a Committee, for to obtain suitable designs for, and to present the certificates and medals to the prizemen; and that said Committee be also requested to revise the programme of Examinations for next year."

Resolved—"That the specimens of Terre Sienne now submitted, be placed in the hands of Professor Hind, for scientific and practical examination thereof, and for notice in the Journal."

Resolved—"That the Secretary communicate with the Hon. the Minister of Agriculture, regarding the amendments to the act constituting this Board, and their early introduction to the Legislature."

The meeting adjourned.

W. Edwards, *Secretary*.

* The $10 received by the Toronto Mechanics' Institute was awarded by its Committee to the most successful of the candidates passing the Preliminary Examination, Richard Lewis, jun.

DEATH OF DR. CRAIGIE.

It becomes our painful duty to record the death of a most valuable and highly respected member of the Executive Committee of this Board, Dr. W. Craigie, of Hamilton, who departed from amongst us on the 9th of the present month, and in the 65th year of his age, after a few weeks' illness.

On the organization of the Board of Arts and Manufactures, in the year 1857, Dr. Craigie was elected a delegate by the Hamilton and Gore Mechanics' Institute, and at once took a warm interest in furthering the objects of the Board. At its first general meeting he was elected a member of the Executive Committee, to which position he has been annually re-appointed. He also held the Vice-Presidency of the Board during the past year; and although in attending to his duties he had to travel from his home to this city, he was seldom absent from its meetings. His kindness of manner, and intelligent discussion of all matters brought under his notice, won for him the esteem of all his colleagues. His loss will be severely felt, not only by this Board, but by several scientific and other Societies with which he was actively associated.

EXHIBITIONS TO TAKE PLACE THIS AUTUMN.

PROVINCIAL AND STATE.

Upper Canada, at Kingston, September 21 to 25.
Lower Canada, at Montreal, September 15 to 18.
New York, at Utica, September 15 to 18.
Ohio, at September 15 to 18.

AGRICULTURAL ASSOCIATION OF UPPER CANADA.

The Annual Meeting of the Directors of the Association will be held at the city of Kingston, on the Exhibition grounds, on Friday, the 25th September, at 10 a.m., when officers will be elected. and the place appointed for holding the next Exhibition in 1864.

The Draft of Rules and Regulations, as submitted by the Council at their last annual meeting, and published in Vol. II. of this Journal, p. 299, will be taken up for discussion.

The members of the Board of Agriculture, and of the Board of Arts and Manufactures, and the Presidents and Vice-Presidents of County Societies and of all Horticultural Societies (or any two members whom a County or Horticultural Society may have appointed Directors instead of its President and Vice-President) are the Directors of the Association.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE.

Shelf No.		
J. 38—	Heat considered as a mode of motion; a course of Twelve Lectures, delivered at the Royal Institution of Great Britain, in the season 1862; 12mo.	*Prof. Tyndall, F.RS.*
J. 39—	Manual of Elementary Chemistry, Theoretical and Practical, 197 illustration; 12 mo.; 1862	*Prof. Fownes, F.R.S.*
L. 23—	United States National Almanac and Annual Record for the year 1863; 12mo.	*G. W. Childs.*
	Donated.	
	Proceedings of Institution of Mechanical Engineers, Birmingham; January, April, July and November, 1862; four parts; Illustrated	*By the Society.*

BOOKS RECENTLY PUBLISHED IN GREAT BRITAIN.

Austin (J. B.) Mines of South Australia, 8vo	£0	5	0	*Murray.*
Banister (Henry) Gas Manipulation, with Description of Instruments, 8vo	0	5	0	*Sugg.*
Boat (The), and How to Manage it, by Salacia, fcap. 8vo. red. to	0	1	0	*Houlston.*
Bruce (Charles L.) Races of the Old World, A Manual of Ethnology, cr. 8vo	0	9	0	*Murray.*
Buckland (Frank T.) Fish Hatching, cr. 8vo	0	5	0	*Tinsley.*
Butler (John) Horse, and How to Ride him, fcap. 8vo, red. to	0	1	6	*Houlston.*
Cassell's Popular Educator, Vol. 3, new edit., 4to	0	5	0	*Cassell.*
Chapman's Veterinarian's Pharmacopœia, 32mo	0	2	6	*Chapman.*
Davy (John) Physiological Researches, 8vo	0	15	0	*Williams & Nor.*
Engineer's Handy-Book (The), a Series of Calculations, 18mo	0	1	6	*Simpkin.*
Kemp (George) Description of certain Dry Processes in Photography, post 8vo	0	2	0	*Davies.*
Key (Lieut. G. T.) Table for Correction of Longitude, 8vo	0	2	0	*Bell & Daldy.*
Simmonds (P. L.) Dictionary of Trade Products, new edit., revised, fcap. 8vo	0	7	6	*Routledge.*
Sowerby's Grasses of Great Britain, new edit., roy. 8vo	1	14	0	*Hardwicke.*
——— Useful Plants of Great Britain, new edit., roy. 8vo	1	7	0	*Hardwicke.*
Templeton (W.) Engineers', Millwrights' and Machinists' Prac. Assistant, 3d ed. 18mo	0	2	6	*Lockwood.*
VanMonckhoven (D.) Pop. Treatise on Photography, tr. by W. H. Thornthwaite, 12mo	0	1	6	*Virtue.*
Woodcroft (Bennet) Brief Biographies of Inventors of Machines, post 8vo	0	2	6	*Longman.*

BOOKS RECENTLY PUBLISHED IN THE UNITED STATES.

Dussance (Prof. H.) Treatise on the Colouring Matters of Coal Tar, and their Practical Application; the Principles of the Art of Dyeing; and Description of Important New Dyes now in use. 12mo	$3 00	*H. C. Baird.*
Graham (Andrew J.) Standard Phonographic Dictionary, 12mo	3 00	*A. J. Graham.*
Hooker (Prof. W.) Science for the School and Family, Part I, 300 Engs., 12mo	1 00	*Harpers.*
How to Colour Photographs, paper	0 10	*Tilton & Co.*
Kemble (F. A.) Journal of a Residence on a Georgian Plantation in 1838-'9	1 25	*Harpers.*
Lessons from Insect Life, 18mo, numerous Illustrations	0 40	*Am. Tract Soc.*
Lewis (Dio, M.D.) Weak Lungs, and How to make them Strong. The Movement Cure. 12mo	1 25	*Ticknor & Fields.*
New York City Directory to May 1, 1864; 8vo	3 00	*J. F. Trow.*
Tyndall (John, F.R.S.) Heat considered as a mode of Motion, Illustrated, 8vo	2 00	*Appleton.*
Ure.—A Supplement to the Dictionary of Arts, Manufactures, and Mines. From the last edition, edited by Robert Hunt, F.R.S., F.S.S. Illustrated by 700 Engravings on wood. 8vo	6 00	*Appleton.*

British Patents.

ABRIDGED SPECIFICATIONS OF BRITISH PATENTS.

3041. E. Marriott and S. Holroyd. *Improvements in the purification of gas, and in obtaining certain useful products therefrom.* Dated November 11, 1862.

In purifying gas, the patentees use a combination of sulphate of iron with ammonia; and in carrying out this part of the invention, they take ammonical gas liquor, and add a solution of iron, so as to precipitate all the sulphides, and leave a slight excess of iron. This excess, however, must not be sufficient to neutralize all the ammonia present, but must leave the solution with a decided alkaline reaction. The quantity of iron to be added will vary with the composition of the gas liquor, but the fact of all the sulphides having been precipitated will be readily ascertained by test in the usual manner. The solution thus obtained, they use by pumping it continuously through the ordinary gas scrubbers, but as the iron will become decomposed during the process of purification, small quantities must from time to time be added. The necessity for such addition may be ascertained by the character of the gas as it passes off; if it be foul, more iron is then required, just after the same manner as the condition of the ordinary lime purifiers is ascertained. Secondly, the invention consists in treating the gas with sulphide or sulphuret of iron, and this necessarily takes place in carrying out the first part of these improvements. The invention, however, also consists in the use of sulphide or sulphuret of iron derived from other sources for purifying gas, either in the wet or the dry way.

3157. J. MOULE. *An improved method of deodorizing mineral oils and hydro-carbons.* Dated November 25, 1862.

This invention consists in using dentoxide of azote or nitrous gas in any form, or nitrous acid may be used, for the purpose of deodorizing and destroying the peculiar and disagreeable odour found in various samples of petroleum and other rock oils, including paraffin oil, and also for removing and changing the odour of other liquids, the products of petroleum, coal, and other substances.

3159. A. L. WOOLF. *A new or improved metallic alloy.* Dated November 25, 1862.

This invention consists of a new or improved metallic alloy, which is highly malleable and ductile, and of a colour scarcely to be distinguished from that of gold. The said alloy is less liable to oxidize or tarnish than other base metals or alloys, and is suited for the manufacture of jewellery; it may also be applied to other purposes. The said alloy is composed of from 90 to 100 parts weight of copper, from 5 to 7½ parts by weight of aluminum, and 2½ parts by weight of gold. In making the said alloy, it is only necessary to melt together in a crucible, the respective quantities of the several metals of which it is composed, when on fusion the metals immediately enter into alloy.

3170. J. STEINTHAL. *An improved moulder's blacking.* Dated November 26, 1862.

Instead of the ground charcoal hitherto used by moulders in the process of making metal castings, the patentee uses the following materials in about the following proportions:—Wood charcoal, 0·45; anthracite, commonly called shale or slate, 0·45; animal carbon, 0·10; with a small quantity of prussiate of potash. The said materials are to be well mixed together and reduced to a fine powder by grinding, pounding, or other suitable means. He subjects the anthracite used in the manufacture of this improved blacking to the process of cokeing in a stove or kiln, by which the paraffin, oily, and sulphurous substances and gases are extracted. The anthracite and animal carbon being non-conductors, withstand the sulphuric gases of the fluid metal, so that the coat of blacking between the mould and the metal remains intact, the fluid metal forming a perfect casting, thus preventing blisters and blemishes on the castings caused by the affinity of the sulphuric gases to the silicate contained in the sand.

Selected Articles.

EFFECTS OF VIBRATION ON WROUGHT IRON.

More than twenty years ago the cranked axle of a locomotive happened to break during the passage of a train from Paris to Versailles. The breaking of a crank-axle is, unfortunately, no very uncommon occurrence; in this case, however, it led to the deaths of nearly one hundred persons. An accident involving such a wholesale destruction of human life engaged universal attention, and the entire array of Continental science was soon called upon for an explanation of the disaster. It was noticed that the fractured part of the axle showed a crystalline structure; and upon this appearance the explanation was founded that the jarring naturally induced in a railway axle through the vibrations caused by the engine and rail led to the deterioration and ultimate destruction of its cohesive properties. The eminent French savant, Arago, considered that the crystallization of wrought iron was only a matter of time, the length of time being in an inverse ratio to the amount of the vibration. Ever since that period the question as to the "crystallization" of iron has been argued and re-argued *ad finitum*, by scientific and practical men, but without any definite settlement of the matter. Some have altogether denied the fact that any structural alteration in iron is caused by vibration; while others have as strenuously asserted that such a change does take place, accompanied with an actual metamorphosis in the structure of the metal. Several papers have been read on this question before the Institution of Civil Engineers, amongst which we may mention Mr. Hood's, on the "Changes of Internal Structure of Iron" (Proceedings of the Institution of Civil Engineers, Vol. II., page 180), and Mr. Thorneycroft's on the same subject (Pr. Ins. Civ. Eng., Vol. IX., page 295). In 1850, Mr. T. E. McConnell read a paper on "Railway Axles and their Deterioration," and the discussion that ensued elicited great difference of opinion on this question amongst the members of the Institute. The late Robert Stephenson controverted the assertion that iron was liable to crystalize, or to change its molecular structure, through vibration. He instanced the Cornish engine beam with a strain of 56 lb. per inch, and, nevertheless, "working eight or ten strokes per minute for more than twenty years;" and the connecting rod of a locomotive vibrating eight times per second for several years, "making more than 200 million times altogether, but the iron retained its fibrous structure." Mr. Slate stated that he had "made a machine in which he put an inch square bar, subjected to a constant strain of 5 tons, and an additional varying strain of 2½ tons, alternately raised and lowered by an eccentric 80 or 90 times per minute, and this motion was continued for so long a time that he considered it equal to ninety years railway working, but no change whatever was perceptible, and, therefore, he was one of those who did not believe in a change from a fibrous to a crystaline structure." Now, with all deference to such an authority as Robert Stephenson, it appears to us that the connecting rod of a locomotive is in a very different condition as regards jar and vibration to the cranked wheel or axle driven by the rod. There is no absolute jar on a connecting rod *working under ordinary circumstances*, and where the engine is properly balanced the rod suffers very little vibration. With the wheel and axle, however, the case is very different. There is a continual jarring—what may be termed a true jar—produced by *metal hammering on metal.* The inequalities of the permanent way, and the various oscillations of the engine and carriages must cause a very powerful and continued vibration of the locomotive and other axles. In the case of the Cornish engine there is none of the jar produced by the impact of metal on metal. This was also absent in Mr. Slate's experiments. We have noticed that the long-continued "chipping" of cast iron with a chipping chisel will often cause the head of the hammer to break in two, especially if the hammer be not struck truly on the chisel head. Here we have a somewhat similar case to that of a wheel on a badly kept permanent way.

There is one very common form in which iron is used that is peculiarly favourable to the developement of this jarring action. The different links of a common chain or cable have a continual tendency, when in use, to rattle and strike against each other. The iron forming a chain is necessarily cut up into a number of different parts, which are often obliged to reciprocate each other's blows while the chain is performing its duty; and, in addition to this, chains are often exposed to sudden and powerful tensions. We thus find that the greater number of complaints as to structural alterations in wrought iron have pointed to chains. Mr. McConnell, while speaking on "Railway Axles and their Deterioration" at the Institution of Civil Engineers, 1850, mentioned that another striking instance of the conversion of tough wrought iron into a brittle material is shown in the chain slings used for carrying the bars during the process of hammering at a forge. "He had lately an opportunity of observing a chain which had been in use for this purpose, and had become so extremely brittle that it was more like glass in its fracture than the strong tough iron which it had been when first made; and he was satisfied that it had only been subjected to this extreme jarring action for a few months, and had not been otherwise applied." The chains used on inclined planes are also stated to break very soon. It is notorious that the crane chains used in engineer's shops almost always become brittle after being two or three years in constant use; their original condition is, however, restored by annealing. The chains used in drawing the "stuff" in the Cornish mines are generally withdrawn from the shaft after six months' use. They are then rolled in a heap, and covered with a sort of cylindrical furnace, and brought to a red heat. This operation is intended to do away with the effect of the vibration. Several of the witnesses before the 1860 "Select Committee on Anchors and Chain Cables for the Merchant Service," recommended a similar operation for the chain cables of ships, to be repeated periodically in conjunction with a system of re-testing. This deteriorating process in cables is so fully acknowledged by practical men, that Mr. T. M. Gladstone, in his evidence before this committee, even put a numerical value upon it, and stated that the chains of a light vessel which are constantly at work would deteriorate at the rate of 10 per cent. in two years. In ordinary cases, the deterioration of the iron would amount to 5 per cent.; and "it would be continuous, until the chain would ultimately break as short as a pipe stem." The instances we have cited are thus drawn from the experience of the work-shop, the forge, the mine, the railway, and from seafaring life; and the concurrent and universal testimony of those whose lives—daily and hourly—depend on iron, certainly points to the fact that iron is rendered brittle by vibration or undue tension, perhaps combined with other causes, such as deflection, or any sudden chilling through frost, or by contact, while heated, with cold water.

The theories propounded to account for these molecular changes in iron have been very varied and numerous. Until the experiments lately made by Mr. Kirkaldy on wrought iron and steel, it was generally assumed that a crystalline structure, like that of cast iron, was induced in wrought iron by means of its gradual deterioration through the causes mentioned above. Mr. Kirkaldy has, however, shown that a crystalline appearance is the invariable result when wrought iron is *suddenly* broken; when *gradually*, a fibrous appearance is the result. He appears to consider that this observation has settled the question—as a crystallized fracture can be induced in any iron, the crystallized appearance noticed in iron after it has been in use is merely due to its sudden breakage. Now, as all his experiments appear to have been made on new iron; "on pieces taken promiscuously from engineers' or merchants' stores, except those marked *samples*, which were received from the makers," the question as to the gradual deterioration of iron while under the influences of wear and tear is still as far as ever from a solution. It would, no doubt, be difficult to adduce "conclusive proof that the iron which is produced of a crystalline character was once fibrous." Perhaps the only way would be to subject a tested bar to a true percussive action through some time, and to then test the resulting diminution of tensile strain. The experience as to iron undergoing a gradual deterioration under certain circumstances is too universal to be discredited. The multitude of theories put forth to account for it bear witness to the fact, although an explanation of the phenomenon is still required. Mr. Hood, in the paper we have alluded to, ascribes the changes in iron to the conjoint action of "percussive heat and magnetism." Mr. Thorneycroft ascribes it to deflection. Some adduce magnetism alone as a principal cause; others point to the original impurities in iron, such as sulphur, phosphorus, arsenic, &c. Mr. Roebling, a distinguished American engineer, assums that the drawn-out fibre of wrought iron is "composed of an aggregate of pure iron threads and leaves, enveloped in *cinder*. Wrought iron thus becomes brittle under long-continued vibration under tension, "*because the iron threads and laminæ become loosened in their cinder envelopes.*"

There is no doubt, also, that the question has been complicated by many specimens being originally weak, either from defective quality or from being burnt in the forging. The fact seems to be that we are very ignorant as to the ultimate molecular structure of iron, or, indeed, of any other substance. Why does the presence of a per centage of carbon, more or less, exert such a mysterious influence on the cohesive powers of iron? We may never know much more about molecular structure until, in combination with experiments such as those of Mr. Kirkaldy, a powerful microscope shall have been used to investigate the structure of the specimens. It is difficult to believe that a change in tensile strength is not accompanied with a change in molecular structure. Robert Stephenson pointed to the use of the miscroscope for examining the differences in fracture of so-called crystalline and fibrous iron. He stated that, under the microscope, there was no difference between a fibrous and a crystalline specimen of iron.

We are inclined to offer a fresh explanation of the deterioration of iron under vibration, and of the partial restoration of its tensile strength by annealing. Each bundle of fibres in a bar of wrought iron consists of a number of very small crystals. We might compare a piece of good wrought iron, properly forged or rolled, to an assemblage of strings, each string being composed of a thread of small crystals. An exaggerated picture could be afforded of this by imagining a bundle of glass threads. If the iron has been burnt in the manufacture, instead of these threads being continuous, they are broken in different parts of their length. The same effect is produced after a long-continued jar; there is a solution of continuity in the fibres—they are shaken apart, and the fibres of the iron threads are broken up into shorter pieces. Deflection will produce a similar effect. Frost, or a sudden chill, will contract the fibres, and they will be pulled asunder. On the application of a low red-heat—the process of annealing—the ends of the crystal threads again come into contact through the resulting expansion. The expansion of the whole mass favours the ultimate coherence of the fibres; and, on contracting, the wrought iron returns to its pristine state—that of a bundle of crystal fibres. Thus, under long-continued vibration—before it receives its *coup de grâce*—it is already partly broken; its intimate structure, inaccessible to the eye or to atmospheric influences, is already partially in fragments. The application of a *gradual* strain to iron thus deteriorated and brittle, would have the effect of drawing out the fibres that were still entire, leaving undisturbed the parts that had already given way in the interior. According to this it will be evident that the face of the fracture—at a right angle to the axis—of a bar of iron injured by vibration, would show no signs of injury; but if it were possible to examine the structure in a like line parallel to the axis of the bar, it would, perhaps, be seen that the fibres was broken up into pieces of different lengths.—*Mechanic's Magazine.*

FORGINGS IN IRON.

BY MR. MUIR, OF WOOLWICH ARSENAL.

After some preliminary observations, Mr. Muir said that the primary condition for obtaining a good forging, whether from under the tilt or the steam hammer, was, undoubtedly, the employment of good material.

In fagotting from slabs it should also be a rule to place invariably the thinnest slabs in the heart of the fagot, so as to ensure that the heat applied should permeate the whole mass equally. The proper construction of the furnace was another consideration of much moment, as was the employment of a skilful furnace-man. So great was the diversity of forging, both with regard to size and purpose, that it would be impossible to refer to each kind. It was only possible in a brief paper to mention some of the most important, and they in this case would be those which seem of the most difficult character, and which required the greatest amount of care and caution in their production. Such forging as were to have collars and projections were among the class named. In these it was of the highest importance to take down sufficient "stuff" to allow for finishing off, and to make sure that the projections were in their proper places. If the space between the collars were too little, the chances were that, in drawing out, the forging would become too small to turn up to the right size. If the space were too great, it involved the necessity of "upsetting" or staving up, and the grain of the iron was thus deranged and the forging would be consequently weakened.

It was a well-known fact that heavy shafts—for example, propeller shafts—which have to be coupled by means of large collars or flanges, are very difficult to forge soundly. Not unfrequently the collars were, after great care had been taken, found to be so hollow that a two-foot rule might be concealed in the central cavity. He (Mr. Muir) objected to having those collars rounded in forging, although he could find few who agreed with his views. It was far better, he believed, to forge the collars or flanges of such shafts as those he had referred to square, and to round them up afterwards. It was his impression that solidity would be found to result from this process in almost all cases; for if a proper heat were taken upon the the work, it was next to impossible for a square forging to be made hollow. On the contrary, a circular forging could scarcely be made solid. The advantages arising from the mode of procedure he had indicated were, he thought, undeniable; the objection to it was its extra cost.

In one remarkable instance he had been permitted to forge a propeller shaft with a square flange. At four heats the four corners of the square were taken off, the flange was rounded up, and the work proved, as he had anticipated, a great success. He entertained, moreover, a very strong opinion that the great difficulty which had been experienced in obtaining a sound malleable iron gun might be overcome by first forging it in the square instead of of the round form. There were many reasons for supposing—and, indeed, he might say that he knew—that many an important forging had been lost, or at least was sadly deteriorated, by the fagot having been composed of different kinds of iron: say, for example, hard and soft. In this case, there would be a natural resistance to amalgamation. Great care and practical judgment, therefore, were required in assorting the irons to be employed for particular forgings, and in putting them into classes in accordance with the special purpose to be served.

He would also recommend that, in any forging requiring taking down, well-rounded setts should be employed, so as to leave always a gusset or fillet which would save the grain of the iron, and could easily be turned off afterwards if required. It was desirable, also, to put the last wrought heat into the furnace, after it has been worked either by planishing or swaging, and thus bringing it to a low red-heat. This was a kind of annealing process which equalized the consistency of the surface. Beside if one part of the latter had happened to get a larger share of hammering than another, the forging would, while undergoing this ordeal, manifest a tendency to bend, and this would be the fitting time to straighten it. Whatever the nature of the piece of work in hand, only so much of it should be made hot, or at least be brought to a welding heat, as can be at the same time operated upon. The parts submitted to unnecessary heating will crystalize, and as a matter of course, become weak or brittle. In piecing or lengthening shafts, or large forgings of any kind, Mr. Muir recommended that when lays were used for the purpose, the scarfs of those lays should be left tolerably thick at the points. If they are thinned too much, the air acts upon them when drawn from the furnace, and they are sure to be too cold before reaching the anvil. The consequence will be disastrous if this contingency arise. You must then take another heat, without the certainty of being better off next time. It may become a sound union, but will it stand up to the required fire? As has been said, it is desirable in all cases to have the scarfs of the lays of a proper thickness to avoid these evils.

With regard to furnaces, Mr. Muir entered into some interesting particulars, for which we have not space, but he remarked that, when the work to be done was never likely to exceed a foot in thickness, he should suggest the following as proper proportions for the furnace:—3 ft. wide, and 22 in. high. At the door way the fire-grate would thus be 3 ft. by 3ft. The neck or flues should be 20 in. deep, and 14 in. wide. The chimney-stack should be at least 36 ft. in height, and the orifice 18 in. in diameter. The reader of the paper was rather disposed to invert the rule with regard to the taper usually given to the inside of furnace chimneys; he would have them wider at the top than at the base. He prophesied that, if such a plan were adopted, there would be fewer complaints in reference to defective draught.

Mr. Muir proceeded to remark upon the desirability of employing workmen who had theoretically and practically a knowledge of the material with which they had to deal, and of paying them in proportion to their merits.

A discussion followed, which was of an eminently practical character. Mr Onbridge complained that the vital question of the quality and kinds of fuel to be used in the preparation of forgings had not been touched upon.

Mr. Ives thought that further information might have been given as to the making up of forgings, the proper lay of the grain, so as to combine tightness with strength, &c.

Mr. Gray made some remarks of a similar tendency.

Mr. Stanly, in reference to a statement made by the reader of the paper, as to the superior strength of beams which tapered from the centre instead of being parallel, thought that such beams should not have a straight, but a curved, or parabolically curved, taper, in order to give the maximum of strength.

Mr. Seccomb was much more ready to undertake a forging than to talk about it. He entered, however, into some practical details in reference to forgings, which demonstrated his capability for both talking and working.

Mr. Stapho spoke at some length, and though approving of what Mr. Muir had said, pointed out numerous items of interest in relation to the subject which had been left unnoticed.

The Chairman must admit that he, too, felt a little disappointed with the paper. So far as it had gone, it was all very well, but it had not gone far enough. It was to be hoped that Mr. Muir would take an early opportunity of supplementing his work, and that other members of the Association who were so well qualified to enlighten and instruct would assist in the task. A more appropriate subject it would be difficult to find for the consideration of that Society, and it ought to be treated of in all its varied points. He was not without hope that the question of "Forgings in Iron" would ere long be re-opened in that room. Mr. Newton further suggested that the claims of the Messrs. James to the founding of the railway system as opposed to those of the Stephenson's, formed a legitimate and proper field of inquiry for the Foremen Engineers, whose object was to elicit truth and maintain it.—*Mechanic's Magazine.*

ON COLOURS, PERMANENT AND FUGITIVE.*

Colours, artist colours, may be classed as inorganic and organic, and may be described as being either permanent or fugitive, transparent or opaque. Their transparency or opacity, however, being more strictly artistic qualities, will not, except in the case of new claimants for palette fame, be remarked upon. As is their due, those pigments shall have precedence which are permanent, whether obtained from metals and earths, or from the vegetable and animal worlds.

Permanent Pigments.

Inorganic Yellows.

Aureolin.—There has, until within the last year or two, been wanting a yellow at once permanent, transparent, brilliant, and pure in tint. This void aureolin fills. The preparation being a trade secret, I shall not in courtesy enter into its composition, or attempt to describe a means of producing it. Suffice it to say that the colour is extremely beautiful, and, to my knowledge, is quite uninjured by air, light, time (that great enemy of artists), sulphuretted hydrogen, or by admixture with other pigments.

Cadmium Yellows are obtained from cadmium and sulphur. Being sulphides, they are not affected by impure air, and the deep gorgeous varieties may in other respects be safely relied upon. Those of a pale lemon hue should be regarded with suspicion. There were several samples of that tint shown at the International Exhibition both by foreign and British colour makers, but all, without exception, became, I noticed, gradually coated with white.

Lemon Yellow, produced from barium and chromium, when skilfully prepared, is a safe, reliable colour. Unlike chromates in general, it is not sensibly altered either by light or a foul atmosphere.

Mars Yellow is an artificially prepared ochre, of which the chief constituents are iron, silica and alumina. When pure it is a most stable pigment, of a clear, sober, gravel tint.

Except with respect to colour, the same remarks are applicable to the native iron earths, such as yellow ochre, Roman ochre, &c.

Organic Yellow.

Cyanogen Yellow, in the preparation of which, as its name denotes, cyanogen in some form or other

* From a paper on Picture Chemistry, by Thos. Salter, F.C.S., in the *Chemical News.*

is employed, was one of the many new pigments first introduced to the public by Messrs. Winsor and Newton at the last Exhibition. Of a gorgeously golden hue, it may claim to be our only permanent organic yellow. Less opaque than the cadmiums, it is quite as durable, and equally unaffected by sulphuretted hydrogen.

Inorganic Reds.

Indian Red is a dark peroxide of iron, of a purple-russet hue, brought, it is said, from Bengal. This nature-furnished pigment is but little altered either by light, time, impure air, or mixture.

Light Red, Venetian Red, &c., are iron ochres, either native or artificially prepared. Clear, though not bright in tint, they are most stable colours.

Vermillion, composed of mercury and sulphur, is the only brilliant inorganic red (iodide of mercury excepted) at present known, and the only permanent scarlet which the art world possesses. If true, neither exposure nor a foul atmosphere sensibly affect it.

Organic Reds.

Madder Carmine, Rose Madder, &c., are preparations of alumina or its compounds stained more or less deeply with the red colouring matter of the madder root. When skilfully made they are not liable to change by the action of either light or impure air, or admixture.

Fugitive Pigments

Inorganic Yellows.

Chrome Yellows, products of chromium and lead, become black by impure air, and cannot well be employed in admixture, ultimately destroying (for example) Prussian blue, when used therewith in the composition of greens.

Chromate of Cadmium, made from chromium and cadmium, is not sensibly affected by sulphuretted hydrogen, but soon greens by exposure. The very slight affinity which chromic acid has for cadmium, and the too great solubility of the chromate in water, render it ineligible as a pigment. A bright pale yellow, inclined to transparency, and not long introduced.

Naples Yellow, if true, is a compound of antimony and lead, and cannot be relied upon. Now, however, the colour sold under that name is sometimes nothing more than zinc-white tinted by cadmium yellow, in which case its permanency is unquestionable.

Orpiment, a poisonous preparation of arsenic and sulphur, is unstable in the light, and injurious to other colours.

Organic Yellows.

Gallstone is an animal calculus, formed in the gall-bladder, principally of oxen. Its rich golden yellow is quickly destroyed by light, though not apt to be altered by foul air.

Gamboge, a yellow gum obtained from Indian trees, and collected in a liquid state and dried, may be called a semi-fugitive pigment. Deepened by impure air, weakened by light, and injured by many metalline colours, gamboge is yet too useful to be dispensed with. It is especially serviceable as a glaze over other colours in water, when its resin acts as a varnish which protects them.

Indian Yellow, a urio-phosphate of lime, produced from the urine of the camel, is injured by light, air, and a foul atmosphere, and injures cochineal lakes, when used with them.

Inorganic Reds.

Pure Scarlet, a combination of iodine with mercury, is at once the most vivid and the most treacherous of all colours, and cannot be relied upon in the slightest degree. By exposure the scarlet vanishes altogether, leaving a pure white ground. By impure air the colour is utterly destroyed. When used in water, gum ammoniac or a glaze of gamboge are advantageous accompaniments.

Red Lead, a deutoxide of lead, is blackened and ultimately metallised by sulphuretted hydrogen, although, if pure, not liable to be altered by light.

Organic Reds.

Dragon's Blood, a resinous substance, brought chiefly from the East Indies, is sometimes used to colour varnishes, &c., being soluble in oils and alcohol, but as a pigment does not merit the artist's attention. It is darkened by light and impure air.

Lakes of Cochineal, aluminous bases stained with the colouring matter of the insect—coccus cacti—comprise crimson lake, carmine, &c., and are unrivalled in their richness and beauty. Far surpassing the madder preparations in depth and brilliancy, they are as much inferior to them in permanency, their colour being quickly discharged by exposure to light.

Inorganic Blues.

Antwerp Blue is a lighter and brighter Prussian blue, containing a larger excess of alumina, but possessing all the qualities of

Prussian Blue.—This blue, being compounded of iron, alumina, and ferro-*cyanogen,* may be called a semi-organic pigment, and described as semi-fugitive. Though its tints fade by the action of strong light, and are darkened by damp or impure air, yet when used in deep washes, its body somewhat secures its permanence, and its transparency gives force to its depth.

Verditer, in the preparation of which copper and lime are employed, is greened and ultimately blackened by time, damp, and impure air. There are copper compounds, such as mountain blue, &c., but they should all be avoided by the artist.

Organic Blues.

Indigo, the produce of several East and West India plants, is injured by impure air, and in other respects is inferior in durability to Prussian blue.

Intense Blue is indigo refined by solution and precipitation. The process renders it rather more durable than before, and much more powerful and deep. It is apt, however, when not well freed from the acid and saline matter used in its preparation, to penetrate the paper on which it is employed.

Inorganic Greens.

Scheele's Green, a rankly poisonous compound of arsenic and copper, may fairly be called the most popular and best abused of all inorganic colours. Although blackened by impure air, the palette, at any rate, could ill do without it, for, when required, no mixture will serve as a substitute. As vivid in its way as iodide of mercury, it immediately attracts the eye to any part of a picture in which it may be placed. Non-artistically speaking, the lavish employment of this dangerous colour for painting toys, the leaves of artificial flowers, and paper-hangings, and for mechanically dyeing thin gauzy dresses, may well be regretted. Much nonsense has been written about this green being prone to volatilise, and much good sense about its liability to become detached, to drop or be brushed off, and so to float about in the atmosphere. For toys, at least, this pigment should never be used, and people would do considerable service by refusing to buy them if suspiciously bright in colour. It is one of the pleasures of childhood, a pleasure no no child can resist, of sucking or biting anything and everything which comes in its way. If, therefore, the attractively green handle of a roller or what not becomes suddenly shabby, it may be taken for granted that a certain amount of arsenic has been rapturously swallowed by its little owner. For ourselves, if we must have poison on our heads, our clothes, and our walls, means should be taken of securely fixing it by a proper proportion of albumen or other suitable substance. In the case of paper, perhaps a glaze of gamboge might be found advantageous, that pigment being, as has been before remarked, "especially serviceable as a glaze over other colours in water, where its resin acts as a varnish which protects them." For the rest, until a new colour equally vivid and equally cheap is discovered, this preparation of arsenic will continue in use. The only way is to limit that use as much as possible, and to find out the best and safest mode of employing it.

There are also several other copper products, such as verdigris, mountain green, &c., but as pigments they are all too fugitive to be safely employed.

Organic Greens.

Prussian Green may rather be classed as organic than inorganic, inasmuch as it is now generally a mixture of gamboge with Prussian blue, itself containing cyanogen. It is neither permanent nor very unstable.

Sap Green, prepared from the juice of the berries of the buckthorn, &c., has but little durability in water-colour painting, and less in oil.

Inorganic Orange.

Chrome Orange, obtained by the action of an alkali on the yellow chromate of lead, is liable, though in a somewhat less degree, to the changes and affinities of that substance.

Organic Orange.

Chinese Orange, produced, it is said, from aniline, is of a rich, sober, orange-russet colour, and is very transparent. It is unfortunately blackened by sulphuretted hydrogen. Quite new.

Inorganic Purples.

There are no fugitive inorganic purples in common use, except those made by mixing red and blue.

Organic Purples.

Burnt Carmine is the carmine of cochineal partially charred. In colour it resembles the purple of gold, but not in durability, being, like carmine itself, fugitive.

A want of permanency is likewise possessed by the other cochineal purples, purple lake and violet carmine.

Inorganic Browns.

Cadmium Brown, prepared by igniting carbonate of cadmium, was shown for a short time in the International Exhibition;—for a short time, because it had to be speedily withdrawn on account of its rapid whitening, which takes place in this way: When the white carbonate of cadmium is thoroughly burnt, it becomes converted into the brown oxide, or cadmium brown. By exposure, this brown oxide eagerly absorbs carbonic acid from the atmosphere—so eagerly, that in a few weeks it is once more a carbonate, and as purely white as before. This utterly worthless preparation is opaque, and of an agreeable yellow-brown tint.

Organic Browns.

There are too many browns permanent, whether inorganic or organic, for fugitive preparations to be usually employed.

Inorganic and Organic Blacks.

No fugitive blacks are now used.

Inorganic Whites.

Lead Whites are mostly carbonate of lead, and are sold under various names, such as flake white, cremnitz white, &c. They are all blackened by sulphuretted hydrogen, and are injurious to cochineal lakes, gamboge, orpiment, &c.

Pearl White, prepared from bismuth, turns black in impure air. It is chiefly used as a cosmetic by ladies, to whom an atmosphere free from sulphuretted hydrogen is especially desirable.

Organic Whites.

There are no fugitive as there are no permanent organic whites.

ON THE PERMANENCY OF PHOTOGRAPHS.

In May, 1855, a committee, consisting of Mr. Delamottee, Mr. Hardwich, Dr. Percy, Mr. Henry Pollock, Mr. Shadbolt and Dr. Diamond, was appointed by the Photographic Society for this purpose, His Royal Highness the Prince Consort contributing the sum of £50 towards the expenses of the inquiry. The special objects of the committee were thus stated:

1st. To report upon the evidence that can be collected with regard to photographs that have been printed for a long time; to ascertain whether there are any that appear to be quite unaltered by time, and, wherever it is practicable, to find out the methods by which they were prepared.

2nd. To conduct a series of experiments carefully, preparing photographs by different means, and exposing them under various circumstances, in order to ascertain what method combines in the highest degree the essential qualities of permanency and beauty.

Circular letters were addressed by the committee to photographers of experience and reputation, asking them to assist in the purposes of the inquiry by information and suggestions, and also by contributions of prints, with particulars of the method of producing them, in order that the fullest experiment and examination might be made. The results of this inquiry were furnished in the following report:—

Evidence of Permanence.

"The Committee have unquestionable evidence of the existence of photographs which have remained unaltered for more than ten years, prepared by salting plain paper with a chloride, afterwards making it sensitive with either nitrate or ammonio nitrate of silver, fixing with a freshly-made solution of hypo-sulphite of soda and washing in water; also of positives produced by Mr. Talbot's negative process.

"They have not been able to obtain evidence of photographs having been prepared at all upon albuminized paper, or colored with a salt of gold or fixed with 'old hypo,' so long ago as ten years.

"They have, however, ample evidence of the existence of unaltered photographs so prepared five, six and seven years ago.

"They have not found that any method of printing which has been commonly followed will necessarily produce fading pictures, if certain precautions be adopted; nor have they evidence that any method which has been adopted will not produce fading pictures unless such precautions are taken.

Causes of Fading.

"The most common cause of fading has been the presence of hyposulphite of soda, left in the paper from imperfect washing after fixing.

"The Committee think it right to state that they have been unable to find any test to be relied upon, which can be used to detect a minute portion of hyposulphite of soda, in the presence of the other substances which are obtained by boiling photographs in distilled water and evaporating to dryness; yet they have no doubt of the truth of the above statement, from the history given of the mode of washing adopted.

The continued action of sulphuretted hydrogen and water will rapidly destroy every kind of photograph; and as there are traces of this gas at all times present in the atmosphere (and occasionally in a London atmosphere, very evident traces) it appears reasonable to suppose that what is effected rapidly in the laboratory with a strong solution of the gas, will take place also slowly but surely in the presence of moisture, by the action of the very minute portion in the atmosphere.

"The Committee find that there is no known method of producing pictures which will remain unaltered under the continued action of moisture and the atmosphere in London.

"They find that pictures may be exposed to dry sulphuretted hydrogen gas for some time with comparatively little alteration, and that pictures, in the coloration of which gold has been used, are acted upon by the gas, whether dry or in solution, less rapidly than any others.

"They also find that some pictures which have remained unaltered for years, kept in dry places, have rapidly faded when exposed to a moist atmosphere.

"Hence it appears that the most ordinary cause of fading may be traced to the presence of sulphur, the source of which may be intrinsic from hyposulphite left in the print, or extrinsic from the atmosphere, and in either case the action is much more rapid in the presence of moisture.

Mode of Mounting Photographs.

"The Committee find that taking equal weights dried at a temperature of 212°, of the three substances most frequently used, viz., gelatine, gum, and paste, the latter attracts nearly twice as much moisture as either of the former; and as in practice a much smaller weight of gelatine is used than of gum, gelatine appears to be the best medium of these three; and the Committee have evidence of fading having in some cases been produced by the use of paste.

"In illustration of some of the circumstances alluded to above, the Committee think it well to mention some instances of prints at present in their possession.

"Out of several prepared together in 1844, three only are unaltered, and these were varnished soon after their preparation with copal varnish.

"Half of another print of the same date was varnished, and the other half left; the unvarnished half was faded, the varnished remains unaltered. Three pictures were prepared in 1846, all at the same time, with the same treatment: when finished, one was kept unmounted; the other two were mounted with flour-paste at the same time, one of these latter having been first coated with Canada balsam; at present the unmounted one and the one protected with the balsam are unchanged whereas the other has faded.

"A picture prepared in 1846 was so exposed that the lower part of it became wetted with rain; at present the part so wetted has faded, while the rest of it remains unaltered. Several pictures were prepared and mounted about ten years ago, and kept a dry room for about three years without any change, after which they were placed in a very damp situation, and then faded decidedly in a few months.

"The Committee propose very shortly to actually test the durability of the various modes of printing by exposing pictures to different treatment, and they have been fortunate enough to obtain a grant of space for this purpose from the Crystal Palace Company.

"The Committee make the following suggestions arising out of the above report:

"1. That the greatest care should be bestowed upon the washing of the prints after the use of hyposulphate of soda, and for this purpose hot water is very much better than cold.

"2. The majority of the Committee think that gold, in some form, should be used in the preparation of pictures, although every variety of tint may be obtained without it.

"3. That photographs be kept dry.

"4. That trials be made of substances likely to protect the prints from air and moisture, such as caoutchouc, gutta percha, wax, and the different varnishes."

ON THE SUBSTITUTION OF SOLUBLE GLASS FOR THE RESINOUS SOAP USED IN THE MANUFACTURE OF ORDINARY SOAP.

BY MR. FR. STORER.

In many countries, but especially in America, enormous quantities of colophony have long been used in making hard brown or yellow soap. These compound soaps are very useful, and in point of cheapness no other soap can compete with resinous soap. The civil war in America, by causing the blockade of the ports of the slave States, whence most of the rosin is derived, has induced an extraordinary rise in the price of colophony, so that the further manufacture of cheap soaps seemed for the time arrested.

The attention of soapmakers is then directed to the preparation of soaps containing silicate of soda. The idea of employing soluble glass is by no means new. Its application to this purpose was long ago proposed and patented by M. Wilson, followed by M. M. Sheridan, Gossage, and others. It seems to have been recently taken up anew in England. But the American process differs notably from those previously in use, by making use of a product rich in silica, capable of forming a hard and comparatively neutral soap, instead of the extremely alkaline mixtures of the above-mentioned inventors.

This constitutes another example of the rapidity with which one industrial process displaces another, previously preferred, but whose further development is impeded by circumstances.

The American process commences in preparing by the dry way a silicate of soda containing five equivalents of silica and two of soda, which is dissolved by prolonged boiling in water. The solution is sometimes hastened by pressure.

The limpid solution, freed from all insoluble impurities, is decanted and concentrated to about 35° B., 1.32 specific gravity being the state in which it is sold.

After preparing by the usual process a certain quantity of pure soap with tallow, oil, or other kind of grease, and when the boiling is just finished, it is poured, while still hot and in a fluid state, into forms or moulds, and the desired quantity of concentrated solution of silicate of soda, either cold or heated, is added at the same instant. To incorporate the silicate thoroughly, the mass is stirred, until the cooling renders this operation difficult. It is then left to harden. By this process the silicate of soda becomes so perfectly incorporated with the soap that as much as 60 per cent. of this solution at 35° B. may be added, and yet yield a soap of adequate consistency. But generally not more than from 25 to 40 per cent. of silicate is added to the soap.

It is this power of adding so large a proportion of alkaline silicate thoroughly saturated with silica which forms one of the great advantages of the American process. According to M. Steeber's experiments (Wagner, *Chim. Tech.*, p. 128), it is possible to mix only small quantities of the more alkaline silicates, such as were formerly used, with hard tallow or oil soaps, for when more is added the excess separates.

The experience of some American soapmakers who have recently tried to introduce 32 per cent. silicate of soda into their soaps, confirms M. Steeber's opinion.

Soap prepared by the American process differs materially from ordinary rosin soap neither in appearance nor action. It has passed satisfactorily through the trial of a great demand during the past year, and appears to serve perfectly well for all the uses to which ordinary soap is applied. The American Government has already bought large quantities of it for the use of the army at a much lower price than was formerly given for resinous soaps, and it as undergone all the tests exacted by the agents of the Federal Government.

We may remark that a mixture of silicate of soda and ordinary soap has been preferably used for some time in washing woollen fabrics in one of the largest establishments of the United States.

Silicate of soda is useful to soapmakers for several qualities not possessed by rosin ; for instance, the addition of a large quantity of silicate of soda imparts to the soap neither that disagreeable odour nor the glueiness which too great a proportion of rosin communicates. It may be introduced into soap in much larger proportions than rosin without in any way injuring the sale of the product.

It is not probable that rosin will ever resume its former importance to the soapmaker. It will still be used conjointly with the silicate of soda, since a little rosin serves to correct the nauseating odours of inferior fats, and because, according to some makers, it augments the detersive action of the soap.

The use of soluble glass in hard soaps should not be confounded with the use as detergents of simple solutions of silicate of soda, as described by M. Kopp in the *Répertoire*, vol. 1., p. 193. The latter are simply alkaline solutions, similar to those of alkaline carbonates. They act chiefly, if not wholly, by their chemical nature, for they do not lather, and in that and other respects are unlike real soaps; while the silicate of soda soap, owing to the portion of fatty acid it contains, lathers abundantly, and behaves like ordinary soap, the mechanical and chemical conditions required by a good soap being fulfilled.

It should be borne in mind that silicate of soda soap is distinct from siliciferous soaps formerly prepared by the mechanical addition of silica or of some insoluble silicate, such as silicate of alumina, which is simply a useless adulteration, while in soaps containing soluble glass a portion of fatty acid, so to speak, is replaced by a weak mineral acid, equally efficacious in modifying the causticity of the alkali.

These silicate soaps must not be confounded with the "Marseilles soap," which, when genuine, is still the soap *par excellence*. I am far from thinking that the silicate of soda produces soap equal to that made strictly from fatty bodies.

FLAX MACHINES.

On page 38 of this journal for the year 1862, we published a woodcut and description of a new and improved Flax Scutching Machine, patented by Messrs. J. Rowan & Co., of Belfast; four of which machines were imported by the Canadian Government, for the use of such parties as might require them.

Owing to the very high price and scarcity of all cotton goods, the cultivation of flax, and its preparation for market, is of immense importance, both to this and the mother country, as is shown in another article on flax, which can be found on a preceding page. We are therefore gratified to notice any new improvements that may be made in the machinery requisite for its preparation.

At the annual meeting of the Chemico-Agricultural Society, recently held in Belfast, a new

American Flax Break was introduced by Mr. Guild, and highly commended:

MR. GUILD.—I beg to bring under the notice of the Chemico-Agricultural Society a new American invention, for more thoroughly breaking flax straw, and so preparing it for the operation of scutching that the adhesion of the boon or shoove to the fibre is so slight that the scutching can be performed in less time, and the yield of fibre will be greater, than if the breaking be performed by any machine now in use. Nearly two hundred of Sandford & Mallory's flax and hemp breaks are at work in America, and the saving effected by their use is such, that the machine is paid for in from twenty to thirty days. They are simple in construction, portable, not weighing over 10 cwt., do not occupy more than five feet square, require less than one horse power to drive, and no skilled attendance, will break from 20 to 30 cwt. of straw per day, taking from it in the operation from 34 lbs. to 50 lbs. per cwt. of shoove, and will give an increased yield of fibre of from 6 to 38 per cent., according to the nature of the straw. No particular machine is required to scutch with afterwards; that operation can be performed by hand, or by the ordinary mill stocks; if by the latter, much less speed will be necessary, at least one-third less than if the straw were broken on ordinary rollers. The flax produced is also softer, and more stones can be cleaned to the hand per day, whilst the tow left is clean, and worth nearly double the common scutching tow. The machine consists of an iron frame, carrying two pairs of fluted metal rollers, the flutes being of a peculiar shape; to these rollers is communicated a rapid vibrating backward and forward motion, whereby the straw is crushed and rubbed so as effectually to loosen and shake off the shoove, and by an ingenious arrangement a continuous progressive movement is given to the rollers, as well as the vibrating motion, whereby the straw is fed through in a steady stream. No more hands are required to work this break than those now in use; the straw is streaked ere being presented to the rollers, and is ready for the scutchers as it comes out. The machine arrived here at so late a period in the season, when most of the scutch mills had ceased working, that I had difficulty in getting the trials I wished. Still, through the kindness of some gentlemen, I am able to give the Society a statement of a few. The Rev. Joseph Bradshaw, Milecross, Newtownards, writes me, under date March 7:

"SIR,—The flax straw (112 lbs.) which was put through your brake (Sandford & Mallory's patent) produced, when cleaned or dressed, 22 lbs. 4 oz.; whilst another lot of exactly the same kind of flax, and same weight, produced 20 lbs. 10 oz.; thus showing a difference of 1 lb. 10 oz. in favour of the American brake.

"I superintended the operations of both parcels from first to last, so that I can guarantee the accuracy of the result. The second lot was done in the ordinary way, having been rolled by wooden rollers, and afterwards scutched at three handles driven by a water wheel; the first lot, after being passed through your brake, was likewise scutched in a similar manner by the same men at the same stands; so that I consider there could not have been a fairer experiment than the one I made.

"I remain, &c., JOSEPH BRADSHAW.

"Mr. Alex. Guild, Belfast."

And Mr. John Williamson, Roughport, at whose scutch mill a machine has been at work for a month, says, in a letter dated the 9th instant:

"ROUGHPORT, April 9, 1863.

"DEAR SIR,—I have to report to you on the merits of Sandford & Mallory's American brake, which has been at my scutch mill for the last three weeks. I have tried it on various kinds of straw, and find the results as follows: On very poor and hard straw I found a gain of 1 lb. per cwt. over the same broken by ordinary rollers; on medium quality of straw a gain of 2 lbs. 4 oz. per cwt., the yield by your break being 18 lbs. 4 oz. against 16 lbs. on same straw broken by ordinary method. On very tender straw over-watered the gain was 3½ lbs. per cwt., the yield by your brake being 14½ lbs. against 11 lbs. by ordinary method. I find the flax from your rollers easier scutched, and the yield softer to feel (and the quality improved), than that rolled in the ordinary way.

"Yours truly, JOHN WILLIAMSON.

"Mr. Alex. Guild, Belfast."

It will be seen that the saving in overwatered and tender straw is very great. In America, even better results have been obtained, and I have several certificates to that effect; but I prefer that the machine should make its way here on its merits, as tested here; and I shall feel under obligations to the Society if they will appoint suitable parties to test the merits of the invention in a thorough manner. There is a machine at work every day at Messrs. Thompson & Co.'s foundry, Brown Square, and any gentleman is welcome to bring his own straw and experiment for himself. Mr. Williamson has also kindly offered to show the one at his place at work to any one calling. I may mention here that the machine breaks hemp so thoroughly, that little or no scutching is required afterwards. The price complete is £50.

On this subject the New York *Working Farmer* says:

From the inquiries which prevailed among farmers a few months since, upon the subject of Flax culture, we presume that much more than the usual breadth of land has been devoted to this crop the present season. We expect to receive shortly the reports of the Commissioner of Agriculture for the month of June, in which the statistics of the flax crop, so far as ascertained, will be presented, and we shall then be enabled to judge of the prospective yield of this great staple for the year 1863.

We have every reason to believe, however, that the crop of 1863 will be enormous, as compared with that of other years, and consequently we desire again to call the attention of flax growers to the unprecedented merits of Sanford & Mallory's new Flax Brake. On page 161 will be found a fine representation of this ingenious and efficient machine, and also many flattering testimonials from those who have used it for months, showing its great superiority to any flax brake previously in use. In our August number we shall publish similar recommendations from other parties, as the proprietors desire that the public shall become fully acquainted with those *practical tests* and well authenticated *facts*, which furnish an indisputable criterion of the great merits of their machine. Over *seventy* of these flax brakes have been sold in various sections of the country during the past eight months, and no better test of their efficiency can be asked, than the uniformly favorable reports and opinions of the different operators.

Messrs. Sanford & Mallory are now manufacturing a small machine—costing only $155—admirably adapted to the wants of the farmer. We witnessed its operation a few days since, at their rooms in the Harlem Railroad Buildings, corner of White and Centre streets, New York; and while the work it performs fully equals in quality that of the larger machines, the labour required to drive it is hardly as great as that of turning a grindstone. Every farmer who has a crop of flax to prepare for market, should order one of these small brakes immediately, as it will pay for itself in one season, in the saving it will effect in the preparation of his flax, and its transportation to market. We ought to thank the persevering industry of the inventors, who have brought out this new flax brake in the very nick of time, when the demand for flax as a substitute for cotton, and the scarcity of labourers on account of the war, render a machine of this description a prime desideratum in the economy of the farm.

ON THE PROGRESS OF THE PETROLEUM TRADE.

There is no record in the commercial history of this or any other country in the world of a natural product or an article of manufacture becoming so generally known and appreciated in so short a period as petroleum. When Queen Elizabeth put on the first pair of silk stockings ever worn in England, many years elapsed before they came into general use among her subjects; and long after her death, when in the year 1601 tea was first brought to Europe by the former Dutch East India Company, and fifty years later (1660), imported into England as an article of luxury and novelty by Lord Arlington and Lord Ossory, who brought over some from Holland, what a time it took to become even generally known in this country; for we find that half a century subsequently (1711), the quantity imported for home consumption was only 141,995lbs., whilst it has taken another century and a half since then to make it what it has now become—a favourite beverage in general and daily consumption in every house throughout the length and breadth of the kingdom. The same remarks apply equally to coffee, sugar, cocoa, spices, and many other articles no longer considered as luxuries, but rather as necessaries of life, and of general and everyday consumption.

On the other hand, we have had occasion several times to point out the wonderfully rapid and unprecedented development of the trade in petroleum, and in our remarks in the *Oil Trade Review* for May we showed the statistical returns for the first quarters of this year and the two previous ones, from which we learn that the export from the United States two years ago was only 60,021 gallons, whilst in the first quarter of the present year it had risen to more than nine millions of gallons, being an increase in two years of *above fifteen thousand per cent.!*

According to the analysis of the French chemists, Pelouze and Cahours, petroleum contains a number of different gases, the most inflammable of which boils at 30 deg. of Celsius' centigrade thermometer (86 deg. F.), and the least at 180 to 184 deg. C. (388 to 395 deg. F.) Refined petroleum, which alone is suited for burning in lamps, has undergone distillation, and is free from the most volatile gases. Several recipes for experimental tests have been recommended, to convince people that the oil is sufficiently purified for use, the most simple and practical of which is as follows:—Fill a glass about a third full with petroleum, and then pour in an equal quantity of water, of the temperature of 70 to 80 deg. C. (158 to 176 deg. F.). If the oil is not pure, or at least not sufficiently refined, the mixture generates gas that will ignite if brought into contact with a flame. This is the surest and most efficient means of obtaining positive proof that the petroleum contains none, or but very little, of the more volatile carbonated hydrogen. The refined petroleum sold in our shops will easily stand this test, which is further confirmed by a reference to the temperature of its boiling point. At 87 deg. C. (187 deg. F.), it begins to boil slightly, and it is only when the thermometer rises to the great height of 120 deg. C. (280 deg. F.), the boiling point of the water being 212 deg. F.), that it may be said to take fire rapidly and become dangerous. It appears then that well-refined petroleum is less inflammable, and consequently less dangerous than alcohol.

The test above described is more preferable than the one recommended by the Belgian Board of Health, at Brussels, and circulated in all the foreign newspapers. It is as follows:—"Fill a cup an inch deep with petroleum and apply a burning match to the liquid. If the petroleum is pure, the match will consume itself without igniting the former." But this test is by no means to be universally depended on, as the result arises very much from the greater or lesser steadiness with which the experimenter holds the light on the oil. A burning piece of common writing paper ought to go out without igniting good purified petroleum; but by a little dexterity in the management it will continue to burn, feeding the flame with the liquid, and at length igniting the latter.

But the recommendations of the above-named Board of Health at Brussels, about the careful use of the petroleum lamp, are so excellent, that they cannot be too widely made known and generally attended to. We therefore extract the following part for the benefit of our readers:—

"The lamp should always be kept hermetically closed; for whenener there is an opening that admits a direct communication between the oil holding receptacle and the flame, the lamp ought not to be used, as an explosion may ensue. The receptacle may contain more petroleum than is sufficient for one burning, and should be made of glass or other transparent material, so that the quantity of liquid in it may be easily ascertained. The foot of the lamp ought to be broad and heavily weighted, so as to give it greater stability, and prevent its being easily upset. Care should be taken, before lighting the lamp, to see that there is a sufficiency of petroleum in the receptacle, and should it, nevertheless, be consumed earlier than expected or required, the flame must be first extinguished, and time allowed for the lamp to cool, before refilling and lighting it again."—*London Grocer*.

HOME MANUFACTURE—THE EASTWOOD BARREL FACTORY.

The proper application of capital, with a wise division of labour has raised sections to world-wide celebrity, and what has produced community advancement in England and America, will hardly fail in a new and advancing country like Canada. Every day we are directed to the gaining importance of some locality that even the map of our county fails to point out.

Cobourg, at one time, for the character of its textile exportations, stood in the front rank of our manufacturing towns. Now, Georgetown and Hespeller claim attention, the former for its paper, its carpet, and its cloths, the latter for its whiskey and domestic manufactures.

The little village of Eastwood, a point on the Great Western, about four miles from Woodstock, is putting forth efforts that deserve notice, and not in one line alone, but in several of the most important branches of industry.

The highest brands of flour that find sale in the Boston market are those of the Eastwood Mills, and the lumber from the Blandford forests is excelled by no other in Canada, being colourless, and wholly free from resinous substances.

The most important branch of the extensive trade carried on by the Messrs. Burrows & Co., is the manufacture of barrels. The necessity for these articles, consequent on the developement of Canadian Petroleum, induced this interprising firm to engage in this new trade, and possessing themselves of the practical abilities of Mr. Peter Welsh of Oswego, the original inventor of machinery for the manufacture of barrels, they have now the satisfaction of realizing their utmost expectations, not merely as to the efficiency of the machinery employed, but in public appreciation of the manufactures.

Barrel making by machinery, i. e., chiefly by machinery, has not the novelty of newness; for years ago, by artificial means, in conjunction with hand labor, the manipulation of timber into barrels was a common practice. The peculiarity of the machinery employed by the Messrs. Burrows is that artificial means accomplishes everything. The very logs are elevated to, and secured on the platform of the first saw, by steam power. The huge monarch of the forest is thus separated into parts by machinery, either for staves or headings, the former by a curiously constructed saucer-like shaped circular saw, that only requires to be set in motion and kept supplied, producing staves of exact thickness, and with the proper bilge, at the rate of 3,000 per diem, or 6,000 in the twenty-four hours. These staves are then passed by means of simple agents into the kilns for drying, and wnen thus treated are carried to the jointing-machine. This jointing machine is a very curious but not complex contrivance, patented by Mr. Welch, and is the only one in use in Canada. It consists of two fine circular saws, guided by cranks and elbows in such a manner as to give to each stave the proper excess of centre surface, and with the requisite bevel to form the barrel, and all this is done while the stave is forced into the position it is intended to occupy when associated with others in the perfect manufacture. The stave thus prepared comes to the hands of lads whose business consists in setting them up, and subjecting them to the action of the heating machine, which establishes the solidity of the article, the warmth in easy yielding to the pressure of the hoops used in tying the staves. The barrel is next passed to the man who superintends the machine that perfects the chime, and the exactness with which this is accomplished, and the rapidity is marvellous. The heads are then put in, and the iron hoops forced on, and the barrel is completed. Those intended for the reception of coal-oil are charged with a glutenous compound, that is by steam forced into the pores of the wood, and all this is accomplished without the aid of plane or drawing knife—machinery has done all—"setting up" and hooping alone excepted.

In ordinary barrel-making, no little trouble is expended in giving to the iron hoop not only its circular shape, but its bevel, inducing it to set level on the bilge of the barrel. This is no trouble to the Messrs. Borrows. Machinery cuts the iron into the given lengths, and at the same time punches the holes for the rivets. Rollers of a pecular construction form the hoop, and in doing so shape it in conformity with the bilge of the barrel. A circular plane cleans the pieces intended for heads; the holes for the pegs that constitute that constitute the fastening, is the work of machinery and even the pegs are produced from waste stuff by artificial means. A circular saw, acting with a revolving table, shapes the head, and following the saw, is a plane that gives it the edge requisite.

Thus it will be seen that manual labour is in a great degree discarded. Mechanical ingenuity, with capital are the chief agents. The capabilities of this factory, reconing twenty staves to the barrel which we believe to be the number used, will give a daily average of one hundred and fifty, or three hundred, if the business require a double set of hands. This has not yet been tried. The barrels produced are of three descriptions:—of oak and of oak and pine—a stave of each description of wood placed alternately—and of pine. Those who have tried the pine barrels pronounce it superior, the staves being of equal thickness in the centre with the ends, and the centre having the perfect grain of the wood, strength is secured; while pine though softer, is less porous, and consequently better fitted for the secure custody of coal oil. The machinery is equal for the one description or the other, and in price there is but a slight difference. Already these manufactures have found a preference, and we shall be much surprised if the Eastwood barrel is not the only one in use when properly tested. The combined business directed by this firm gives employment to about forty hands, including the superintendance of Mr. Welch, who, in his intercourse with the public, as well as in his management of this extensive trade, puts forth evidences of gentlemanly parts, with great practical skill. Eastwood may well feel proud of its mechanical powers, and our wish is that continued success will attend the highly creditable efforts of the Messrs. R. W. & A. Burrows & Co.—*Woodstock (U. C.) Times.*

THE SCIENTIFIC BALLOON ASCENT.

Blackheath, July 6th, 1863.

In my eleventh ascent—that from Wolverton—I had furnished myself with a second spectroscope, whose slit I could open at pleasure, leaving the larger with its slit adjusted for observations on the sun itself.

The circumstances of the ascent, however, were so remarkable, experiencing clouds to the height of 4 miles, and encountering a snow-storm on descending from 3 miles to 2 miles, that I had no opportunity of using the larger spectroscope at all, and the smaller for a few minutes only, at our highest elevation, viz., exceeding 4 miles: there the sky was of a very pale blue colour, the atmosphere was misty, and the spectrum as seen through the small spectroscope, was exactly as when viewed from the earth when the air is misty and the sky of the same degree of faint blue.

The action of the wet-bulb thermometer on this occasion, when the temperature was approaching to and passing below 32°, was remarkable; its reading continued to descend to 26°, whilst the reading of the dry-bulb was above 32°; but on the latter passing below 32° the wet-bulb increased to 32°, and continued therefor some time, whilst the dry-bulb continued to decrease; then a slight decrease of the wet to 31° took place, and then very suddenly it passed to its proper reading some degrees below the dry, and then acted well at all temperatures till the reading of the dry-bulb ascended above 32°; its proper action was then checked for a time, till, in fact, all the ice was melted from the conducting-thread and bulb, a process which alone can be performed in the situation by taking the bulb and conducting-thread into the mouth, being, in fact, the only source of heat at command. Mr. Lowe had forwarded to me to Wolverton, on the day of ascent, several bottles of ozone powders made from starch derived from different grains and vegetables; but the circumstances were not favourable; they were all, however, deeply tinged, whilst ozone papers were very slightly coloured.

At the highest point reached, about 4½ miles, the sky was very much covered with cirrus clouds; the sky as seen between them was of a very faint blue, as seen from below through a moist atmosphere; we were above clouds, but there were no fine views or forms; all was confused and dirty-looking,—no bright shining surfaces, or anything picturesque,—and the view was exceedingly limited, owing to the thick and murky atmosphere.

At 2h. 3m., on descending, we lost even the faint sun, and re-entered fog, and experienced a decline of temperature of 9° in little more than a minute. At 2h. 6m. there were faint gleams of light; fog was both above and below, but not near us. At 2h. 7m. large drops of water fell from the balloon, covering my notebook; the next minute we were enveloped in fog, which became very thin at 2h. 14m. At 2h. 14½m. rain fell pattering on the balloon; this was shortly succeeded by snow, and for a space of nearly 4000 feet we passed through a snow-storm; there were many spiculæ and cross-spiculæ, with snow-crystals small in size, but distinct; there were few, if any, flakes; as we descended the snow seemed to rise above us.

At 2h. 17m. we passed below the regions of snow, and shortly afterwards we saw a canal, and then another, each being straight for miles apparently. The state of the lower atmosphere was most remarkable; Mr. Coxwell had never seen it so murky before; when far from a town, it was of a brownish, yellowish tinge, and remarkably dull. No distance on land could be seen.

When at the height of 1 mile, we had no more sand, and simply became a falling body, checked somewhat by the balloon; we threw away leaden weights, &c., to help to check the rapidity of descent. The ground wind was strong, and the descent was somewhat rough; we rebounded from the earth three or four times, and finally the grapnel caught in a water-course.

Photographic papers of two kinds were taken up, the one prepared with iodide of silver and the other with chloride of silver: and arrangements were made that both kinds (part of the same sheets of paper) should be observed at Greenwich in the first minute of every five minutes from noon to 5 o'clock. The comparison of results shows all much deeper colours at Greenwich at first, but the sky at Greenwich was not cloudy for three hours after it was overcast at Wolverton; but coloration of both kinds of paper under a cloudy sky was very nearly the same as that in the balloon.

JAMES GLAISHER.

OCEAN TELEGRAPH LINES.

An international conference has lately been held in Paris, which was attended by representatives from several Governments, for the purpose of examining into the project of a new telegraphic line between Europe and America, by Arturo De Marcoartu, chief engineer of the Spanish corps, who has forwarded to us a short treatise on the subject. In this production its author discusses the merits of the several projected lines for establishing Atlantic ocean telegraphy. The new line is set forth as a universal telegraphic enterprise, not to be under the control of any particular Government, but to be cosmopolitan in its character, open to the people of all nations. It is proposed to commence the line at Cape St. Vincent in Spain, and to reach America at Cape San Roque, Brazil, touching at several islands in the Atlantic, which are to form stations, and the whole oceanic line to consist of seven submarine cables of different lengths. It will start from Cadiz, run to the island of Madeira, 616 miles, next to the Canaries, by a section of cable 318 miles; thence to Cape Blanco, 533 miles; then to Cape Verde islands, 652 miles; next to Penedo de San Pedro, 1,000 miles, thence to Fernando Norona, 392 miles; and from that point to Cape San Roque, Brazil, 226 miles. The total length of line by this route will be 3,746 miles divided into seven sections of submarine cable. From Brazil it is proposed to extend the line to New York, by way of the West India islands and Cuba, with a line of six cables having a total length of 4,594 miles, thus making the entire line to New York from Europe 8,340 miles long.

It is undoubtedly much easier to work short than long submarine lines, and some of the intermediate stations on the proposed line are important positions, but compared with the line between Ireland and Newfoundland thence to New York, the expense of constructing it must be prodigious. The longest section of a cable required on this old route is 2,200 miles, while there are three sections of cable required by the new route, each of which exceeds 1,000 miles in length. If a cable can be laid and worked successfully between Ireland and Newfoundland, this will form the cheapest and most advantageous route. It is now known that the old Atlantic cable was defectively constructed, and it is asserted that, by recent improvements in the construction of cables and in apparatus for working them, no difficulty will be experienced in laying and operating the long line of 2,200 miles; therefore we hope it may soon be commenced and carried out with vigor and success. No person, however, can object to the objects endeavored to be secured by the newly-proposed line of M. De Marcoartu, namely, a universal enterprise of a cosmopolitan interest. We would like to see several ocean-telegraph lines established, if there were sufficient business to render them necessary and remunerative. Every commercial tie of this character which binds nations together exerts a beneficial influence.

There are forty-five submarine telegraph cables in operation. The first was laid between England and France, a distance of 25 miles, in 1851, and has thus been twelve years in operation. The longest, between Malta and Alexandria, is 1,535 miles long, and has been in operation about one and a-half years. The success of this line affords a guarantee for the proposed line between Ireland and America, which require a cable of only 665 miles greater length, but the distance between the two shores is not quite seventeen hundred miles. —*Scientific American.*

Miscellaneous.

Ultramarine Blue.

"The composition for a dark aluminous ultramarine consists of 100 parts of slightly burned kaolin (porcelain clay), 90 parts of soda-ash (95 p. c.), 100 parts of refined roll sulphur, 6 parts of rosin, and 4 of dry pine charcoal. Each of these ingredients is powdered, with the exception of the rosin, which is only added in pieces the size of a walnut when the materials have been mixed, and the whole is rolled together for the space of four hours. It then forms a smooth gray powder, and is loosely packed into fire-proof boxes, which are covered up, properly luted, and placed on the lower floor; and after closing up all the apertures of the furnace, it is rapidly brought to a point of temperature equivalent to the fusing point of an alloy of equal parts of gold and silver, at which temperature the oven is kept for from five to six hours. By means of small tubes inserted in the front of the furnaces, the process is watched: samples being taken from time to time, by means of hollow cylinder screws. When these samples remain of a green color on cooling, the fire is gradually slackened, and afterwards the draught is shut off; the furnace being left to cool for 28 hours. Two days afterwards the mass is removed from the boxes. It is first broken up under mill-stones, then finely powdered, filled into cast iron annealing boxes (1½ feet high, 2 feet long, and 1½ feet wide on top, somewhat narrower in the bottom, the iron ½ of an inch thick), the covers of which overlap the sides. These boxes are placed on the upper floor of the furnace, at the same time that a fresh charge is placed on the lower floor; and are removed about twelve hours after the firing has ceased. This annealing or coloring, which changes the green to blue, by partly oxidising, and partly removing an excess of sulphur, is similar to the process of coloring red lead.

"The blue pigment now obtained is lixiviated, and then, while moist, ground between granite or quartz millstones. When the desired fineness is obtained, the pulp is run into draining bags, and afterwards put in cast-iron dishes, which are also placed in the upper floor of the furnaces to dry, whenever the iron annealing boxes have been removed. On the Rhine, some factories are supplied with reverberatory furnaces, the soles of which are heated from below by the fire, which then again passes over the charge before reaching the flue. Such furnaces hold as much of the crude materials as will yield about 1,300 pounds of ultramarine.

"Another method consists in mixing the materials in smaller quantities, and forming them into batches, in boxes containing only about 700 pounds each. These boxes are placed in pairs on the benches of a double floor reverberatory furnace, constructed after the manner of a smalt furnace, heated by one fire, which first passes around the boxes on the lower floor, and from underneath them to the upper floor. The masonry of the lower floor is fire-brick, the supports of both soles and arches being stone, and the upper floor is formed of iron plates. The boxes are made from fire-proof tiles, one inch thick, grooved and let in at the edges. The fuel used is bituminous coal." *Dingler's Journal.*

Photo-zincography and Photo-papyrography.

It is curious to note, whenever the properties of any substance, (if light can be so designated) have been discovered, and the students of the science are intent upon multiplying the variety of its applications, how by apparent accident, and sometimes coincidently, the phenomena of a new art are suggested to persons widely sundered by place and circumstances. Colonel Sir Henry James, at Southamption, and Mr. Osborne, at the Antipodes (Melbourne), hit upon the zincograph in the same month: the latter obtaining for his invention a patent, with a reward of 1,000*l.* from the spirited and munificent government of Victoria; Colonel James and his accomplished subordinate, Captain A. DeC. Scott, resting content under the conscious sense of public usefulness with the honour conferred by the noble and enlightened of all lands. In December, 1859, an ingenious young lady asks Sir Henry how she could get her etchings cheaply printed; and he takes one of them to the Ordinace Office at Southampton, submits it to the chromo-carbon process, and transfers the imprint to the zinc plate.—This was the first zincograph. Again, shortly afterwards, one of the workmen having, by mistake laid the ink on the wrong side of the paper, thus giving a reversed outline, Sir Henry obtains from this negative on paper a copy of the original, and ascertains that the negative can be printed on paper instead of glass.—Here was the first papyrograph. Now, by these discoveries we possess the means of reproducing, with a fidelity, cheapness, and durability hitherto unattained, copies of any subject unaltered, enlarged, or reduced in size, and with every graduation of shade or tone; for the lithographic ink used, of which the main ingredient is pure carbon, is like the carbonized ink of some of the ancient palimpsests, ineffaceable except by the destruction of the material on which it is inscribed. In the reduction of plans and maps the greatest deviation by the photographic process did not amount to $\frac{1}{100}$th part of an inch in the rectangle; and even this minute error is not cumulative, and can be estimated with mathematical accuracy, if required. With deeds, MSS. and all artistic and natural objects, so minute a deviation would, even if appreciable, be of no consequence. It would not be admissible to detail here the modes and manipulation of these novel appliances of photography, which afford to all the learned professions, as well as the workers in every employment, useful and ornamental, advantages as widely diffused as the very light which is their intervenient instrument; but the manipulation is not so difficult, nor the materials so expensive, as to prevent the practice of photo-zinctography and photo-papyrography even by lady amateurs, who would wish to furnish their drawing rooms with fac-similes of objects of rare beauty and elegance, whether the originals be the productions of their own talent, or gathered from the kingdoms of Nature and of Art. JOHN LOCKE.

Vats, their Construction and Working.

A solid dye of indigo-blue is given to wool plunging it into an alkaline solution of indigo-white, and then exposing it to contact with the air. The solution of indigo-white is prepared in a vessel usually from eight to nine feet in depth, and six to seven feet in diameter, which should be made of wood or copper, and always bears the name of *vat.* This sise is very convenient for the requisite manipitulation, and presents a large volume of water, which, when once heated, is capable of preserving a high temperature for a long time. These vats are covered with wooden lids, divided into two or three equal segments, covered over with thick blankets. Without this precaution the bath would be more or less exposed to the atmosphere, and a portion of the indigo, absorbing oxygen, would be precipitated. There would also be a great waste of heat.

A most necessary operation, and one of frequent recurrence, consists in agitating the deposit of vegetal and coloring matter which is formed in the vat, and intimately mixing it in the bath. For this purpose a utensil, called a *rake,* which is sometimes formed of a strong square piece of wood with perforations therein, and set on a long handle, is employed. In Britain it is generally made of iron, with a wooden handle. The workman takes hold of the handle with both hands, and, dipping the flat surface into the subsidence at the bottom of the vessel, he quickly draws it up until it nearly reaches the surface, when, giving it a gentle shake he discharges the matter again through the whole liquor of the bath. This manœuvre is repeated until the whole of the deposit seems to be removed from the bottom of the vessel. Before the tissue is dipped into the dye-bath, it should be soaked in a copper full of tepid water; it is then to be hung up and beaten with sticks. In this state it is plunged into the vat, and thus introduces less air into the bath, while the fibre is more uniformly penetrated by the indigo solution. The cloth is now kept in a depth of from two to three feet below the surface of the liquid, by means of an open bag or piece of net-work, fixed in the interior of an iron ring, which is suspended by cords, and fixed to the outside of the vat by means of two small iron hooks; the bag is thus drawn backwards and forwards without permitting it to come in contact with the air. When this operation has been continued for a sufficient length of time, the cloth is wrung and hung up to dry.

Flock wool, when dyed, is also enclosed in a fine net, which prevents the least particle from escaping, and which is fixed in the bath in the same way as in the foregoing case.

The many inconveniences attending the use of a wooden vat—the pouring of the liquor into a copper, for the purpose of giving it the requisite degree of heat, being necessary—have led to the general employment of copper or iron vessels. In England the latter are chiefly used. These are fixed in brickwork, which extends half-way up their surface, whilst a stove is so constructed at this elevation, that the flame shall play around their upper part. By this means the vat is heated, and kept at a proper temperature, without the liquor being removed.

The potassa vats are usually formed of conical shaped coppers surrounded by a suitable furnace. These may be constructed with less depth, inasmuch as there is less precipitation induced in the liquor. By using steam to heat the vats, the use of copper vessels might be dispensed with, and so a return to those of wood adopted.

The vats employed for dyeing wool are known under the name of the pastil vat, the woad vat, the potassa vat, the tartarlic vat and the German vat.

Steam Trumpets.

A good deal has been said lately in London about "steam trumpets" as a mode of signalling on railways. It appears that these instruments are the invention of a Dr. Upham, of Boston. About a year ago he obtained the use of two locomotives for the purpose of an experimental talk by the sounds of the steam-whistle. The inventor had attached several contrivances to the whistle in the shape of bells, trombones, and clarionets; and by means of these he was enabled to represent the sounds of the alphabet by very different sounds. He found that by their means he could convey a message to a distance of three miles, which could be heard and understood even amid the more immediate sounds produced by the movement of a railway train. The doctor has, it is said, found it possible, by the simple trumpet, to transmit any message, however long or complicated, the distance of a mile.

The total exports of petroleum from Philadelphia from January 1 to June 13, 1863, were 3,745,771 gallons; New York, 10,581,437; Boston, 1,144,701 and from Baltimore, 536,530 gallons.

Discoveries at Rome.

In a letter addressed to the *Nation*, M. Duchesnay gives an interesting account of the discoveries lately made in the environs of Rome on the spot where Constantine defeated Maxentius, that is near Cremera, outside the Porta del Popolo. On one of the hills of that locality a villa believed to have belonged to Calphuruia, Cæser's wife, has this year been entirely exhumed. One of the conduit-pipes found on the spot bears the name of that lady. At an insignificant depth below the surface of the soil a suite of rooms has been found, which must have been the ground floor of the villa. The walls of one of these rooms are decorated with painted landscapes; one of them represents a grove of palm and orange trees, with fruits and birds on the branches. The colours are perfectly well preserved, and as vivad as if they had been painted but a few days ago. The ceilings had fallen in, but from the fragments it is easy to perceive that they were decorated with aerial figures similar to those discovered at Pompeii. Glass and pottery have also been found on the spot; but the great object of attraction is a beautiful marble statue of Augustus, in his triumphal robes, open enough to reveal a richly-sculptured breastplate, the subjects of which are Rome with a cornucopia, and the twins by her side; Apollo with his lyre, mounted on a hippogryph; Diana with a hart, Mars sheathing his sword, a trophy, and a triumphal car drawn by four horses, and preceded by winged figures of Victory. The feet of this statue are broken off, but not lost; one of them is flanked by a Cupid on a dolphin. The statue is two and a-half metres in height, and bears evident traces of paint on its surface. The busts of Septimus Severus, his wife, and his son Geta have also been found.

A Sensitive Thermometer.

At a recent meeting of the Manchester Literary & Philosophical Society, Dr. Joule made the following communication respecting a new and extremely sensitive thermometer:—"Some years ago I remarked the disturbing influence of currents of air on finely suspended magnetic needles, and suggested that it might be made use of as a delicate test of temperature. I have lately carried out the idea into practice, and have obtained results beyond my expectation. A glass vessel in the shape of a tube, two feet long and four inches in diameter, was divided longitudinally by a blackened pasteboard diaphargm, leaving spaces on the top and bottom, each a little over one inch. At the top space a bit of magnetised sewing needle, furnished with a glass index, is suspended by a single filament of silk. It is evident that the arrangement is similar to that of a "bratticed" coal pit shaft, and that the slightest excess of temperature on one side over that on the other must occasion a circulation of air, which will ascend on the heated side, and after passing along the fine glass index, descend on the other side. It is also evident that the sensibility of the instrument may be increased to any required extent, by diminishing the directive force of the magnetic needle. I purpose to make several improvements in my present instrument, but in its present condition the heat radiated by a small pan, containing a pint of water heated 30 degrees, is quite perceptible at a distance of three yards. A further proof of the extreme sensibility of the instrument is obtained from the fact that it is able to detect the heat radiated by the moon. A beam of moonlight was admitted through a slit in a shutter. As the moon (nearly full) travelled from left to right the beam passed gradually across the instrument, causing the index to be deflected several degrees, first to the left and then to the right. The effect showed, according to a very rough estimate, that the air in the instrument must have been heated by the moon's rays a few ten-thousandths of a degree, or by a quantity no doubt the equivalent of the light absorbed by the blackened surface on which the rays fell." (A few months ago Professor Tyndal, the popular lecturer at the Royal Institution, London, described experiments which he had made, and which he alleged proved that the moon radiated cold, instead of heat. Dr. Joule's new and sensitive instrument appears to negative, in the most direct manner, the Professor's conclusion.)—*Manchester Courier.*

The Antiquities of Mexico.

The Scientific commission which accompanies the French expedition in Mexico, will have an opportunity to make some interesting researches, in consequence of the recent discovery in the midst of the forests of ruins of majestic appearance and great antiquity. The buildings are supposed to have been erected by a civilised nation, existing at least seven centuries before the discovery of Christopher Columbus. The most probable suppositions attribute their construction to an emigrant people who, having crossed Behring's Straits, occupied Mexico, then advanced as far as Peru, where Cyclopean monuments are still found, and afterwards, being driven back from the South, attained their highest degree of civilisation in the peninsula of Yucatan, where the most remarkable palaces are now to be seen. Among the French travelers whose relations have thrown light on the past of the New World, the most recent are those of M. Brasseur de Bourbourg and M. Desire Charnay. The latter, who is a distinguished artist and literary man, was deterred by no difficulty. He proceeded to those antiquities buried in the depths of virgin forests, in contempt of Indian balls, and the thousands of serpents which now take shelter among the ruins. He brought back valuable notes of his journey, and an album of photographic drawings is now being published under the patronage of the Emperor.—*Paris Papers.*

To Measure an Acre.

Land, 30¼ square yards make 1 square rod; 40 square rods make 1 square rood; 4 square roods, 1 acre; 640 acres, 1 square mile; 4,840 square yards, or 160 rods, make 1 acre. In measuring an acre by yards, the usual practice is to trace off 70 yards in length and 70 yards in width. This, in a rough way, may be considered near enough for practical purposes; but as 70 yards either way make 4,900 square yards, it exceeds one acre by 60 yards. To determine an accurate acre it may be measured 70 yards in length by 69 1·7 yards in width. The same result may be arrived at by measuring 220 feet in length, and 198 feet in width, or by measuring 73¼ in length by 66 yards in breadth."

Magnesium.

Magnesium, although a less plentiful constituent of the earth's crust than calcium, enters into the constitution af a great variety of minerals. It is found occasionally combined with phosphorus and with boracic acids. But it is in combination with silicic acid that it is most universally diffused. Precious serpentine, and meerschaum, are hydrated silicates of magnesium. Venetian talc, white augite, amianthus, and the varieties of amphibole, are also examples of silicates of magnesium associated with more or less of foreign substances. Carbonate of magnesium forms a range of low hills in India. The rarer hydrate occurs in a few localities. But the most economically important mineral containing magnesium is Dolomite, which consists of carbonates of magnesium and of calcium, and usually overlies (with or without the intervention of sandstone conglomerate) the coal formation. In England the magnesian limestone formation extends, with little interval, from Tynemouth to Nottingham, a distance of 147 miles. At Sunderland the bed is fully 600 feet thick. It is this magnesian limestone which furnishes most, if not all, of the magnesia prepared in this country. Abroad, magnesia is economically obtained from the mother-liquors left after sea-water has been evaporated down for its salt. Probably these mother-liquors will ultimately turn out the best source of magnesium, since here the metal is associated with chlorine, and it is from the chloride that the metal is most readily procurable. Every ton of sea-water contains a fraction over two pounds avoirdupois of magnesium in combination with chlorine, and almost exactly half that quantity combined with sulphuric acid. A rough calculation shows that, if the surface of the ocean be taken at twice that of the land, and its average depth at three miles, then the specific gravity of magnesium being 1·75, the ocean contains about 160,000 cubic miles of magnesium.

Railways.

An elaborate statistical article on railways appears in a late number of the London *Engineer*, from which we select a few results. The actual extent of railway now open throughout the world is probably about 70,000 miles, and the capital expenditure nearly one thousand one hundred and seventy millions sterling. This vast sum has almost wholly been raised and expended within twenty-five years. The share of this immense capital which Great Britain and its colonies have expended appears to be upwards of four hundred and seventeen millions sterling, and the miles of open railway on which it has been expended amount to 14,277. On the continental railways, four hundred and seventy-six millions and a half sterling have been expended on 22,692 miles of open railway. On the North and South American continents, exclusive of British possessions, about two hundred and fifty-seven millions and a quarter sterling have been expended in India on 1,408 miles of open railway, and upwards of twenty millions and a half in Canada, on 1,408 miles of open railway. Nearly ten millions have already been expended in Victoria on 183 miles of Railway; but in such cases as those of Victoria and India, works in progress are included in the expenditure named. France has expended upwards of one hundred and eighty-four millions and a half on 6,147 miles of open railway; Prussia, forty-four millions and upwards on 9,162 miles of open railway; Austria, forty-five millions and a quarter on 9,165 miles; Spain, twenty-six millions on 1,450 miles; Italy, twenty-five millions on 1,350 miles; Russia, forty-three millions and upwards on 1,289 miles; Belgium, eighteen milions on 955 miles; Switzerland, ten millions on 600 miles; Egypt, four millions on 204 miles; the United States, one hundred and ninety-three millions and a half on 22,384 miles; the Confederate States, nearly forty-nine millions on 8,784 miles; Brazil, five millions on 111 miles and others in progress.

The Test for Grease.

If whilst camphor is actively moving on water, the most minute particle of certain greasy substances only touch the water, instantaneously as if by some magic shot, the camphor is deprived of all motion, and repelled. The scene of previous activity is changed to the immobility of death.

By availing ourselves of this curious property of camphor we may detect grease in quantities so extremely minute, as would almost appear fabulous.

New Mode of Lighting Churches.

A novel mode of lighting has been introduced at a Baptist church, just built at Philadelphia. There is not a gas-burner in the audience-room. In the panels of the ceiling are circles of ground glass, two feet in diameter. Above each of these, in the loft, is an argand burner, and over the burner a powerful reflector. The effect is just about the same as if there were thirty full moons shining in the ceiling. The light is not sharp and intense, but abundant and mellow, and not painful to the eyes.

New Fibre Plant.

There is a weed called the *sida retusa*, which grows wild in unfrequented streets and vacant places at Brisbane, in Eastern Australia, and was looked upon there as a pest. This weed has been found to yield a valuable fibre., and £30 a ton for 3,000 tons have been offered for it for shipment to England.

Natural Barometers.

Chick-weed is an excellent Barometer. When the flower expands fully, we are not to expect rain for several hours; should it continue in that state, no rain will disturb the summer's day. When it half conceals its miniature flower the day is generally showry; but if it entirely shuts up, or veils the white flower with its green mantle, let the traaveller put on his great coat. The different species of trefoils always contract their leaves at the approach of a storm; so certainly does this take place, that these plants acquire the name of the husbandman's barometer. The tulip, and several of the compound yellow flowers, all close before rain. There is a species of wood-sorrel which doubles its leavs before storms. The bauhinia, or mountain ebony, capial and sensitive plants, observe the same habits.

Practical Hints for the Construction of Lightning Conductors.

Beginning at the upper end of the lightning conductor we have first the platina point; it generally suffices to be made 1½ in. high and ⅝ in. diameter at its base; the base of the copper cone 11-16ths in., while the iron rod is ¾ in. diameter, copper being a better conductor than iron. It is preferable to make the rod of round, rather than of square iron. The rod should increase in diameter downwards, and should consist of 6 ft. lengths, each welded together—these lengths are screwed together with 1 in. gas thread sockets. If the ground string of the conductor is to be led overground, it ought to be 11-16ths of an inch, if underground, ¾ of an inch diameter, in either case to be made of bar iron and not wire cable. The copper cone is 11-16ths of an inch diameter screwed and 1½ in. long; the iron rod adjoining is screwed similarly; but one must have a left and the other a right handed thread, joined by a corresponding screwed socket, the end of the rods abutting against each other. All the other joints to be made in the same way. The horizontal string of the conductor joined to the vertical by hard-soldering a ring welded on to the former to the latter. The ground string terminates in a cast-iron pipe filled with charcoal, and with a hermetically closed cover, screwed at the part where the conductor passes through. The end of the conductor is screwed into a metallic disc. If it is led into a well, the disc should be of cast-iron of from 6½ to 8½ sq. ft. area, resting on the bottom of the well. If it ends in the earth, however, the end should be of a copper cylinder, of 10 to 20 sq. ft. superficial area, according to the moisture in the soil. The diffusion of the current is more effective, the larger the surface. If the ground string is made of wire cable, the end of the same should be soft soldered into a piece of iron, whose other end is screwed. A screwed socket joins the same to the ring, or other part of the conductor. The mode of joining by screwed sockets is simple and cheap and is very convenient in laying the ground string of the conductor when made of round bar iron, as recommended.—*Practical Mechanics' Journal.*

Wilkinson's Rotary Printing Press.

Macniven and Cameron's Paper Trade Review gives a description of this new printing machine, which, it says, will print at least twice as fast as any now used. It will throw off with ease twenty thousand sheets an hour, printed on both sides, cut and folded, ready for immediate delivery. The process of printing with this machine may be described briefly as follows:—The paper being made of the proper width for the sheet intended to be printed, is wound upon a shaft in one continuous piece, in the same form as an ordinary roll of carpeting, and, at the same time, is damped so as to enable it to take a perfect impression. The type, which is slightly conical in form, is placed upon the surfaces of two cylinders, the circumferences of each of which is exactly equal to the length of the newspaper to be printed. Each type is made in the precise line of the radius of the cylinder on which it is placed, and a small projection on one side of the type, with a corresponding indentation on the other, furnishes a means of locking the type together on the surface of the sylinder, so that it is impossible to displace them by the most rapid rotary motion. The machine being set in motion by any ordinary power, the paper is unwound from its shaft by the action of an endless apron, by which it is carried forward and introduced between the first type cylinder and corresponding press roller, where the impression on one side the paper is made. After this first impression, the paper is still carried forward in a direct line, and immediately passes between the second type cylender and press roller, by which the impression is made on the reverse side. The sheet being now printed on both sides, is still carried forward into the apparatus by which it is folded, and at the precise point when the folding process is completed, a heavy standing shears, by a single blow, separates it from its original roll, and it drops upon the floor a printed newspaper, ready for immediate distribution.

Photographic Gas.

A prospectus as been issued of the Photogenic Gas Company for the purpose of introducing the patent of Mr. Mongruel, which is alleged to produce either from ordinary gas or from atmospheric air, a light more powerful, cheap, and healthy than any hitherto known. The proposed capital is £200,000 (of which one-half is to be first put forth) in shares of £20. The price to be paid for the patent is £5,000 in cash and £45,000 in shares.

Cape Race Electric Telegraph Company.

The preliminary announcement has been made of a new project, bearing the title of the Cape Race Electric Telegraph and Lightship Company (Limited). It is intended to construct, equip, and station a steam lightship off Cape Race, Newfoundbound to and from the North American Colonies land, in the track of steam and sailing ships and the northern ports of the United States. The lightship will have telegraphic communication with the shore by means of a submarine cable, one end of which is to be worked on board the vessel. It is urged that by these means there may be obviated throughout one-half of every year an unnecessary delay of three days, which now occurs in the receipt and exchange of news between Europe and America. Various other useful services are to be rendered, with the aid of a steam tender. The capital proposed is £100,000.

Strychnine.

Dr. Riederhoff, says *Galignani*, has successfully administered fatty substances as an antidote to strychnine. From experiments instituted on about 30 dogs and rabbits, it appears that the absorption of strychnine and its compounds is prevented by administering fat, butter, or oil, the first being more active. Time is thus gained to proceed to other remedies, such as emetics; but as any fatty substance also impedes the action of the latter, they must be given in larger doses, or else the stomach-pump should be used. At all events, fat seems to be more efficacious than other antidotes in the case of poisoning by strychnine, especially more so than morphine, conicine, or aconitine.

Concentration of Sulphuric Acid.

For many purposes sulphuric acid is required of greater density than 1·750, as it is obtained by concentration in lead pans. In South Lancashire not less than 700 tons of concentrated acid is made weekly. The use of glass vessels for this purpose has been largely superseded by the use of platinum retorts. The enormous cost of these vessels is partly due to the unjust and unenlightened monopoly exercised by the Russian Government, and to the circumstance that the manufacture of platinum is in the hands of few persons.

Experience has shown that under the influence of boiling sulphuric acid, platinum is gradually acted upon, particularly in the presence of nitric or nitrous acids. To obviate these disadvantages, cast iron retorts, partly filled with sand or gypsum, have been tried, but not very generally. The proposal recently made by M. Keller, to evaporate by exhaustion, has not been more favourably received, though it would admit of vessels being used for the purpose that could not otherwise be used. This plan was proposed by M. Kuhlmann several years ago.

In America, Mr. Clough has obtained a patent for a method of concentration based on the fact that lead is not acted upon by sulphuric acid, even when concentrated, at the ordinary temperature. It consists in heating the surface of the acid in a leaden pan contained in a cast-iron case, with a current of cold water between them. Mr. Shanks and others have, for some time, adopted similar plans, but they have not become general.

In 1850, Mr. Gossage, jun., obtained a patent for the concentration of sulphuric acid by means of a current of heated air passed through a column of flints in a lead cylinder, against a shower of the acid. He found that the concentration could be effected in this way at a much lower temperature than any other way, but unfortunately the acid was also evaporated with the water to a great extent.

In many factories, especially in Lancashire, platinum vessels are no longer used, and glass retorts of a larger size than were formerly used are being substituted in their place. These glass retorts are heated either by the bare fire or in a sand bath, and the temperature of the retort-house is kept very high, in order to protect the upper parts of the retorts from sudden cooling. The retorts are filled with hot acid, and the concentrated acid is drawn off by a syphon. In France platinum retorts are still used generally.

Monhaden Oil.

In the Peconic Bay there are no less than six manufactories, consuming, in the aggregate about 2,000,000 fish weekly. The fish are caught in Gardiner's Bay mostly, where they abound in great quantities. They are taken by what we call purse seines, and can be caught in any depth of water. The seine is made (as its name indicates) like an old fashioned purse; after rowing around the fish, the bottom is closed by a purse line, and the fish are secure. There are four companies of fishermen from Rhode Island here at this time, having from four to five large boats apiece, and from eight to nine men. The fish are bought for $1 per thousand. These seines some days catch 150,000 each, which you see makes a paying business of it. The manufactories are nearly all on different plans. Some use large tanks, in which the fish are placed, and into which steam is forced. A portion of the oil is extracted, coming on the surface of the water, and is skimmed off; the water is then drained off, and the refuse is pressed by hydraulic presses or powerful levers. In another way of working, used by one manufactory, the fish are placed in a large iron cylinder, similar to a boiler, and steam is let in at a given pressure, while the cylinder is made to rotate by a steam-engine. The fish are steamed from twelve to fifteen minutes, then turned out and subjected to hydraulic pressure, which, of course, extracts oil and water together. This runs off through pipes into tanks, where the oil rises to the top and is taken off. There is a patent for this cylinder style, as it is called. The fish, after being pressed, are dried on large platforms (some of them covering half an acre of ground), and, after being thoroughly dried, the mass is ground into what is called fish guano, ranging in price from $25 to $35 per ton, and is considered an excellent fertilizer. These manufactories employ from fifteen to sixty men each, and consume an enormous quantity of fish. That it is a paying business I have no doubt, considering the amount invested, which is considerable, the manufactories costing from $10,000 to $60,000 each.—*W. Hill, Greenport, L. I.*

Opening of the Bhore Ghaut Railway Incline.

Such events as the celebration of the opening of the Bhore Ghaut incline of the Great Indian Railway, present a refreshing contrast with the sad records of daily intestine strife which Indian papers but too lately presented. We hail the increased development of railway communication in our Indian dependencies as an assurance of peace and tranquility not likely to be easily disturbed. The active part taken by the Government in the promotion of this line goes far to prove, that England at least understands that the civilization of India should be one of her first objects. Little doubt remains that to her we may in future look for the greater proportion of our cotton supply; and the success which has attended the working of the heavy inclines on this line proves, plainly enough, that there will be no difficulty whatever in supplying a means of transit by which the precious material may easily be brought to convenient shipping ports. The *Bombay Saturday Review* says:—

"The Incline reaches at one long lift the height of 1,832 ft., the highest elevation yet attained by any railway incline. It is 15½ miles long, and its average gradient consequently 1 in 46·39. The highest gradient is 1 in 37, and the sharpest curve 15 chains radius. The tunnels are 25 in number, the greatest length of any of them being 341½ yards. There are eight viaducts, one consisting of eight arches of 50 ft., and being 129 ft. high, and another with a like number of arches with a maximum height of 143 ft. The quantity of cutting amounts to 2,067,738 cubic yards, and of embankments to 2,452,308 cubic yards; and there are 22 bridges of various spans, and 74 culverts. The total cost of the works has been £1,000,000, or £68,750 a mile.

"The Giovi Incline is upon the Turin and Genoa Railway, and commences 7¾ miles from Genoa, a point 295 ft. above the level of the Mediterranean, and ascends the Appenines. The Semmering Incline is upon the Vienna and Trieste Railway, and crosses the Noric Alps at the pass of that name. It is replete with extensive and extraordinary works. The preliminary operations and study of this Incline occupied from 1842 to 1848, a period of six years. It was opened in May 1854, its construction having taken 5½ years. Upon the Bhore Ghaut, about four years were spent in preliminaries, and the works have been completed in about 7¼ years from the date of their commencement. In the four months of the monsoon, during which about 150 in. of rain fell, no work could be carried on except in some of the tunnels, where the work has never ceased night or day.

Great International Wheat Show.

A Great International Wheat Show will be held at Rochester, N. Y., September 8th, 9th, and 10th, under the auspices of the Monroe County Agricultural Society. The following premiums are offered:—

For the best 20 bushels of white winter wheat...	$150 00
For the second best 30 bushels of white winter wheat	75 00
For the best 20 bushels red winter wheat	100 00
For the second best 20 bushels red winter wheat.	50 00
For the best 2 bushels white winter wheat	50 00
For the second best 2 bushels white winter wheat	25 00
For the best 3 bushels red winter wheat	40 00
For the second best 2 bushels red winter wheat...	20 00
For the best 2 bushels spring wheat	20 00
For the second best 2 bushels spring wheat	10 00

Competitors for these prizes will be required to furnish samples of the wheat in the ear, and with the straw attached (say fifty ears of wheat and straw); also to furnish a written statement of the nature of the soil on which the wheat grew, method of cultivation, time of sowing, quantity of seed sown, manures (if any used), and mode and time of application; also the time of ripening and harvesting, and the yield per acre, with such other particulars as may be deemed of practical importance; also the name by which the variety is known in the locality where it was grown. The wheat must be one variety, pure and unmixed. The prize to be awarded to the actual grower of the wheat, and the wheat which takes a prize to become the property of the society.

Composite Soap Patents.

The following constitute the substance of two patents granted for composite soaps: Patent for soap granted to W. L. Dawson, of Lynchburg, Va., on April 9, 1861:—strong potash lye, 75 pounds; tallow, 75 pounds; cocoa-nut oil, 25 pounds. Boil until the compound is saponified in the usual manner.

To make 30 pounds of the new composition, take 2 gallons of boiling soft water in a kettle, add half a pound of sal soda, 2 ounces of borax, 2 tablespoonfuls of spirits of turpentine, and 1 teaspoonful of linseed oil. Stir this mixture until the borax and soda are dissolved: then add 15 pounds of the above soap made from lye, tallow and cocoa-nut oil; and continue the boiling with stirring for fifteen minutes, until the whole is incorporated and dissolved. Now add two ounces of the spirits of hartshorn, and stir. It may be scented with any essential oil, or odor, and colored, if desired; then run off and molded into cakes fit for toilet use. It is a good soap for chapped hands, and is free from any disagreeable odor.

Patent for soap, granted to Henry Warren, Goshen, Ind., on Sept. 3, 1861, called "Warren's compound chemical soap," 2 gallons of water; when boiling, add eight pounds of Brown's opodeldoc, shaved fine, three-quarters of an ounce of alcohol, half an ounce of spirits of turpentine, half an ounce of ammonia, 2 ounces of sal-soda, 2 ounces of borax, 1 ounce of spermaceti; boil until all is dissolved; color red, with Chinese vermillion; blue with ultramarine. This makes 24 pounds of soap. Pour it out into frames and it becomes solid in three weeks. Brown's opodeldoc is an article of common manufacture.—*Sci. Am.*

Sulphur in Coal.

Taking the amount of sulphur in the coal used for gas-making at 1 per cent., the coal used annually for this purpose in London would contain more than 10,000 tons of sulphur.

A Smart Canadian Village.

The *Scientific American* thus describes a village in Central Canada, which is the type of many now springing up into towns throughout both divisions of the Province. The village of Hastings is situated on the River Trent, a few miles from Rice Lake, C. W. Three years ago there were some dozen houses in it; now there are over one thousand inhabitants, two four-story factories—one cotton and one woollen; two large saw mills, grist mill and tannery, and ten stores; altogether, it is quite a thriving village. The cotton factory is called the Trent Valley Mills; it has 30 looms, and turns out about 8,000 yards of grey cotton per week. The same firm have a small factory, where they knit gentlemen's underclothing, vests and pants.

Canadian Mineral Wealth.

From information received from Quebec, says an English paper, we learn that the mineral wealth of Canada is slowly but surely becoming developed. It is something less than six years since the copper regions of Lower Canada first attracted attention, and we now find them filled with mining enterprise, drawn by the rich promise from Europe and the States, bringing abundant capital, and giving employment to hundreds. The Acton mine, in the county of Bagot, was the first to which much attention was directed, and the success of the operations in regard to production and money value are supposed to be without parallel. Within three years after it was opened 490,000 dols. worth of ore had been obtained, and between 500 and 600 hands were employed in its working. The Harvey Hill Mines, in the county of Leeds, a large interest in which was held by citizens of Quebec, is, as we learn, a still more valuable property than that of Acton. These mines have been disposed of within the last few days to Boston capitalists for the sum of £50,000 sterling. 322 tons of this ore from the Harvey Hill Mine, sent to England, give an average of 38 per cent. This is a much higher percentage than is generally obtained, but we are informed that much of the ore raised from this mine is as high as 50 per cent.