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HOME MANUFACTURES, vs. IMPORTED ARTICLES.

One of the advantages of our annual Provincial Exhibitions, consists in placing before the public eye, where they may meet with the greatest share of attention, those articles of general consumption which might be largely manufactured in the Province, if due encouragement were given to home industry in all its branches. We imported, for instance, in 1861, 321,084 lbs. of starch, yet the raw material from which starch is manufactured,—namely, grain,—chiefly wheat and Indian corn,—together with potatoes, are staple productions. Of china, earthenware and crockery, we imported to the value of $274,369. This branch of industry is altogether in its infancy in the Province, and is one which offers an ample field for enterprise. At the last Provincial Exhibition, there were some good specimens of native art in the coarser varieties of crockery, which will no doubt be much improved on at our next exhibition. Of glass and glass-ware, we have hitherto had no representation; and this industry is not even referred to in the prize list; yet last year we imported to the value of $344,527. Sandstone for glassmaking exists at Williamstown, Beauharnois, and was used for the manufacture of glass some years ago at St. John's and Vaudreuil, but it was found difficult to compete with foreign importation. The rock from which this excellent sandstone is obtained is called geologically the Potsdam Sandstone. We may yet look for the introduction of glass-making in Canada. The raw materials are present in abundance, and it is a mere question of time as to the extensive manufacture of all common articles of glassware as soon as a beginning is once made and public attention directed to the subject. Of the different varieties of candles, we imported to the amount of $36,227; and yet we now possess within our own resources, much material for the manufacture of common wax, and paraffine candles. Our consumption of tallow is enormous; in 1861, the total importation amounted to no less than 3,045,122 lbs., valued at $242,474. It is clear that the demand for the raw material is far beyond the resources of the country to supply, and as it enters the Province free of duty, we may assume that it is consumed chiefly in the manufacture of candles, on which there is an *ad valorem* duty of 20 per cent. The Petroleum refineries should now supply as much of the crude material as we require for the manufacture of paraffine candles, which are superior to wax; and thus a new branch of industry may shortly spring up in our midst. Salt belongs to the class of free goods; it is an absolute necessity of life, and last year we consumed 1,697,314 bushels, valued at more than $300,000. Salt is one of those articles which form a very important source of profit to private enterprise, and is in many countries a lucrative source of revenue to government. In the State of New York, the celebrated Onondaga salt springs have reached an astounding development within the last few years. The amount of salt inspected in 1861, on the Onondaga Salt Springs Reservation, in and adjacent to the city of Syracuse, N. Y., was 7,200,391 bushels, being equivalent to 1,440,000 barrels, of 280 lbs. each. The duties collected by the State amounted to $72,003, although the duty is only one cent a bushel. The disbursements for the support of the salt springs amounted to $45,000, and the dividend paid to the lessors of the salt vats reached 20 per cent. annum. The salt trade of Syracuse is already enormous. This important article constitutes a large share of the return freight to the boats on the Erie Canal, and the vessels engaged on the great lakes in the transportation of grain and other western productions. The quantity of salt shipped from the Reservation, not forty miles from Oswego, amounted in 1858 to four hundred and twenty millions of pounds, or equal to the load of four thousand canal boats, with cargoes from fifty to one hundred tons. This quantity would ballast one thousand four hundred sailing vessels, with one hundred and fifty tons each. Canada obtains much of her salt from importations *viâ* the St. Lawrence from Britain, but there is ample field and opportunity for manufacturing salt within our own boundaries. The shores of the lower St. Lawrence, or of the Bay of Chaleurs would probably, says Mr. Hunt of the Geological Survey, afford many favourable localities for the establishment of salines; the heat of our summers, which may be compared to those of the south of France, would produce a very rapid evaporation, while the severe frosts of our winters might be turned to account for the concentration of the water by freezing, as is practised in Northern Russia. Although we import salt to an amount exceeding $100,000 from Britain, yet the United States' salt drains us of nearly two hundred thousand dollars per annum. A Salt spring was formerly worked at St. Catherines (1835), but although the brine was of considerable strength, yet owing to the importations of the foreign article the enterprise was not successful. Paper hangings, at 20 per cent. duty, cost us yearly about $80,000, of which sum we pay the United States more than $45,000. We are glad to know that home manufactures will soon diminish this outlay, and that some very excellent Canadian papers will be exhibited at our next exhibition. Who would think that our hats, caps and bonnets cost us more than a third of a million dollars a year, and that we pay the United States upwards a quarter of a million for these necessary articles. It would be at least patriotic to wear a Canadian hat, or a Canadian bonnet, and a great stimulus might be soon given to home manufactures, which are already assuming fair proportions.

Leather cost us $270,000 in 1861, and yet we exported $21,115 worth of hides. Here we plainly export the raw material and receive back the manufactured article. We pay the United States more than fifty thousand dollars a year for broom-corn, an agricultural production which can be well grown in Canada, and although it is in the class of free goods, there can be no doubt its cultivation would be profitable. Our soap cost us last year fifty thousand dollars, and we imported more than a million pound weight. We have abundance of potash for soft soap, but no soda for the hard varieties. Yet in the salt waters of the Gulf of St. Lawrence, there is a never failing store of sulphate of soda, which by well known processes can be converted into the carbonate. If common salt were manufactured in the artificial salines before referred to, which might be profitably established on the shores of the Gulf, enough soda could be obtained from which a very extensive manufactory of the more common kinds of hard soaps might ultimately spring, and thus one branch of industry would indirectly lead to the prosecution of another equally important. The finer varieties of toilet soaps are generally made from olive oil and soda, hence we should be always dependent to a certain extent on the foreign market. But for all ordinary domestic purposes, soaps from animal fat and soda are sufficiently well fitted. Our musical instruments cost us nearly $140,000; and $120,000 of this large sum goes to the United States. The Pianos exhibited at London during the last Provincial Fair lead us to hope that this item will soon be reduced in favour of home manufactures. The progress which has been already made bids fair to show that we may soon expect to be independent of the foreigner for these delightful sources of enjoyment. The Exhibition at Toronto will furnish a splendid opportunity for native talent and industry to display itself, and it will no doubt secure a well-earned reward.

Foreign Stationery cost us $148,674 last year, of which large sum not less than $65,393 went to the United States, besides $24,913 for paper, for which we paid in the aggregate $57,826.

These are manufactures which we may hope so far to produce at home as to diminish materially our dependence on other countries for all kinds except those of the finest description.

Cabinetware and Furniture, which we manufacture largely within our own limits, nevertheless cost us last year $43,957, of which nearly $40,000 went to the United States. Although a duty of 20 per cent. is charged on these articles, yet we are still unable to supply ourselves, notwithstanding the excellent style and cheapness of most articles of domestic use manufactured in the country and a duty of 20 per cent. on importations.

The following list embraces the principal articles imported last year. Some of them it is impossible to produce at home; others might from year to year be diminished and a home manufacture substituted:—

	Valued at
Cottons..........	$5,690,777
Woollens..........................	4,271,276
Sugar	1,627,781
Iron and Hardware............	1,489,645
Tea	1,867,025
Silks, Satins and Velvets......	921,152
Bar, Rod and Hoop Iron......	713,249
Coal and Coke	732,212
Meats, fresh, smoked and salt,	507,472
Hides and Horns.	545,578

All these items with the exception of Sugar, Tea, Silks, &c., and Coal, we may hope to reduce as our population increases and manufactures become more developed by the introduction of capital and skilled labour. The field, it will be seen at a glance, is of vast extent, and yet there are thousands waiting for the opportunity to enter upon it. The unfortunate strife which distracts the United States has checked the progress of one branch of industry, namely, the Cotton manufacture, which would ere this have taken a firm root in our midst.

In concluding this sketch we wish earnestly to call the attention of our manfacturers to the forthcoming Provincial Exhibition. In another part of this issue we have adverted to the necessity of a complete representation of our industry during the present year at Toronto. In view of the disastrous civil war which cramps the energies of our neighbours, we should be ready to embrace the opportunity and take our own stand in Manufactures and Art. A well-sustained Exhibition will show what we can do alone, and there cannot be a doubt that if manufacturers and mechanics will come liberally forward and exert themselves to display their work, it will warm into life a spirit of equally liberal encouragement and a determination to sustain home manufactures and home industry to the utmost degree.

THE INTERNATIONAL EXHIBITION.

(Extracts continued from "The Mechanics Magazine.")

The Eastern Annexe.

Referring to the trophy in class II. Chemical Substances and products, the *Mechanics Magazine* remarks:

"The anomaly of this trophy is that finer specimens of most of its constituents are to be seen in other parts of the class. Thus we find the most magnificent crystals of red and yellow prussiate of potash, in the case of the Hurlet and Campsic Alum Company, No. 535, and Bramwell & Company, No. 484. Of the prussiate of potash, we would remark that it fills a very important place in our manufactures. Albeit it is made from such apparently worthless materials as rotten wool, rags, hoofs, horn waste, or any other azotized organic matters. These are mixed with the impure carbonate of potash and iron filings, and, whilst being stirred with an iron rod, submitted to a red heat in close iron vessels, the whole is afterwards treated with hot water, filtered and evaporated, when crystals are obtained of ferrocyanide of potassium. By passing chlorine gas through a solution of the ferrocyanide, the ferrid cyanide is formed, or by another process, too elaborate to describe here, cyanide of potassium is the resulting product so much used in electroplating, gilding, and photography, the finest specimen of which may be seen in the case of Messrs. Hopkin and Williams, No. 530. Again, from ferrocyanide of potassium, or the yellow prussiate of potash and sulphuric acid, the deadly hydrocyanic, or prussic acid, is formed, and prussian blue is an admixture of this same substance with a salt of iron.

"We have already spoken of the utilization of the ammoniacal liquor of the gas works. This leads us to consider the truly marvellous results that have been developed in the new product, aniline, from coal tar. Not long since gas was the only product that was obtained from coal, of a profitable character. Coke could scarcely find a purchaser; tar was a bug-bear of defilement—ponds of it seemed to beg for a hiding place from the anathemas of mankind. Yet from this very tar have we now a series of most valuable and surpassingly beautiful results. Witness the crowns of dazzling beauty made from the acetate of rosaline, the crystals of which, when dissolved, form that brilliant colour, the magenta; in fact, so far as colours are concerned, a fairy-land of etherial blues, and deep rich crimsons, not to speak of violet, reds, and yellows, seem to have issued, at a touch of the chemist's wand, from the styx of all abomination, coal tar. Messrs. Perkins exhibit their beautiful blues, purple, and mauve, as also a jar of coal tar, from which they obtain twelve grains of aniline. On the opposite side is a similar jar, containing one grain of this highly dispersive and wonderful salt in water, producing in that infinitesimal quantity the colour that has been so much and so long the rage amongst the fair sex.

"Messrs. Maule and Nicholson, the manufacturers of the resplendent crowns of acetate of rosaline just referred to, have the more abundant, if not the finest specimens, of the coal tar products, and apropos of the aforesaid crowns, we must not forget one acid that has been called in to aid their production—we mean the acetic acid. It must appear wonderful enough to the uninitiated to learn that their white wine vinegar is obtained, in the form of acetic acid, from the smaller branches of the oak and other hard woods, and yet more so to learn that it is now also obtained from that apparently useless material that has so long sought a satisfactory destination—sawdust. This dust now finds itself entering the mouth of a long retort through a hopper, is coaxed forward by an endless screw occupying the whole diameter of the retort, and brought under a heat that implies *destructive* distillation, thus parting with its volatile products, and leaving the retort at the far end fairly exhausted, it has the satisfaction, whilst assuming its sombre carbonaceous form, of having become the parent of the acetates, whose names are legion, and are of so great a commercial value amongst dyers, as also in chemistry and pharmacy. Sawdust also yields, at the hands of Roberts and Dale, some fine specimens of oxalic acid. The Melinevythan Co. (case 566), as also Messrs. Wright and Francis, shew beautiful specimens of acetate (sugar) of lead; indeed the acetates are exceedingly well represented in this class.

"Passing by, though not without an acknowledgment of their usefulness, the thousand and one products that constitute our ordinary list of chemical and pharmaceutical substances, we halt ever and anon at the beautiful specimens of crystalology that has proved our chemists to have been on the *qui vive* in their contest for the palm with our Continental neighbours, and amongst these unique specimens we would mention those of the bichromate of potash by White and Co., and codeine by McFarlane & Co., indeed, a list made of even the most noteworthy would occupy far too much of our limited space, so we trust that our readers will find an early opportunity of forming their own estimate of the excellence of this department of our International Exhibition.

"A vast improvement in quality and price is shown in the alkalies, especially in soda. Our readers may remember reading in their catechism of chemistry, in their youthful days, how that soda was made from the ashes of marine plants, but most of them know that now-a-days Salt is the great source from whence we are supplied with this useful alkali. Salt is a chloride of the metal sodium; by pouring sulphuric acid upon it the sulphate of soda salt-cake is formed, and the chlorine set free.

"This sulphate of soda is then furnaced with chalk and small coal, the sulphuric acid is thus exchanged for the carbonic acid, and an impure carbonate of soda is the result. Again, lime is made to supply its oxygen in exchange for the carbonic acid, and we have, as a final result, instead of salt (the chloride of sodium), soda (the oxide of sodium), at a price just one-half that of potash or pearl ashes, which are still made, as aforetime, from the ashes of plants. This manufacture is most ably represented by Muspratt, 571, Gaskell, Deacon & Co., 520, Hutchinson and Earle, 537, and the Jarrow Chemical Company, 540.

"Soda very appositely leads us to the grand discovery of Sir Humphrey Davy of its base, the metal sodium. This has, until lately, been seen only as a curiosity in the laboratories or in choice collections of the chemist. Judge of our astonishment to find that it may be now had for something like 3s. per lb. Exceedingly fine samples of this metal are exhibited by Bell and Co., of Newcastle, as also of aluminum. In connection with this metal, we may mention a new product, for the first time exhibited to public notice—the silicate of alumina—a beautiful crystalline substance resembling glass. It is formed by mixing two alkaline solutions of silica and alumina; from the great affinity of the alumina for the silica, a union is formed between them of a most permanent character. The bases in the mixed solution, however, showing a most energetic action in strong solutions when diluted with water have that action so retarded that they remain in the form of a liquid for some hours, admitting of many useful applications, such as the preserving of stone by induration, and the manufacture of artificial stones, which processes are exemplified in the case, No. 471, by Messrs. Bartlett Bros., of Camden Town, who are also manufacturers of very fine specimens of the silicates and aluminates of soda and potash.

"Fecula or starch has been brought of late years to a most wonderful degree of perfection, and the palm is hotly contested by Berger, Colman, Jones, and the manufacturers at the Glenfield and Springfield Works. Suffice it to say of this product, we never saw finer samples than those exhibited by the manufacturers referred to.

"Our artist colourmen seem to have outdone themselves in the superb collections they display. Windsor and Newton, Reeves, Rowney, and Newman, each and all deserve the highest praise for the skill they have shown as manufacturers, and the taste they have displayed as exhibitors. Their cases contain most valuable as well as most beautiful specimens, though the exceedingly great value of quantity should not lead us from a fair judgment of quality, a standard to which the afore-mentioned exhibitors, with others, have so ably and successfully aspired.

"A very unpretending case, yet one whose contents are of the greatest importance in a sanitary point of view, is that of Cundy, of Battersea, No. 500. We cannot dwell upon it longer than to say that the permanganate of potash there exhibited is a most powerful and innocuous deodorizer and disinfectant; its oxidizing powers are beautifully shown by treating pure and impure water; with a small quantity of the fluid each water may be perfectly pellucid or clear; but if organic matter be in solution, it will instantaneously be oxidized and precipitated as a powder to the bottom, leaving the water colourless; but if nothing of the kind exists in the water, it remains tinged with the pink colour of the fluid, which retains its normal condition.

"Smith & Co., case 604, exhibit an interesting collection of opium products. The opium eater would, we opine, gaze with bewilderment at the various products extracted from his quid, the narcotine, codeine, morphia, narceine, and meconic acid, each adding to the physicians' influence over the evils to which flesh is heir. A very nice collection of sea-weed products are exhibited by Stanford, of Worthing, proving the untiring research of the chemist into the most unpromising of substances; we may also, whilst so near the sea, call attention to the fish manure, exhibited by Whitworth, case 622. And the products used in sugar refining, in case 501, are worth something more than a glance, reminding us that the extreme whiteness of sugar is derived from the presence of the blackest of all substances, and the sweetest material in creation is made even more pure in its sweetness by contact with a property of grim death's burnt bones. Our readers will find an interesting subject in the varnishes and their gums, fine specimens of which are exhibited by Wilkinson and Co., 623, Mander Brothers, 562, and others too numerous to mention. An instance of the efforts exhibitors have made to please the eye with even the most inartistic materials, is to be seen in the case of black lead exhibited by Chick, No. 514, which certainly exhibits a high degree of perfection in its manufacture.

"Mr. R. Rumney, of Manchester, has very patriotically provided a collection of dyes and dyed fabrics, shewing the novelties and improvements that have been introduced since the year 1851. Splendid specimens of madder, garancine, and murexide, with an almost countless number of other dyes, are exhibited in class 2; and as to the gentlemen who have so skillfully and laboriously produced the more rare chemicals, their successes and laurels will be most appropriately discussed by a more technical journal than our own."

The Western Annexe.

"A very beautiful combination of science and mechanics as applied to the art of engraving is to be seen in the Electrograph engraving machine of Mr. Henry Garside, of Coupland-street, Manchester. This is intended for the engraving of copper cylinders used in calico printing. The distinctive feature of this apparatus, apart from its mechanical arrangement, consists in the application of voltaic electricity in communicating movement to important and delicate portions of the machine. The cylinder to be engraved is first coated with a thin film of varnish sufficiently resistant to the continuous action of the strongest acids. The required number of copies of the original design are then traced on the cylinder by means of a series of diamond points arranged on the machine, in a line parallel to the cylinder. The metallic surface of the latter thus becomes exposed at the parts required to be engraved. A bath of nitric or some other potent acid is afterwards used to deepen the exposed portions to the extent required, and thus the operation is completed. The diamond points are all in connection with as many small magnets, and these are so arranged that intermittent voltaic currents are established in unison with the original design. The result is that the diamonds are withdrawn or advanced at the proper moment, and the tracery forms an exact counterpart of the copy. There are, also, adjustments, which enable the operator to enlarge or diminish at will the size of the patterns to be engraved. It is unquestionable that this exquisitely ingenious contrivance will interfere materially with the system of hand-engraving as pursued heretofore, but as usual in such cases, the benefits accruing to the public will be marvellously enhanced. It is not long since we had occasion to speak of a machine intended for engraving upon steel, and cutting cameos. It is to be regretted that this contrivance cannot be placed in the Exhibition beside the electrograph engraver above named. Together these machines would point out the only course which, in future, is likely to be open to copper and steel engravers, namely, the more perfect study of designing and modelling.

"As regards the steel-engraving machine, work done by which we have seen and intensely admired, we have no hesitation in saying that it is destined to revolutionize die-engraving and gem-cutting. It appears to delight—if we may so speak of an inanimate object—in the performance of the minutest elaboration of workmanship. The first process in connection with steel-engraving by machinery is to form, in wax, a model of the device to be copied. Of this an electrotype is taken with great care, and from it, as a guide, the machine proceeds to its task. As in the case of Garside's electrograph, the size of the engraving may be varied from that of the model or copy, without difficulty. Voltaic agencies are not, however, used in the actual engraving of the device—mechanical means compassing all that is required in this respect.

"It is probable that when a new Patent Law shall exist, which will deal more fairly with clever inventors than the old ones have done, this admirable discovery will see the light of day. As it is, the inventor, like many others of his class, prefers keeping the precise mode in which his machine works, a secret.

"Pursuing the subject of automatic machinery yet further, and we come to Thompson's patent universal joiner. This is the invention of Robert Henry Thompson, of H. M. Dockyard, Woolwich. It is an ingenious apparatus, capable of being worked by hand or by steam power, and applicable to a variety of purposes, as its name implies, connected with joinery. The copying principle is here again employed, and thus diversity in the form of work to be produced is no barrier to its action. It may be used for any description of joiners' work, including gothic heads, elliptic and all other curves, mouldings of whatever form, the strings of stairs, with treads, risers and handrails, together with plain or ornamental work for cabinet or coach-work.

"With some modifications, and, of course, with a change of cutting tools, the 'universal joiner' may be converted into a general mason, for it does not object, under such circumstances, to deal with stone.

"Mr. Thompson also exhibits a 'patent tree-feller,' and a 'patent sawing-machine,' and these are the natural feeders to the joiner. They perform the rough work, indeed, and the joiner the smooth.

"We have before spoken eulogistically of the sawing, planing, turning, and other machines of Worssam and Co., of Chelsea, and it would be unjust to omit equally honourable mention of Powis, James, and Co., of the Victoria Works, Blackfriars-road, who figure in similar kinds of wood-working machinery. The contractors' and builders' combined machine for planing, moulding, and edging planks or timbers on all four sides at one time, is a remarkable specimen of an economic contrivance for working on wood. So also is what they felicitously and accurately designate their '*multum in parvo*,' or general joiner. This machine will saw, plough, groove, rebate, thickness, bore, cross-cut, and strike mouldings. In its presence, therefore, the carpenter must hide his diminished head. Many other machines for the conversion of wood into the thousand forms required for cabinet operations, carpentry, pattern-making, &c., are shown by this firm, but space warns us that other mechanical wonders must pass unnoticed if we linger too long among them.

"It is not necessary to tell the generality of the readers of this journal, of the advantage which attends the existence in engine factories of ready means for sharpening tools for cutting iron, or grinding those for cutting wood. The first point is to have stones of the proper grit, and the second, to keep them in good order. This latter is frequently a matter of difficulty, from the inattention of those who use them. Mr. Muir's* grindstones are, so to speak, self-adjusting and self-repairing. He places two stones in one trough, and these work edge to edge. They are regulated by a right and left hand screw, and, by means of a cam, a slight lateral motion is given to one of them. The effect of this is to keep the grinding surfaces of both constantly "true," however unfairly they may be used by the workmen. The disagreeable, and, from the dispersion of particles of sharp-cutting dust, very objectionable process of turning down grindstones, is completely obviated in this instance.

"We have said on a previous occasion that with steam hammers the Western Annexe is well supplied. The name of Nasmyth is of course, inseparably connected with this valuable implement for the forge; and Nasmyth and Co. are represented extensively at South Kensington. Many modifications of the steam hammer have been made by different makers, with a view to overcoming some of the defects existing, or said to exist, in its original construction. Of these modifications, Robert Morrison and Co., Ouse Burn Engine Works, Newcastle upon-Tyne, display a rather remarkable example. This is called 'The Double-Acting Steam Forge Hammer.' The main point of improvement in this apparatus is comprised in the fact that the hammer bar and the piston are forged solid together. In other cases, where a different mode of attachment was adopted, the piston and piston-rod have sometimes from the violence of repeated strokes, parted company. In this instance such a catastrophe, we need not say, is next to impossible. The steam cylinder is firmly bolted to the single frame which supports the whole. This frame also contains the steam-chest, steam-passages, and the steam and exhaust pipes. The hammer-bar is furnished at its lower end with a claw for holding in the different faces or dies required for various kinds of work.

"The piston is simple in its construction, and two small steel rings fitting into grooves on its circumference make it steam-tight. Above the

* Of the Britannia Works, Manchester.

piston, the bar is planed flat on one side, a corresponding flat being left in the cylinder cover. This arrangement has the effect of keeping the bar and the hammer face constantly in the same relative position to the anvil. On the top of the hammer-bar there is a small roller which works in the slot of a lever. The lever, with the aid of a pair of links and a slide-rod, gives motion to an ordinary box slide which admits steam alternately above and below the piston.

"These arrangements comprise the distinctive characteristics of Morrison's hammer; but there are other points of detail, and especially with respect to the control exercised over it by the attendant which are worthy the consideration of those who require so formidable a forge assistant.

"The Kirkstall Forge Company, of Leeds, and 35 Parliament street, London, are also exhibitors of steam hammers, and rapidity of action is one of the principal qualifications for which they claim attention to their implements. No doubt in many cases this point is a momentous one, because the completion of a forging at one heat is very frequently a desideratum. The machines shown are massive and well constructed."

AMERICAN COURT AT THE INTERNATIONAL EXHIBITION.

(From the Mechanics' Magazine.)

"The display of American products at the Great Exhibition would no doubt have been greater, but for the present unhappy conflict in that country. As it is, the American Court is well worth a visit, and deserves a careful study. Scientific men will recognise in the varied and useful inventions which are there exhibited, simplicity of construction and beauty of workmanship; and the unscientific will see much to admire in the appliances by which labour is made easy and toil pleasant. American 'notions' are intensely utilitarian. Increased production at the smallest expense of labour, is their maxim. Many of the machines here exhibited are adapted to field and farm labour, and it is no disparagement of our eminent agricultural engineers to say, that, in regard to these implements, the Americans have been able to hold their own, and maintain their position against all competitors.

"On entering the court, which is at the south-east corner of the building, Wood's mowing and reaping machines occupy a prominent position. These are exhibited by Mr. Cranston, of King William Street, and have attained a large sale in England as well as in America. During the last eight years, 30,000 of them have been manufactured, 2,500 of which have been sold in England.

"The combined machine for either reaping or mowing is at present set up as a reaper, but can be easily changed to a mower, by removing the reel and platform. A self-acting rake can be adjusted to the reaper, which will deliver the cut grain in bundles at the side. The rake is worked by a pitched chain which margins the platform, and carries the toothed end of the rake round with a smooth and uniform motion, the back end being supported by a double-jointed guide. In its action it is very simple, there is no loss of power, and no risk of bruising the straw or shedding the grain. The driver, by the pressure of his foot on a spring, can stop or accelerate its motion, so that, however uneven the crop may be, the bundles deposited by the rake can be of uniform size.

"Next is the mowing machine which gained the first prize at the Royal Agricultural Society's show at Leeds, last year. Apart from the ingenious construction of this machine, it really merits inspection for the beautiful style and finish of its workmanship.

"These and other kindred machines, are producing a wondrous change on the slow, rude forms of agricultural labour. The application of science to farming is making the land more productive, and it must be a great boon to the husbandman to be able to cut down his crops of corn or grass at the rate of twelve acres a day, over ridge or furrow, and on steep hill sides, and cut them closer and better than by the scythe.

"While on the subject of husbandry, let the visitor walk straight across from these machines, and inspect some hay and manure forks manufactured by Batcheller and Sons, and exhibited by Messrs. Smith, of Doncaster. These forks look more like elegant toys than implements for laborious work. They are made of the best American cast-steel, with two, three, and four oval prongs, and are remarkable for lightness, strength, and elasticity. They are about half the weight of an ordinary English fork, maintain their perfect shape till worn out, and enable the labourer to do his work with ease and rapidity. They are the most perfect agricultural instruments we ever saw.

"In a case adjoining these are exhibited coopers' axes, chopping axes, and adzes, from the Douglas Axe Company, Massachusetts. These tools are of beautiful shape and finish; the steel is of the finest temper, and, as specimens of American cutlery, will, we think, be unsurpassed by anything of the kind in the Exhibition.

"Drake's Boring and Spacing Machine, exhibited by Mr. Wemple, Albany, N. Y., is a novel and very useful invention for boring blind stiles, or any other wood-work where a series of holes are required at equal distances apart, doing the work with great accuracy, and saving the labour of spacing and laying it out. The bits, twenty in number, are driven by one continuous belt, instead of separate belts, as in some other machines. The distance between the holes may be varied by simply moving the lever, when the transverse rods regulate the distance of the bits. The machine, though having the appearance of being complicated, is really very simple and effective, doing its work, which otherwise would be tedious, with great rapidity and precision.

"On passing Ward's Ocean Marine Telegraph, which we noticed in a recent number, we found him in the midst of a circle of enquiring visitors, who were taking a lively interest in his invention. On a table before him he exhibits two models which are worthy of notice. One is an improved wheel for railway carriages. The tread of this wheel is in form of an O G moulding, which runs with great smoothness, prevents the flange from grating against the rail, and renders it less liable to jump off. The other is a simple substitute for the ordinary castor for table legs and bed posts. It consists of a ball set in a neat brass moulding, which runs upon smaller balls at the top, and by vertical pressure moves easily in any direction without the necessity of a joint or the liability to injure the carpet. It is one of those simple contrivances which commends itself to one's approval at first sight, and appears to be on the same principle as a turntable exhibited by the same inventor in the Eastern Annex, which we have noticed in another column.

Beardsley, of Otsego County, New York, exhibits two machines of a very American-like appearance, which have attracted considerable attention in that country. The hay elevator is intended for unloading hay into the barn, or on to the stack. The fork or lift, the points of which are three feet apart when open, move on a pivot, and are made to clutch the hay by tightening a chain. A trip-hook is put into the ring of the chain, or to unload by horse-power, a sheaved block is attached to the ridge, and another on to the floor where the horses are hitched, and as they walk off on to the ground, up goes the fork with one-third of a waggon-load at once. The trip-hook is let loose by jerking a catch-cord, and down goes the hay. By this means a ton of hay may be unloaded by five lifts of the fork. Some contrast, this, between pitching a fork full at a time, under a scorching July sun.

The earth elevator, by the same inventor, is on a similar principle. It is meant chiefly for drain cutting and ditching, and has the same object in view, rapid working, and the saving of hard labour. The elevator is hoisted in a gin, and may be worked by hand, horse, or steam power. This gin is made of four poles, twenty or more feet in length, secured in a frame at the base and meeting together at the top. Half-way up the poles are secured timbers for a railway, on which a dumping car is made to move, to receive and carry off the earth raised in the elevator. The base of the gin is twelve feet square, having wheels to roll upon plank laid on the ground. The railway may be somewhat inclined, that the car may move by its own gravity. The extreme ends of the railway may move upon wheels, the wheels moving upon a single track underneath. For making embankment or draining on a large scale, we think the machine merits attention.

"As one might expect, sewing machines are well represented—those of the lock stitch, the chain-stich, and the shuttle machine, with all their peculiarities. They are successfully exhibited, and form a great attraction. The rapidity and neatness with which these machines execute a variety of needlework is amazing to those who know only of the common needle as the grand making and mending instrument in the household, and the symbol of the most distressing drudgery. As we intend to devote a special paper to these machines, we pass them by at present. In class 1, Mr. Feuchtwanger exhibits a thousand specimens of minerals; Mr. Meads, from Lake Superior, and the New Jersey Zinc Co., specimens of zinc ores with their products, pig and bar iron, and steel. In class No. 2, Mr. F. S. Pease of Buffalo, has a variety of mineral and animal oils for use in lubricating machinery, and as illuminating agents.

"The various oils are shewn to great advantage in glass cylinders of various altitudes, and appear to attract great attention. We have coal oil for lubrication; oil from tar for machinery; also signal oil, that is, oil which may be used on locomotives, on the foremast of a ship, or on a railway signal; we have oil so limpid that it adapts itself excellently to the rapid motions of the sewing machinery, as it never gets gummy. There is a sample of oil from compressed lard of amazing transparency. The latter goes by the name of winter oil, as at 3° under freezing point it never coagulates, and is admirably adapted for the lamp in cold climates on that account. The engine and machinery oil is equal to sperm, and much cheaper; it stands a greater degree of heat and a greater degree of cold than sperm oil, and does not consume so fast. Mr. Pease has samples of petroleum in the crude and refined state, which cannot be exhibited in the building on account of the fire insurance policy. There is, further, an oil shown called 'armour oil,' which is intended especially for gun locks, and in which our volunteers may perhaps feel an interest on account of their Enfields and Whitworths.

"By the side of these oils are exhibited hops, seeds, wheat, beans, peas, buckwheat, and samples of starch and flour manfactured from Indian corn or maize, of which there are shewn a number of specimens in the ear. The starch is extolled for the gloss it gives to the linen or cotton to which it is applied. The flour is remarkably white and fine. Samples are here, too, of a farinaceous article manufactured by the Glencove Starch Company, of New York, under the name of 'Maizena.' It is the purest preparation of the finest maize. In a short time, and without any trouble it can be made into various forms of diet and is a good substitute for arrowroot

"Having disposed of these odds and ends, we proceed to notice a few mechanical contrivances and, first, near the south-east entrance one is attracted by a cork-cutting machine invented and patented by Mr. Conroy, of Boston, there is one machine which cuts the cork into parallelopipedons, and then into smaller figures of the same kind according to the length of bung or cork required. These smaller pieces are brought in contact with a knife mounted on a circular horizontal disc. The disc is put in motion by a large wheel similar to a cutler's wheel, and a band running over a drum in immediate connection with it; or it may be worked by steam power. This disc, by means of gearing, traverses a platform from right to left, and *vice versa*, by which arrangement a cork is no sooner cut on one side than a cork is cut on the other. The square body to be transformed into a rounded is placed in a groove; the gearing seizes it in the manner of a piece of wood in a turning lathe, by its extremities, advances it to the edge of the circular knife, and in an instant the rough block of cork appears a shaped article wherewith to stop a beer barrel, a bottle of champagne, or a medicine phial. The ease with which this machine does its work is surprising. A clever cork-cutter, working by the hand, can turn out, on the average, eight gross of corks a day. By this machine can be made fourteen gross of corks per hour. In a day of ten hours, therefore, two men can produce 20,160 corks or bungs, while two men by the hand in the course of the same time can turn out only 2,304. The corks can be cut in perfect cylinders, or bevelled to any angle required by slightly elevating the horizontal disc. The machinery is very simple, and ingenious through its simplicity.

"A bolt is shown in one part of the court, which has all the excellency of the rivet, with this advantage over a rivet, that when required it may be moved from its place without any trouble It is well adapted for the framework of locomotives and railway carriages. The bolt passes through an iron frame, or through woodwork, and is secured behind by a nut. But inasmuch as a nut is liable to be unturned in the extremity of the thread of the screw-bolt by vibration, and as many railway accidents have happened from the fact of bolts having parted for the want of their retaining nuts, in the present case the nut is kept in its place by having a spring inserted into it, which adapts itself to the rachet work of a hollow washer. The inventors are Messrs Lawrence and White, of Melrose, N.Y. Close to the screw-rivet bolt is a contrivance for common land carriages. A coupling iron, which accomodates itself to the oscillations, of a carriage on a rough road, without inconvenience to the horse or horses, and which, fitted on the fore axle of a four wheeled vehicle, answers all its radical motions, without being pinned like the bolt under the axle. It is, in fact, a kind of universal joint, answering to every motion of the carriage or of the horse, and which, if adopted generally, is likely to prevent many accidents.

"Scholl's life-boat is constructed on a novel principle. The model exhibited is rather a rough one. It looks like a great green porpoise, with a lid opening into its back. Look into the interior, however, through the lid, and you discover the arrangements for the accomodation of a crew and passengers—for the saved and the saviours, as the case may be. The object of the boat is to pass through a heavy surf with safety. The internal fittings of the boat are below the centre of gravity and of flotation. They are hung in the manner of a binnacle compass, that is, be the motion of the external shell or hull of the boat what it may, the persons within are always maintained in a horizontal position. Indeed, let the boat turn round and round like a spindle, which is hardly possible, its passengers are nevertheless unmoved. The steering apparatus is within, and so also all the arrangements for a screw propeller. This boat has no outer deck; indeed, as we have said in form it resembles a porpoise in the model, and on a large scale it must be something 'very like a whale.'

"There are four exhibitors of pianos, all of New York city or county. These instruments vie in tone, and power, and in cabinet work, with any in the other courts of the building. In power, we suspect that they will carry off the prize against all competitors. We had the opportunity, at least, of listening to a square and a grand exhibited by Steinway and Sons. The internal arrangements of these instruments are novel; the strings are not all in parallels like those in the usual pianos; on the contrary, the bass strings are placed at acute angles above the tenor and treble strings, and obtain the full advantage of the sounding board. The motions of the hammers are not impeded by this arrangement. The grand has seven octaves, and tone loud enough for a large concert room, and yet, through the mechanical arrangements of the instrument, it can be made to play as softly as if it had been intended for a sick chamber. Amidst the many musical instruments to be found throughout the building, the visitor, curious in these things should by all means see the pianos in the American court.

THE ECONOMIC MINERALS OF CANADA.

(*Continued from page 170.*)

MARBLES.

Limestones.

Arnprior.—At the mouth of the Madawaska, in McNab, a great extent of crystalline limestone is marked by grey bands, sometimes narrower, sometimes wider, running in the direction of the original bedding, and producing, where there are no corrugations in the layers, a regularly barred or striped pattern. When the beds are wrinkled, there results a pattern something like that of a curly grained wood. The colors are various shades of dark and light grey, intermingled with white. These arise from a greater or less amount of graphite, which is intimately mixed with the limestone. The granular texture of the stone is somewhat coarse, but it takes a good polish, and gives a pleasing marble. Mr. W. Knowles has opened a quarry in limestone of this description at Arnprior, and erected a mill for the purpose of sawing and polishing it for chimney pieces, monuments, and other objects. A monument of it has been erected in the Mount Royal cemetery.—*Laurentian.*

Augmentation of Grenville.—In the township of Grenville and its Augmentation, a band of crystalline limestone, which has an extensive run through the country, presents, in many places, a peculiar variety of marble, having a white ground marked with a number of small green spots, arising from the presence of serpentine; which occasionally forms angular masses several inches in diameter. This disseminated serpentine, more or less aggregated, usually runs in bands parallel with the beds, and clearly marks the stratified character of the rock. These bands, as in the case of the Arnprior marble, are sometimes even, and at other times corrugated, giving diversities of pattern in cutting. Sometimes the serpentine, instead of green, is sulphur-yellow, as in the specimen from Grenville. In many parts of the country, the Laurentian limestones are free from foreign minerals, and give white marbles. These, however, are usually too coarse grained for statuary purposes, and sometimes they are barred with slight differences of color. The specimen from Elzivir, obtained from Mr. Billa Flint, of Belleville, is an instance of this. Many years ago, a mill for cutting and polishing a marble like the specimen from the Augmentation of Grenville, was erected on the Calumet, lot 19, range 3, of Grenville, where a similar rock occurs; but the demand for the marble was not sufficient to make the enterprise profitable.—*Laurentian.*

St. Armand.—The marbles occur in great abundance in the immediate vicinity of Phillipsburg, on Lake Champlain. They are all easily cut, and take a good polish. Should a railway, which is projected between St. John and St. Albans, be carried into operation, it is probable there would be some demand for the stone. No quarries have been opened on any of the beds, and these specimens are taken from surfaces that have long been exposed to the influence of the weather.—*Quebec group, Lower Silurian.*

St. Armand.—About a mile and a half south-eastward from Phillipsburg, there occurs a black marble, similar to this specimen. The beds dip to the eastward at an angle of about twelve degrees; a quarry was many years ago opened on one of them, which has a considerable thickness. The stone was exported to the United States, and much esteemed in New York, but the opening of quarries of black marble at Glen's Falls, where there is a great water-power, interfered with the demand, and caused the enterprise to be abandoned.—*Quebec group, Lower Silurian.*

St. Joseph, Beauce.—This red marble occurs near the river Guillaume, associated with red shales and sandstones, resembling those of Sillery, near Quebec. The red limestone is succeeded by a band of a peculiar argillaceous rock resembling the *gabbro* of the Italians.—*Quebec group, Lower Silurian.*

Caughnawaga.—Similar grey marbles, with red spots, occur in the same formation as the rock of Caughnawaga, behind the city of Montreal, and on Isle Bizard; while beds in the same formation, at St. Lin, in the county of L'Assomption, are wholly red. In all of these localities the rock is filled with fossils, which are plainly seen on the polished surfaces.—*Chazy formation, Lower Silurian.*

St. Dominique.—The marble of St. Dominique is easily cut, and takes a good polish. It is surprising that situated so near to Montreal, with a railway running near, it has not been applied to various purposes in the city, for which a stone not so good is at present used.—*Chazy formation, Lower Silurian.*

L'Orignal.—The bed from which the specimen is taken, varies in thickness from three to six inches; it is near the surface, and is easily quarried, but it has hitherto been but little used. The locality is a quarter of a mile from the S. bank of the Ottawa, four miles west of L'Orignal village, sixty-four above Montreal. The white spots are caused by small bivalve shells (*Atrypa plena,*) filled with calcspar. Of the darker variety there are two beds, of six inches and one foot respectively, near the surface, and overlying the previous bed. Blocks large enough for chimney pieces and tables are readily obtained.

Esquimaux Island, Mingan Group.—This drab colored marble occurs in great quantity on Esquimaux Island, of the Mingan group, where the stone might be easily loaded on board of small vessels. It cuts with great facility, and takes a uniform polish.—*Chazy formation, Lower Silurian.*

Cornwall.—These black marbles, from Pointe Claire and Cornwall, are derived from two beds, each about two feet thick, at the base of the Birdseye and Black River formation. These are apparently the only beds of the formation that will take a sufficiently even polish to be fit for the purpose. In the higher beds there are patches, which, from being more argillaceous than any other parts, receive but an inferior polish, and produce a bad effect.—*Birdseye and Black River formation, Lower Silurian.*

Pakenham.—The Birdseye and Black River formation at Pakenham, on the Mississippi, a tributary of the Ottawa, yields a very peculiar dark smoke-brown or snuff-brown marble. The stone takes a good polish; but small pieces of chert are sometimes met with, which renders it necessary to be careful in selecting slabs to be wrought. Mr. Dickson, of Pakenham, on whose property the bed occurs, and from whom the specimen exhibited was obtained, had at one time fitted up an apparatus, driven by the waste power of his saw-mill, to polish slabs for chimney pieces and other uses. But there was, at that time, no consumption for the material in the neighborhood, and no railway for carriage to a distance, and the marble works were abandoned.—*Birdseye and Black River formation, Lower Silurian.*

Montreal.—The Montreal marble is derived from a bed in the Trenton, and another in the Chazy formation. Slabs for chimney pieces and table tops are sawn and polished by Mr. Hammond and used for common purposes.—*Trenton and Chazy formations, Lower Silurian.*

Dudswell, lot 22, range 7.—Were the limestones of Dudswell worked, it is probable good marble might be obtained from them. The specimens exhibited, of cream-white and yellow, and dark grey and yellow, are from beds that overlie one another. The yellow streaks in both of these marbles are composed of dolomite, while the light ground of the one, and the dark ground of the other, are of carbonate of lime. When the dark grey approaches black, which it sometimes does, and the yellow streaks are narrow, the marble bears a strong resemblance to the Portor marble from Northern Italy, sometimes known as *black* and *gold*. On analysis, the resemblance between the two is farther sustained by the fact, that in both cases the ground is a pure limestone, and the yellow veins are dolomite. It is not unlikely, that if the rock were extensively quarried, some beds might be found in which the resemblance to the Portor would be closer than in the specimens exhibited.—*Upper Helderberg formation? Devonian.*

Serpentines.

St. Joseph, Beauce.—The band of serpentine, from different places on which specimens have been obtained, has been traced on the south side of the St. Lawrence, from Potton to Cranbourne, a distance of 140 miles; in forty miles of which, it is repeated twice by undulations, giving an additional eighty miles to its outcrop. It is again recognized 250 miles farther to the N. E., in Mount Albert, in the Shickshock Mountains; and about seventy miles beyond this, in Mount Serpentine, approaching Gaspé Bay. All the specimens of these rocks, which have been analysed, contain small quantities of chromium and nickel, and the band is associated in its distribution with soapstone, potstone, dolomite and magnesite. The whole of these occur in large quantities, and in them, as well as in the serpentine, chromic iron occurs, sometimes in workable quantities. These rocks, or others immediately near them, contain the metals iron, lead, zinc, copper, nickel, silver and gold; with the drift gold, derived from these strata, are found platinum, iridosmine, and traces of mercury. In 1847, these serpentines, from their distribution, were described in the reports of the Geological Survey as an alterated sedimentary rock. All subsequent observations have confirmed this, and beautifully stratified masses of it have at length been discovered in Mount Albert.—*Quebec group, Lower Silurian.*

None of the serpentines, and with the few trifling exceptions that have been mentioned, none of the marbles of Canada, have yet been quarried for economic purposes. All of the specimens of them exhibited by the Geological Survey, are consequently from parts of the strata that have long been exposed to the influence of the weather, and are of course inferior to the unweathered portions beneath. There appears little doubt that, in time, both the limestones and serpentines will afford a great amount of beautiful material for architectural purposes, and support a great amount of industry.

SLATES, FLAGSTONES, LIME, BRICKS, AND DRAIN TILES.

Roofing Slates.

WALTON QUARRY, MELBOURNE, lot 22, range 6.—This band of slate is in immediate contact with the summit of the serpentine. It has a breadth of one-third of a mile, and dips about S.E. $< 80°$. Mr. Walton commenced opening a quarry upon it in 1860, and found it necessary, in order to gain access to the slate, to make a tunnel through a part of the serpentine. To complete this, and to expose a sufficient face in the slate to pursue profitable working, has required two years of time, and $30,000 of expenditure. The face now exposed has a height of seventy-five feet; but the band of slate crosses the St. Francis and the fall from the position where the quarry is now worked, to the level of the stream, is upwards of 400 feet, the distance being one and a half miles, so that by commencing an open cutting on the slate, at the level of the stream, a much greater exposure can be ultimately attained. Up to a comparatively recent period, the usual coverings of houses in Canada have been wooden shingles, galvanized iron or tin plate, but so many destructive fires have occurred from the use of the first of these, that they are now interdicted in all large towns. Slate, as a covering, costs about one-third more than shingles, but one-half less than tin, and one-third less than galvanized iron. In the following table are shown, 1st, the size of the slates, in inches; 2nd, the number of each slates in a square (of 100 square feet); and, 3rd, the price per square at which Mr. Walton supplies his slates, placed on the railroad cars at Richmond, which is within one and a half miles of the quarry.

Sizes.	No.	Price.	Sizes.	No.	Price.	Sizes.	No.	Price.
24×16	86	$4 00	20×10	169	$4 00	14×10	262	$3 00
24×14	98	4 00	18×11	175	4 00	14× 9	231	3 00
24×12	114	4 00	18×10	192	4 00	14× 8	327	3 00
22×12	126	4 00	18× 9	213	4 00	14× 7	374	2 75
22×11	138	4 00	16×10	222	3 75	12× 8	400	2 75
20×12	141	4 00	16× 9	246	3 75	12× 7	457	2 50
20×11	151	4 00	16× 8	277	3 60	12× 6	533	2 25

The quarry has now been in operation since the spring of 1861; 2000 squares have been sold, and some of the slates have been sent to a distance of 550 miles from the quarry; a quantity of them having been purchased for Sarnia on the River St. Clair. To show that slate, as a covering, is well adapted to resist the influence of a Canadian climate, it may be here stated that slates from Angers in France, have been exposed on the roof of the Seminary building on the corner of Notre Dame and Francois Xavier Streets, in Montreal, for upwards of 100 years, without any perceptible deterioration. The strong resemblance between these and the slates of Melbourne, as well as those from Bangor in Wales, may be seen in the following comparative analyses by Mr. T. Sterry Hunt:

	Welsh.	French.	Melbourne.
Silica	60.50	57.00	64.20
Alumina	19.70	20.10	16.80
Protoxyd of Iron.	7.83	10.98	4.23
Lime	1 12	1.23	0.73
Magnesia	2.20	3.39	3.64
Potash	4.18	1.73	3 26
Soda	2.20	1.30	3.07
Water	3.30	4.40	3.40
	100.03	100.13	99.63

The proximity of the serpentine leaves no doubt as to the geological horizon of these slates.—*Quebec group, Lower Silurian.*

CLEVELAND, (FORMERLY SHIPTON), lot 6, range 15.—The Cleveland slates are a continuation of the Melbourne band. The Shipton Slate Company opened a quarry on them in 1854, and found them to be of superior quality. This quarry is now for sale. The slates of Orford may be on the same band, about ten or twelve miles to the S. E.; but the geological horizon of the Tring slates is uncertain, though they probably belong to the Quebec group. The Kingsey slates appear to be lower in the series than the magnesian group of strata.—*Quebec group, Lower Silurian.*

Flagstones.

GEORGETOWN, ESQUESING.—This is a hard, fine-grained sandstone; and the surfaces are even and parallel. Many of the beds of the band, which is twenty feet thick, can be split into flagstones; which are used in the city of Toronto. Similar flagstones, used at Hamilton, are obtained from the same band there, and an equally good quality can be obtained wherever the band occurs.—*Grey band, Medina formation, Lower Silurian.*

Hydraulic Lime.

ST. CATHERINES.—The bed which forms the Thorold cement is a dark brown dolomite of the Clinton formation. During the construction of various railway, and other public works, the quantity of cement manufactured by Mr. Brown averaged 80,000 bushels annually, but at present the quantity made does not exceed one-tenth of the amount. The present price of the cement is from twenty to twenty-five cents per bushel of sixty lbs.—*Clinton formation, Middle Silurian.*

WALKERTON.—The beds of this deposit are from two to eleven inches thick, occasionally separated by layers of shale, making in all fifteen feet. Cement has not yet been manufactured from this stone; and none is made within 100 miles of the locality, although there would, no doubt, be considerable demand for it in the neighborhood, were it prepared at the place. The locality is in the bank at a mill-dam on the Saugeen River, where an unlimited water power for grinding the cement may be had.—*Onondaga formation, Upper Silurian.*

LIMEHOUSE.—This stone occurs in a band of nine feet thick, in beds varying from three to seven inches. The cement is manufactured in considerable quantities by Messrs. Bescoby and Newton. It sets slowly, and hardens during several weeks, after which it is said to possess great strength.—*Clinton group, Middle Silurian.*

NEPEAN.—Though the rock occurs in Nepean, its produce is usually designated as the Hull cement, from having been manufactured for several years, by Mr. Wright of Hull, opposite to Ottawa. The rock is a limestone holding about 12 per cent. of carbonate of magnesia, and it yields a strong and lasting cement. The bed to which it belongs, has been traced for nearly 100 miles through the country, preserving a very uniform character.—*Chazy formation, Lower Silurian.*

ROCKWOOD.—This specimen comes from a band three and a half feet thick, associated with a layer of chert, and separating into beds averaging six inches. It is not worked, but could be easily quarried, and a good water-power for grinding is ready at the spot.—*Niagara group, Middle Silurian.*

MAGDALEN RIVER.—These specimens of black dolomite are derived from the Mountain Portage, about five miles up the Magdalen River from its mouth. The stone occurs in beds of from two to four inches, interstratified in black graptolitic shales, and yields a very strong hydraulic cement, setting in a few minutes under water, to a very hard and tenacious mass of a yellowish colour. Similar bands occur at the Grande Coupe, six miles below Great Pond River. The range of the formation containing these bands, being from Gaspé to Quebec, makes it probable that a considerable quantity of the stones may be obtained from various places along the south shore of the St. Lawrence. The stone differs from that at Quebec, from which Capt., now Major General Raddeley, R. E., first prepared a cement, now manufactured by Mr. P. Gauvreau. This contains no magnesia, while the Gaspé stone is a dolomite.—*Hudson River formation, Lower Silurian.*

Brick.

MONTREAL.—The red bricks of Montreal are manufactured from a blue clay of marine origin, which is interstratified with reddish layers, and runs under a deposit of sand. The clay has been excavated to a depth of twenty feet, and may be deeper, as the same formation is known to have a greater thickness in other localities. Its marine origin is proved by the occurrence of sea shells, of about six species in the pure clay, and about thirty in the sand clay immediately overlying it; all probably the same as species now inhabiting the ocean. Our knowledge of the fossils of these deposits has been greatly extended by the researches of Dr. Dawson, of McGill College, who has more than doubled the number of shells known a few years since, and added to the list many species of *Bryozoa, Foraminifera*, and other small forms. The remains of the capeling (*Mallotus villosus*) and the lump-sucker (*Cyclostomus lumpus*) are obtained ffom the same clays near Ottawa, and a clay pit of Messrs. Peel & Compte, on Côteau Baron, has yielded nineteen of the caudal vertebræ of a cetacean, similar to a species discovered in Vermont by the late Mr. Zadock Thompson, and named by Mr. C. H. Hitchcock, *Beluga Vermontana.* On Côteau Baron these remains were accompanied by one of the pelvic bones of a seal, by sea-shells, and by fragments of white cedar, *Thuya occidentalis.* The locality is about 140 feet above the level of the sea. In another of Messrs. Peel and Compte's pits there has recently been found a nearly entire skeleton of the Greenland seal (*Phoca Grœnlandica*), a species still living in the Gulf of St. Lawrence; from the size of the head, the animal appears to have been six feet long, and full grown. Within a few days, a clay-pit of Messrs. Bulmer & Sheppard has given many of the bones of some other animal, supposed to be a seal, of much smaller dimensions. The brick yards are situated to the north-east of Mount Royal, on a plateau of considerable extent; above which, well-marked sea margins occur on the sides of the mountain, at elevations of 220, 386, 440 and 470 feet above the sea level, with marine shells up to the last mentioned height.—*Alluvian.*

HANOVER, BRANT, Geological Survey.—The specimens are manufactured from a brownish laminated clay, which burns white, and is underlaid by a considerable deposit of sand. Either red or white bricks are made of this clay, according to the sand used.—*Drift.*

TORONTO, WHITE BRICKS.—The deposit of clay, from which these white bricks are manufactured at Toronto, has a thickness exceeding sixty feet, and extends eastward, at least as far as Cobourg. It appears to be unconformably overlaid by a bed, which is three feet thick, giving red bricks. The white brick clay lies in very even horizontal strata while the other undulates with the general surface, not however descending to the bottom of deep ravines. The average annual manufacture of white bricks in Toronto is from three to five millions, and the ordinary price at the kiln is from $5.50 to $6.00 per 1000. The price of common red bricks is from $3 to $4 per 1000, and the average annual manufacture, including all kinds, is from eight to ten millions.—*Drift.*

Drain Tiles.

QUEBEC.—H. O'Donell, C. E., Quebec.—These tiles are manufactured by Messrs. W. & D. Bell, from a deposit of clay, varying in thickness from three to thirty feet, on the river St. Charles, between one and two miles from Quebec. They are used for main sewers and house drains, in the city of Quebec, where 151,000 feet of them have been laid. They are united by means of rings of the same material, which cover the joints, and permit alterations and repairs without breaking the pipes. When in place, the pipes are capable of resisting a pressure of fifty lbs. to the square inch, and, when properly glazed with a composition, (the base of which is oxyd of lead), which is applied either within and without, or within only, they remain free from the incrustations that are found to gather on the inside of iron pipes. The prices of these drain tiles are:

4 in.	6 in.	9 in.	12 in.	15 in.	18 in.	inter. diameter.
$0.15	$0.21⅔	$0.33⅓	$0.50	$0.84	$1.13½	per linear foot.

Proceedings of Societies.

LOCAL COMMITTEE FOR THE PROVINCIAL EXHIBITION.

The different buildings now being erected under the several contracts with the Local Committee, for the purposes of the Exhibition, are progressing very satisfactorily, and may be expected to be ready by the 1st of August, the time named for their completion.

These buildings are all of a permanent character, strongly framed, and with good shingle roofs. The Horse Stables are three in number, each 184 ft. by 32 feet, with stalls and boxes for 200 horses and are placed in the form of a quadrangle, with an open court towards the main Exhibition Building. The Cattle Sheds are in size and position corresponding to the horse stables, with accommodation for 330 head of cattle. A raised open passage, 8 feet in width, runs through the centre of each shed, between the two lines of cattle.

These erections stand on the Eastern portion of the Exhibition Grounds—the Stables on the North side of the line of King-street, and the Cattle Sheds on the South side.

The Building intended for heavy Machinery and Carriages is 256 feet by 42 feet, standing 60 feet north of the Crystal Palace, and exactly parallel with it.

Mr. Thomas Storm, of Toronto, is contractor for the Horse Stables, at a cost of $3,660; Mr. F. C. Walker, of Hamilton, for the Cattle Sheds, at $2,434; and Mr. J. W. Mason, of Toronto, for the Machine Shed, at a cost of $875; making a total of $6,969.

The funds placed at the disposal of the Committee, up to the present time, are $6,000 from the Corporation of the City of Toronto, and $1,200 from the Council of the Agricultural Association*—making altogether the sum of $7,200, or $231 over and above the amount of the contracts already entered into. Some necessary levelling around the Buildings, and other expenses already incurred, will fully absorb this balance.

The Municipal Councils of Ontario and Simcoe have been applied to, to contribute their quota towards securing the other necessary accommodation for the Exhibition, such as Sheep and Pig Pens, and Poultry Sheds. The Committee look for a liberal response from these counties, as they are to a certain extent as much interested as the city of Toronto, which has already voted for buildings for the past and present Exhibitions the sum of $26,000, besides expending several thousand dollars in draining, levelling and planting the grounds.

The Local Committee meets every Saturday, with few exceptions, either at the rooms of the Board of Arts and Manufactures, or at the Exhibition Grounds.

* The sum of $1,000 had been voted by the Municipal Council for the Counties of York and Peel, towards the Prize List of the next Exhibition; the Council of the Association, therefore, felt it to be their duty to vote to the Local Committee a sum equal to that amount, which, with an additional sum of $200, was promptly done.

THE "CITY OF TORONTO ELECTORAL DIVISION SOCIETY."

A meeting of the Directors of the "City of Toronto Electoral Division Society" was held at the rooms of the Board of Arts and Manufactures, on Monday, the 9th of June, when the following resolutions were unanimously adopted:—

Resolved—"That the entire funds of the Society, after meeting all liabilities of the year, be paid over to the Provincial Association; thereby securing to the members all the privileges of members of the Association."

Resolved—"That members of this Society, for the present year, be each presented with a copy of the "Agriculturist," or the "Journal of the Board of Arts and Manufactures," at their option."

The annual subscription to this Society is $1, which may be paid to the Secretary and Treasurer, Mr. W. Edwards; or to James Beachell, *President;* Rice Lewis and J. D. Humphreys, *Vice-Presidents;* Col. E. W. Thomson, A. Shaw, R. L. Denison, G. Leslie, J. Gray, J. Fleming, and W. H. Sheppard, *Directors.*

TORONTO MECHANICS' INSTITUTE.

A meeting of members of this Institution was held on Tuesday, July 1st, in accordance with a Resolution adopted at the annual meeting, on motion of Mr. C. Pearson, for the purpose of "initiating a series of meetings for the discussion of matters of practical interest to mechanics." The first Vice President, Mr. W. Edwards, occupied the chair and explained the object of the meeting.

The meeting was not numerously attended, but several of the members present spoke warmly in favour of at once proceeding to initiate the meetings, believing that great benefits would eventually result to the mechanic members of the Institute, by the discussion of such topics as are calculated to add to their knowledge of practical matters, and to improve their taste.

Mr. Pearson moved to postpone the commencement of these discussions until about the 1st of October next, and in the mean time to offer two prizes for 1st and 2nd best lists of topics suitable for discussion. This proposition not being agreed to, it was moved by Mr. W. H. Sheppard, and resolved,

"1st. That the Directors be requested to give a Class Room and light for the purpose contemplated by the meeting, and that the undersigned pledge themselves to meet once a fortnight, as far as may be convenient for them to do so, for the purpose of taking part in or promoting the contemplated discussions."

"2nd. That the meetings be opened by the reading of an original paper, or an extract from some reliable author, upon the subject proposed for discussion, by some person previously appointed for the purpose; and that it shall then be the duty of the members present to make such practical remarks, and propose such questions, as may occur to them as bearing upon the subject; to bring forward the ideas of other authors, and to elucidate the subject as much as possible."

"3rd. That the next meeting be held on Friday, the 25th of July; and that the subject for discussion at said meeting be *Heating and Ventilation of Buildings;* and that all members taking an interest in the subject be invited to attend."

Eleven members subscribed their names, when the meeting adjourned.

WHITBY MECHANICS' INSTITUTE.

The annual meeting of this institution was held on Thursday, May 30th, at the hall of the Institute; the president- J. Hammer Greenwood, Esq., occupied the chair.

After reading the minutes of the previous annual meeting, which were adopted, the president read the report of the General Committee, from which we learn that the members number 267, being an increase of 63 during the year. Seventeen lectures were delivered during the past season, which were all well attended. The library at present contains 808 vols, 153 of which were added by purchase during the year. During the same period two hundred members availed themselves of the use of the library, the number of vols. issued being 2,965. This is an increase of 61 reading members, and 591 vols. on the present year. The receipts from all sources amounted to $857 58, and the expenditure to $847 83. The auditors' statement shews assets to the amount of $2,543 50, and liabilities to 1st April $52 80. The report suggests the increase of the members annual subscription, which at present is only one dollar.

On motion of Mr. McCabe, seconded by Dr. Ham, the report was adopted. The auditors' report was also adopted, and the thanks of the meeting voted to the retiring officers.

The following were then elected officers for the ensuing year:

William McCabe, *President*—A. F. McPherson, *Vice-President*—John Shier, *2nd Vice-President*—Mr. Thwaite, *Recording Sec'y*—Rev. K. Maclennan, *Corresponding Secretary*—James Bain, *Treasurer*—H. Fraser, *Librarian.*

General Committee.—Messrs. John Ferguson, Major Harper, M. O. Donovan, J. Bengough, Alex. Mason, S. H. Greenwood, Geo. Hopkins, J. H. Perry, James Draper, and G. Y. Smith.

Resolutions were passed instructing the committee to arrange for an excursion trip under the auspicies of the institute, during the summer, if they deemed the same practicable; presenting the Rev J. T. Byrne with a life membership, in token of his services, and appointing a committee to wait on him therewith; and conveying the thanks of the members of the Institute, to the Trustees and members of the Whitby Division of the Sons of Temperance, for the liberal surrender and sale made by them of their interest in the Hall.

The meeting then adjourned.

THE PROVINCIAL EXHIBITION.

The speedy approach of the Provincial Exhibition reminds us of the necessity of again calling the attention of manufacturers, artizans and mechanics to the value and importance of securing a complete representation of their several departments of industry at Toronto, in September next.

There can be no doubt whatever that the Provincial Exhibition of 1862 will far surpass in all details any of its predecessors, and a better opportunity for display has never yet occurred in the history of the Province.

The large amount of prizes devoted to the Manufacturing Department, and the new arrangement which has been adopted by the Board of Arts and Manufactures will no doubt prove acceptable to many who have hitherto been disposed to express disapprobation at the small amounts awarded. A sum exceeding two thousand dollars, varying from thirty dollars downwards, is itself an attraction, but we believe that the spirit of emulation, which is now beginning to be developed, will alone be sufficient to secure for the Arts and Manufacturing Department of our Exhibition in September next a far better representation of the manufacturing industry of the country than has ever hitherto been made.

ELECTRIC APPARATUS.

By an ingenious contrivance, an Electric Apparatus is attached to the turnstiles at the entrances of the International Exhibition Building, and communicating—by means of a line of copper wire laid across the building—with the finance office of the Commissioners. This instrument is worked without battery-power of any kind, the electricity being generated by a magnetic machine of peculiar construction, connecting with the turnstiles in such a manner as to discharge a current at each revolution of the stile, registering the passing through of each individual, and establishing a complete check upon the money takers at the door.

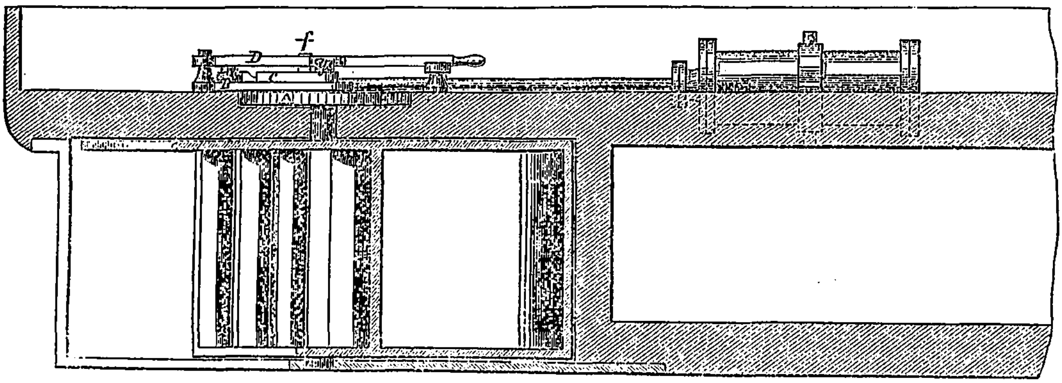
O'HARA'S LIGHT DRAFT PROPELLER.

A great requirement of the present age is a means of propelling by steam power canal boats, by some instrument of propulsion not liable to the well known objections of the paddle-wheel, or screw propeller.

The accompanying engraving illustrates an original propeller designed by Mr. Charles O'Hara, of London, England, (formerly of Toronto,) especially for canal navigation, its object being to propel a boat by a comparatively small expenditure of steam power, by obviating the mechanical disadvantages of crank movements, lift-water, &c., and to cause no surge injurious to canals or their banks.

The propeller is represented detached from a vessel in a perspective view in Fig. 4. It is of semi-cylindrical form, resembling one-half of a cylindrical grindstone with its axis attached; the surfaces on each side of the axis are corrugated or fluted, and the adaptation of the propeller and axis

Fig. 1

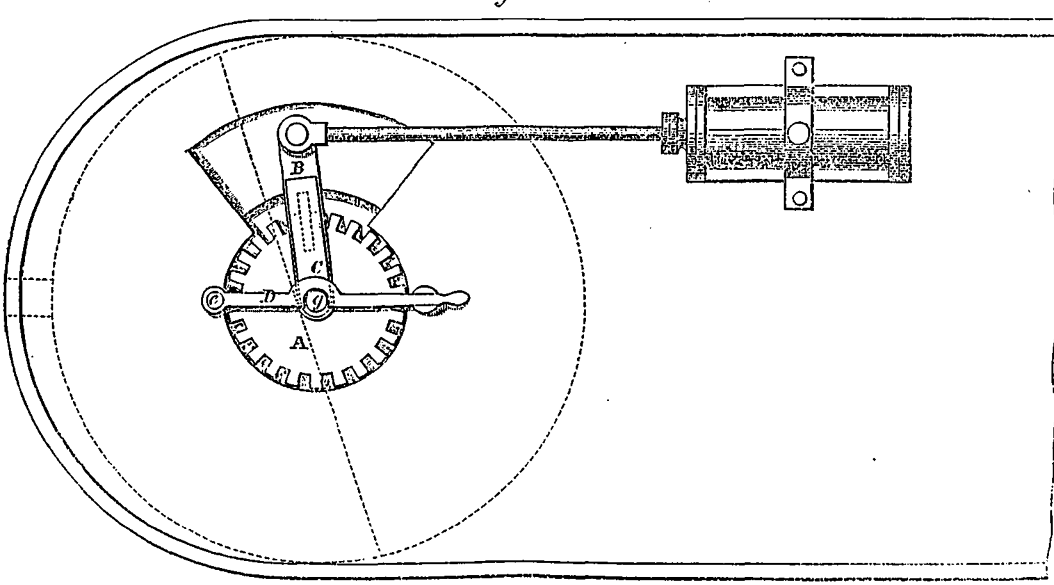


to a vessel and steam-engine is illustrated in Fig. 1. The form of the stern of a vessel for the reception of the propeller is shewn in Fig. 3. The circular surface of the propeller moves close to the surface of the concave or recess at the stern of the vessel as close as possible without touching it.

In Fig. 2 the attachment of the propeller to the engine is represented, and it will easily be perceived that the action of the piston of the engine drives the fluted surfaces of the propeller through the water between those points most favourable to direct propulsion, alternately, and thus the vessel is propelled forward.

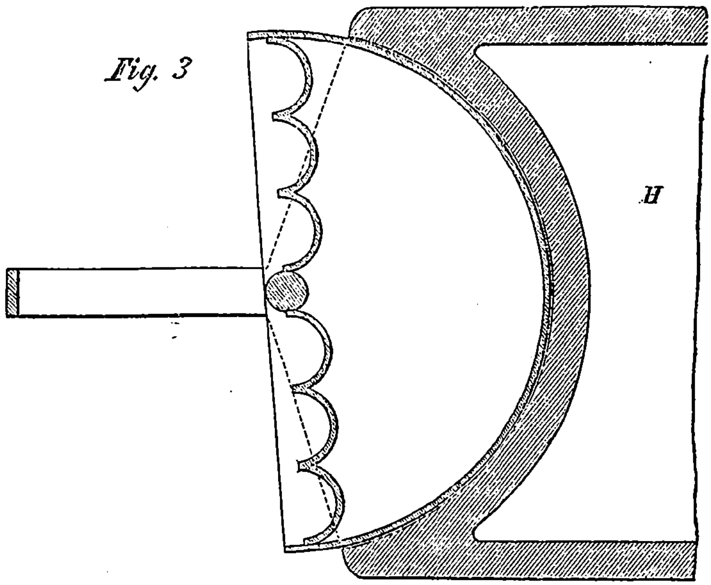
When it is necessary to back the vessel, the propeller is turned round so that the fluted surfaces are opposite the concave at the stern of the vessel, and the reversion is effected by a simple contrivance illustrated in Fig. 2.

Fig. 2



The cog-wheel A is rigidly fastened to the propeller, and the arm B, to which the piston rod is attached, is freed from the propeller by the withdrawal of a bolt which passes through a slot in the arm, and passes into any one of the cogs in the wheel; by this arrangement the propeller may be made to oscillate in any position required, and the boat may be suddenly turned out of its course by the action of the propeller.

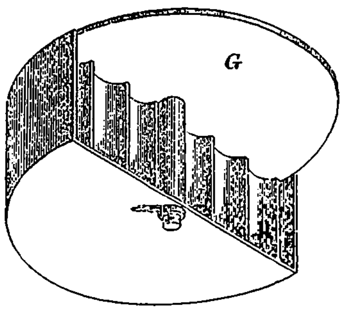
Fig. 3



The inventor of this propeller claims the following advantages for his invention.

1. Simplicity in structure and cheapness in manufacture.
2. Simplicity and cheapness of engine used in connection with it.
3. Very direct action.

Fig. 4



4. No loss of power by lifting water or displacing it, as is the case with the paddle-wheel and screw.
5. Great reduction in the consumption of fuel.
6. For floating batteries, the propeller is submerged and all the machinery may be placed under the water line.
7. No surge is caused by it in canals, to injure or wash their banks, and no rapid vibrations tending to injure the boat or its machinery.
8. On the shortest notice the propeller may be placed in a position to turn the vessel rapidly out of its direct course.

Patents for this invention have been secured in England, Canada, France, and the United States, and information regarding it may be obtained by addressing the assignee.

WALTER O'HARA,
Toronto, C. W.

RECENT CANADIAN INVENTIONS.

FLEMING'S FARM OR RAILWAY FENCE. — This Fence is straight and in panels of any convenient length. It rests on the surface of the ground, or rather the cross-sills which form the base and termination of each panel are partially imbedded in the ground. Two uprights are made to fit corresponding holes in each cross-sill, in such a manner as effectually to exclude moisture. The uprights are bound together, and also to the upper rail, by a bolt and nut. The panels are then filled with rails, laid the one on top of the other alternately.

The material composing the Fence may be prepared three different ways, according as it is found to be most desirable, either as regards economy, neatness, or durability, viz :—

1st. To have it all of sawn lumber.

2nd. To have it partially sawn and partially split.

3rd. To have it all split.

The advantages claimed by the Inventor for this kind of Fence are various :—

1st. It has the merit (in common with all others made to rest on the ground) over a post and board Fence, viz: that the upheavel caused by frost has no effect whatever, while the rigidity and binding together by the bolt, aided by the cross-sills being imbedded in the ground, enable it to resist effectually a gale of wind that would blow down any other kind of Fence constructed to rest on the ground.

2nd. It is less expensive than a post and board Fence, while at the same time it is equally straight and neat.

3rd. It can be all made of split cedar, and consequently in addition to its cheapness it is more durable.

4th. It can be built on any kind of hilly ground, and be as effectually strong as on the level plain.

5th. It will go less out of repair than any other Fence, and in point of fact requires no repair for many years.

6th. It can be all taken apart if necessary, and rebuilt at any other place required, with ease and despatch, and without the loss or destruction of any portion of the Fence.

Invented by D. Fleming, Toronto.

Keachie's Strapless Skate.—The sole of the Skate is made of steel, in the usual form. The part on which the foot rests is brass, and screwed to the Skate. The forward part of the Skate, *i. e.* the part nearest the toe, has two screws inserted in the brass foot-piece, on which is placed an iron plate with two mortices, about half an inch in length, for the heads of the screws to work in, the front end of the mortice being made sufficiently large for the screws to go through. The back part of the mortice, *i. e.*, the part nearest the heel, fits the screw tight, the upper part being bevelled to fit the under side of the screw head, which holds the Skate tight to the foot when the plate is pressed forward.

The iron plate is fastened to the boot with four small screws, and so adjusted that when the foot is pressed forward the heel of the boot will fit close to the spring. A small iron plate is fixed to the heel of the boot, with a hole for a pin to pass through; also a small mortice for a catch to work in. A spring is worked by a ring, which screws the heel part of the Skate to the foot in the firmest manner, much firmer than is possible to do with elastic straps in the ordinary way.

The Inventor claims that its security and simplicity saves much time in putting on and taking off Skates, which is of the greatest importance to Skaters, particularly in very cold weather.

2nd. The inconvenience and unsightly appearance of straps is done away with, leaving the foot free.

3rd. The greatest benefit to be derived from this method of fastening Skates is that it gives the foot free action, and does away with the cramping and benumbing the feet, which always occurs in the old method.

Invented by George C. Keachie, Brantford.

Copper containing twenty-four per cent. of phosphorus, will resist a strain of 48,000 lbs. to the square inch.

PATENTS OF INVENTION.

Bureau of Agriculture and Statistics, Quebec, 21st June, 1862.

His Excellency the Governor General has been pleased to grant Letters Patent of Invention for a period of Fourteen Years, from the dates thereof, to the following persons, viz:

James Rogers Armstrong, of the City of Toronto, County of York, Iron Founder, for "A new Design of a Cooking Stove, styled "The Maple Leaf."—(Dated 29th November, 1861.)

Elihee Stead, of the City of Toronto, County of York, for "A composition of matters to clarify and deodorize Canadian Rock Oil and Coal Oil."—(Dated 26th March, 1862.)

James E. Thompson, Gas Engineer, and Henry Y. Hind, Professor of Chemistry and Geology, both of the City of Toronto, County of York, for "An apparatus for the manufacture of Illuminating Gas from Crude Petroleum or Rock Oil."—(Dated 28th March 1862.)

James E. Thompson, Gas Engineer, and Henry Y. Hind, Professor of Chemistry and Geology, both of the City of Toronto, County of York, for "A Process for the manufacture of Illuminating Gas from Crude Pètroleum or Rock Oil."—(Dated 28th March, 1862.)

Cyrenius Chapin Roe, of the Town of Brantford, County of Brant, Machinist, for "A Horizontal Endless Chain or Rope Horse Power."—(Dated 10th April, 1862.)

Samuel Conover, of the Township of Toronto, County of Peel, Yeoman, for "An article called "The Victoria Concave Washing Machine."—(Dated 12th April, 1862.)

David Elon Norton, of the Town of Bowmanville, County of Durham, Machinist, for "A new and improved Straw Cutter, called "Morton's Diamond Straw Cutter."—(Dated 12th April, 1862.)

John Walmsley, of the Village of Berlin, County of Waterloo, Waggon Maker, for "A machine called a "Combined Sower and Cultivator."—(Dated 12th of April, 1862.)

Charles Bodley, of Mount Forrest, Counties of Wellington and Grey, Carpenter and Fanning Mill Maker, for "An Improved Sifter Fanning Mill and Elevator."—(Dated 12th April, 1862.)

Moffitt Forster, of the Village of Glen William, County of Halton, Miller, for "An Improved Safety Whipple—Tree and Spring closed Hold backs."—(Dated 12th April, 1862.)

James Lorenzo Gage, of the Village of Dacotah, County of Halton, Merchant, for "A Bag Fastener."—(Dated 12th of April, 1862.)

Robert Parr, of the Township of Darlington, County of Durham, Yeoman, for "A Hair and Feather Cleanser and Renovator."—(Dated 15th April, 1862.)

James Dalgarno, of Chatham, County of Kent, Moulder, for "An Instantaneous Adjustment Wrench."—(Dated 15th April, 1862.)

Joseph A. Mardin, the younger, of the Township of Barnston, District of St. Francis, Blacksmith, for "A new and improved Punching Machine, called "Mardin's Punching Machine."—(Dated 22nd April, 1862.)

Edward Long, of the City of Montreal, Carpenter and Joiner, for "A new method of preparing signs and plates, designated "Edward Long's Adjustable Letters and Figures."—(Dated 22nd April, 1862.)

Richard Rogers, of the City of Montreal, Plasterer, for "A new composition of matter to be used in the manufacture of blacking-pots, pomatum-pots or similar articles."—(Dated 22nd April, 1862.)

Ulric Joseph Martineau, of the parish of Longueuil, Tinsmith, for "An improved Metal Roof, made with galvanized iron or other metals."—(Dated 20th May, 1862.)

ABRIDGED SPECIFICATION OF ENGLISH PATENTS.

2783. H. Orth. *An improved soap.* Dated Nov 5, 1861. This consists of a mixture or combination of about 100 parts in weight of finely levigated clay, such as pipe clay, china clay, or other aluminous or ciliceous earths; 20 parts of caustic alkali, such as caustic potash, caustic soda, or caustic ammonia, or the carbonates or bicarbonates of soda, potash or ammonia, corresponding to an equal amount of caustic alkali, and 20 parts of resinous matter, such as ordinary fine resin of a similar nature capable of being saponified. These proportions may be varied according to the quality of the soap it is desired to obtain. In preparing this soap, the resinous and alkaline or caustic alkaline ingredients are mixed with about 50 parts by weight of water, and boiled together, ebullition being continued until the alkali and the resin are combined and saponified. The saponified mass is then mixed with the argillacious or earthy matters, the whole being worked into a homogeneous paste, which is afterwards dried, and which is then ready for use.

2784. G. T. Bousfield. *Improvements in electroplating or depositing metals.* (A communication.) Dated Nov.5, 1861.

This consists in the use of a solution of fused cyanide of potassa of great strength, in connection with a powerful galvanic current, whereby the patentee is enabled to plate iron and other metals rapidly and economically with copper, without the use of either sulphate or cyanide of copper, and without danger or inconvenience to the workmen.

2789. F. H. Schroder. *Improvements in evaporating and in machinery employed therein.* Dated Nov. 6, 1861.

This invention is intended chiefly to apply to the evaporation of the liquid parts from sugar when in a state of syrup, in order to obtain it in a crystalline condition. It is, however, applicable to evaporative purposes generally. The invention consists in placing the syrup, or other matter to be evaporated, in an open pan heated by steam or hot water, let into a jacket or case, in which the pan is placed, and in causing a series of concentric cylinders, through which a blast or current of hot or cold air is forced, to revolve in the syrup, a portion of the cylinders being continually in the cyrup and another portion revolving in the atmosphere. The cylinders are each formed with slots running in the direction of their length.

2877. E. Loomes. *Improved machinery for moulding bricks, tiles, and other like articles.* Dated Nov. 15, 1861.

This consists in adapting to the lower end of the pug mill shaft one, two, or more eccentrics, cams, wipers, &c., in combination with moveable stops, against which the clay or substance to be moulded is pressed by the cams or wipers as they move round. By that means the clay is squeezed between the curved surfaces of the wipers and the stops, and will thereby be forced out of the mill through the apertures provided for the purpose, and will be pressed into or through moulds or dies.

COST OF SHIPPING PETROLEUM TO LIVERPOOL.

In answer to numerous questions respecting freight of Rock Oil, &c., we publish such information as we have been able to obtain from reliable sources:—

1. The Well to Wyoming Station, 40c. to 50c. per barrel.

2. Wyoming to Sarnia, free of dockage and storage 28c. per barrel.

3.	"	Hamilton,	" 60c.	"
4.	"	Montreal,	$1 20c.	"
5.	"	Quebec,	1 38c.	"
6.	"	Portland,	1 60c.	"

$10 per car of (58 barrels) is charged for unloading and dockage at these three last-named ports.

7. Freight has been taken this season at $4 per barrel from Sarnia to Liverpool.

8. Crude oil has recently been purchased at the wells by some of our merchants, at 25c. to 30c. per barrel.

9. Barrels average 40 wine gals., and weigh about 350 lbs. These rates are in actual operation, and may be relied upon. Nothing comparatively has been shipped from St. Clair ports below Sarnia, which, via Great Western Railway, is the favourite route on the St. Clair river; costing, as shown, about 78c. per barrel from the wells to Sarnia,—which, with the price of the oil, 30c., and freight thence to Liverpool, $4, would bring the cost per barrel in Liverpool harbour to $5.08.

The Hamilton route has not been tried, shippers preferring the Lower Canadian ports and Portland.

With regard to our canals, a vessel of 200 tons burden, drawing 8 feet 9 inches of water, has just returned from a trip to Montreal, paying for towage and other fees (no lockage) from Toronto to Montreal and back, the sum of $160. The length of locks on the St. Lawrence Canal is 200 feet, width, 45 feet; average depth of canal, 9 feet. Locks on the Welland Canal* (in passing up to the St. Clair) length, 150 feet, width, 26 feet 6 inches; depth, 9 feet.

* The Welland Canal is 28 miles in length, and has a rise of 334 feet from Lake Ontario to Lake Erie, through 37 locks of 150 feet in length and 26½ in width, and is passable from lake to lake by vessels 134 feet over all, 26 feet beam, and 9 feet draught, stowing 3,000 barrels of flour under deck.

Shipments of oil by the Great Western Railway during the year:

January, 1862	11,775	barrels.
February, "	2,211	"
March, "	4,750	"
April, "	1,438	"
1st to 23rd of May	3,744	"
	22,908	"

Equal to 956,320 wine gallons.

SHIPMENTS OF PETROLEUM.

From the Toronto Globe.

Several cargoes of Petroleum have now cleared for European ports from Canada, and in a month or two the prices will be well established. Until these shipments arrive, the market can hardly be tested, as what has hitherto been shipped, last fall and winter, has only been small lots of 20 to 50 barrels as samples. We notice the following shipments: the barque "Prince of Wales," from Sarnia, with 2,800 barrels for Queenstown; part of this cargo was lost in the canal the barge striking the locks. The brigantine "Snow Bird," cleared from Quebec for London on the 28th ult,, with about 1,450 barrels. This vessel is owned here by G. H. Wyatt, and A. M. Smith & Co., as well as the cargo, with the exception of 500 barrels shipped by Myles & Co. The schooner "Gulnare," owned by Messrs. Myles & Co., is now loading 1,100 barrels for themselves and Messrs. Matthews & McLean of this city. The brig "Chieftain." loaded at Sarnia for Queenstown, Ireland, with about equal to 1,700 barrels. In addition, we understand, the schooner "George Laidlaw" is going to load for Messrs. J. E. Ellis & Co., of this city, for London. She will likely load at Sarnia and fill up at Quebec.

The freight paid was $4 per barrel from Wyoming station to Liverpool. From Quebec to Liverpool, $2 per barrel of 40 gallons; and to London, $2 50 per forty gallons. The rate of insurance on good ocean vessels, without deck load, is from 2½ to 3 per cent.

SMITH & JONES' NAPHTHOMETER, OR BENZINE DETECTOR.

We have received a copy of a little pamphlet, written for the purpose of explaining the construction and mode of operation of a "Benzine Detector," invented and patented by Horace J. Smith and Woodruff Jones. The inventors say:

"The want of a ready and reliable means of detecting dangerous and explosive Coal or Petroleum Oil, has long been felt. The great competition, which exists at present, induces many refiners to sell as "Non-Explosive Coal" that which is entirely unsafe to be used in the family, and the numerous accidents which have occurred with such articles, have created a prejudice in the minds of many against *all* oil, which can only be removed by having a simple means of testing the quality of any that is offered for sale. Since refined Petroleum is comparatively a new article, and its properties but little understood by the public at large, it is very natural that it should be looked upon with suspicion.

The difficulty of detecting a dangerous oil is great. The crude or unrefined oil consists essentially of three ingredients, which are to be separated by the process of refining; these are Benzine or Naphtha, Illuminating Oil, and Lubricating or Heavy Oil. The properties of these when *separated* are very different and distinct, but when *mixed*, it is difficult to detect the quantity of each, or even, in many cases, the admixture. They each differ materially in specific gravity; the Benzine marks 65° on Beaume's hydrometer, the Illuminating Oil 45°, the Heavy Oil 35°; but they may be mixed together in all proportions, and the specific gravity of such compounds will generally be a mean between the gravities of the several parts. Thus, if we mix Benzine and Heavy Oil we can obtain a liquid of a gravity of 45°, exactly that of Illuminating Oil. Now, since the danger is due to the presence of Benzine, on account of the vapor which so readily arises from it and its great inflammability, such a mixed oil would be very dangerous to use in a lamp, and even in the vicinity of a flame it might explode. It is thus clearly seen that gravity is no test. What, then, shall be the test?"

It appears to us that the apparatus Messrs. Smith and Jones suggest is open to a very serious objection, which can however be easily remedied. The construction of the instrument ensures the formation of an explosive mixture of Benzine and atmospheric air *within* the box holding the Petroleum. The flame used in testing for the presence of Benzine vapour would very probably in some instances travel down the space between the wick tube and the outer tube, and thus communicate at once with the explosive mixture immediately over the Petroleum, setting the latter on fire. The difficulty may be obviated by placing a piece of fine copper gauze through which flame will not travel at the top or bottom of the space between the wick tube and the outer casing. We submit this suggestion to the attention of Messrs. Smith and Jones, or else we should fear that their new "Benzine Detector" would in some instances become an "EXPLOSIVE NAPHTHOMETER."

BRITISH PUBLICATIONS FOR JULY.

Abercrombie (John) Culture and Discipline of the Mind, and other Essays, n. e. f. 8vo	£0	3	6	*Edmonston & D*
Adams (E.) Elements of the English Language, 2nd edit., revised, post 8vo	0	4	6	*Bell & Daldy.*
Antrobus (E. C.) Rise and Progress of Painting, a History of Celebrated Painters, 8vo.	0	3	0	*Staunton.*
Aristotle's History of Animals. In ten books. Trans. by Richard Cresswell, post 8vo.	0	5	0	*Bohn.*
Badger, (George Percy) A Visit to the Suez Canal Works, 8vo.	0	2	6	*Smith & Elder.*
Bennett (Thos. R.) Popular Manual of the Constitutional History of England, cr. 8vo.	0	2	6	*Macmillan.*
Black's International Exhibition Guide to London, fcap. 8vo	0	4	6	*Black.*
Bradshaw's Illust. Exhib. Handbook to London and its Env., cor. roy. 16mo, 2s 6d sd	0	3	6	*Adams.*
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Selected Articles.

A COURSE OF SIX LECTURES

On some of the Chemical Arts, with Reference to their progress between the Two Great Exhibitions of 1861 and 1862, by Dr. Lyon Playfair, *C. B. F. R. S., Professor of Chemistry in the University of Edinburgh.*

Lecture I.

Distillation of Coal; especially in its Relation to the Production of Gas and to the Formation of Paraffine.

Ladies and Gentlemen, — In ancient Jewish times, the son of Sirach, in Ecclesiasticus xxxix. 26, has the following passage:—"The principal things for the whole use of a man's life are water, fire, iron, and salt, flower of wheat, honey, milk, and the blood of the grape, oil, and clothing." If it were not that chemistry has advanced so much in recent years that this definition of the son of Sirach no longer represents the comforts and enjoyments requisite for our advanced civilization, I would show you that each of these substances, either in their actual production or their improvements, depend upon the chemical arts; but it is the very progress of chemistry which has rendered this definition of little significance to us at the present time. No science has done so much as chemistry for penetrating into the secrets of nature and discovering those applications in the arts which are so necessary for our daily comforts. It would be impossible for me to attempt in a course of six lectures to go over the range of the chemical arts. All that I can do is to take a few selected examples, and to refer to those chiefly with a view of showing you their progress between the Exhibition of 1851 and the Exhibition of the present year. But it would be contrary to the usual habits of this Institution, were I to confine myself simply to an explanation of the progress of these arts, for I cannot assume that the audience whom I have the honour to address are perfectly familiar with the arts themselves, and, therefore, can be interested by a mere account of their progress. I therefore propose, with your permission, to describe to you, generally, the nature of these arts in a popular manner, and then to refer to the discoveries which have recently taken place with regard to them.

When we examine the application of science to industry, we find that these applications benefit industry generally in one of three ways—first, by adding to human power, either by furnishing substitutes for brute labour, or by affording tools and methods for results formerly difficult or impossible, as, for example, when we use gunpowder in blasting rocks, and in the course of a few minutes can perform what would require ages of brute labour. It very often happens in this application of science to diminishing the efforts of brute labour that natural forces are employed, as, for instance, when Hercules was obliged to clean out the Augean stables, not by using a pitchfork, but by turning the waters of the Alphæus into it and sweeping it out by the use of this natural force. The second method in which science benefits industry is by producing economy in the time necessary to attain the result. Historians record as an example of wonderful dispatch the feat of Sir Robert Carey, who rode from London to Edinburgh to tell James the First that he was the King of England by the death of Elizabeth, and who occupied, in his weary ride, from Thursday to Saturday night. By means of the electric telegraph we can now despatch a message to the northern capital in much less time than the groom of Sir Robert Carey could have saddled his horse. The third advantage which science renders to industry is in the economy of material. There is nothing so characteristic of chemical improvement as the uses which it makes of waste products. A philosopher justly defined dirt as being merely matter in a wrong place. Put it in the right place, and it becomes a utility. The substances apparently the most worthless to-day, are even elegant utilities to-morrow. For instance, the parings of horses' hoofs, the horns of cattle, and cast-off woollen garments of the inhabtants of the sister isle, are mixed with scraps of old iron, and grace the dress of the courtly dames who wear dresses dyed with Prussian blue. All these substances when properly applied become important utilities. In all the manufactures to which I shall have to draw your attention in this short course of lectures, you will find that one or other of these three forms of benefitting industry is very apparent, sometimes appearing altogether, sometimes offering only one of the advantages.

I select to-day the manufacture of gas, not that that manufacture has made any decided progress during the last ten years as a chemical art—it has made very little progress—but its economy is better understood, and its science is also better comprehended. But I select it because I shall show you in the next lecture that the materials which were extremely waste and noxious in the manufacture of gas have all been utilised—at least, most of them have already been utilised; a few of them remain still to be utilised—and that they have produced important, common, and even elegant utilities. I therefore, commence to-day by giving you an exposition of the manufacture of gas.

No great discovery in the industrial arts starts into the world without giving abundant indications of its approach. There is no such thing as an industrial invention starting up full grown and panoplied in armour as Minerva did from the brain of Jupiter: it creeps into the world by slow degrees and by many indications foretells that it is approaching. So with the manufacture of gas. The Persians, ages since, saw gases coming through the soil; they set fire to them and worshipped them as holy fire. In our own country gases constantly came from the coal measures below the surface of the earth; and Shirley describes, in 1659, how he obtained these gases and set fire to them, and how illuminating they were. Sir James Lowther, in 1733, actually took the gases coming from the coal measures and conducted them away by pipes, and he burnt them at the surface and showed that they were combustible and highly illuminative. Clayton, the Dean of Kildare, in 1739, distilled coal in a retort, and he got what he calls "a phlegm, a black oil, and an incondensible spirit," This spirit is what we now know as gas. He could not in any way condense this spirit, so he collected it in bladders, and he pricked holes in the bladders and lighted the issuing gas for the amusement of his friends, Lord Dundonald did nearly the same thing on a much larger scale in 1786; but it was Murdoch, in 1792, who gathered up these isolated threads of science and spun them into a rope capable of supporting an industry. He showed how the knowledge previously acquired might be applied in the preparation of gas, and how that gas might be used for the pupose of illumination. It was not, however, till 1812 that this industrial art took root in London, and then so little was known about it that it is recorded that a lady of fashion, seeing a brilliant gas-lamp burning at Ackerman's shop in the Strand, insisted upon taking it away, light and all, in her carriage. It was no wonder that at that time gas did not become very popular; it was extremely bad; it had a nasty fetid odour resembling that of rotten eggs; it produced intolerable smoke when burning; it discoloured cottons, from the sulphurous acid which was formed in its combustion; it eat off the backs of books, and it produced languor and headache. Luckily it had advocate in Winsor, who thought that all these defects were advantages, and who inspired the public with his own enthusiasm, and who gradually extended the art in spite of these disadvantages; but what was much more important, it had a man of science in Clegg, who admitted the defects, and immediately applied his great skill to remove them; and it is owing to the great labours of Clegg in improving the manufacture of gas that we possess its excellence at the present day.

I need scarcely demand your attention to this as an important subject, because it must be quite obvious to what an enormous advance civilization took when the coal gas became cheap and common. It has improved morality and lessened crime, by making every passer-by in the street a detective policeman. The art of street lighting was discovered as early as the fourth century, when Antioch was lit up by oil-lamps; and even at that time—as early as the fourth century—the art of street-lighting showed its advantages by ending unseemly brawls. We read at that time of a controversy between a Luciferan and an Orthodox, which continued in the midst of a crowd of people until the lamps were lit, when the disputants spat in each other's faces and retired. From the fourth century up to the fifteenth, or, perhaps, the sixteenth century, the art of street-lighting seems to have been lost; and it was only in the sixteenth century that streets began again to be lighted by oil-lamps. Now we have from thirty to forty thousand of these street lamps in London alone.

I now ask your attention a little to the chemistry of coal gas.

Coal gas is obtained by the distillation of common coal, or by the distillation of coals highly bituminous, as they are called—that is, which give out bituminous products in their distillation. Coal consists of carbon and hydrogen largely, of oxygen and nitrogen in smaller quantity, of sulphur a slight quantity also, and of incombustible matter and ashes.

When the coal is heated in a close vessel—that is, when they are distilled—at first the oxygen contained in that coal acts just as the oxygen that is in that fire: it burns some of the constituents of the coal. It unites with the hydrogen of the coal and forms water. Just as the oxygen there [referring to a small portable furnace burning on the lecture table] unites with the hydrogen of the coal and produces water, so does it in the close retort. It unites also with part of the carbon and forms carbonic acid, as it does in the open fire-place. But soon the oxygen of the coal is exhausted, and then the hydrogen, which is in large quantity, divides itself partly between the carbon and produces the illuminating gases and the liquids which I shall afterwards describe, and which are called hydrocarbons; and the rest of the hydrogen goes to the nitrogen and forms ammonia, and this ammonia we shall afterwards have to deal with also.

We will now take a simple case, which is an exact model of the manufacture of coal gas on a large scale. I have here an arrangement which will take a little time to act, and therefore I set it going just now. We have put coal in that retort, and it is connected with a receiver here. You will find, after a short time, that a liquid, which consists partly of water and partly of tar, comes over into the condenser. Our large bottle there is the condenser which we employ for this purpose. It produces, first, gaseous products; second, crude coal oil, which is commonly known by the name of tar; and it produces also a watery portion which contains ammoniacal salts. To-day we have nothing to do with the crude coal oil, or with the watery portion: that will be the subject for the next lecture. All that I have to direct your attention to now are the gaseous products; and these are divided into three divisions. The first class of gaseous substances produced by the distillation of coal consists of hydrogen, carburetted hydrogen, and carbonic oxide; and these are classed as diluents, for a reason which you will presently see. Then there are, secondly, illuminants, which consist of olefiant gas, and two substances called propylene and butylene. And, thirdly, there are impurities which are also gaseous, which are carbonic acid, sulphuretted hydrogen, and nitrogen. We can readily show the differences in the nature of these gases. I have collected these gases in a separate state here. I first have got hydrogen, which is one of the substances classed as diluents; and I will take these different gases and show you that they have very different properties as regards the purpose of illumination. I can easily pass a little hydrogen through here, and then you will be able to see, when we get the draught sufficiently, the amount of light it is capable of affording. We will just allow a little gas to pass through before we ignite it. Now, you see there is very little illumination there; in fact, the little illumination which is produced there is derived from the dust and the material upon the burner. Now, we will take carbonic oxide, which is another of these gases, and you will find that there is very little illumination here too. In this case we are obliged to burn it without a burner. You see there we have produced only a blue flame, without much illumination. Now, I have got here some marsh gas, or carburetted hydrogen, and you will find that this, also, is not much of an illuminant. They are all classed there as diluents. I have now here olefiant gas, which is a strongly illuminating gas. You see there that olefiant gas is very illuminating. I have here common coal gas, and you will see the great differences between these different gases. You see that coal gas, which contains all these gases—diluents as well as illuminants—is not so illuminting as olefiant gas. In that way you can compare the value of these gases as they are placed on the table.

Now, when we examine what is the chemical nature of these gases, we soon get an explanation of the reason of their different illuminating values. The amount of carbon contained in olefiant gas is 86 per cent., the amount of carbon in carburetted hydrogen is 75 per cent., and the amount of carbon in carbonic oxide, which burns with that blue flame, is only 43 per cent, Therefore, the illuminating properties of the gases are in proportion to the amount of carbon which they contain. I think that I can show you this by a simple experiment. I have here hydrogen—a gas which I showed you before. You have seen that it burns with very little flame. I should tell you that the reason that it produces very little flame, is that it produces a gaseous substance in burning. In the act of burning it forms water. Now, gases require a very high temperature before they are luminous, and the products of the combustion of hydrogen is steam; and that product requires such a high temperature to become luminous, that hydrogen is only faintly so. But solids, on the other hand, become luminous in the dark at 700 degrees, and brightly so in daylight at from 1000 to 2000 degrees. Now, I want you to understand the nature of the experiment I am going to make, before I put it in operation. I have here hydrogen burning as you saw before, and producing simply steam, and therefore not producing much light, because that product is gaseous. I will now turn that off, and I will produce the combustion in this tube with peroxide of barium. The peroxide of barium will supply the flame with oxygen, and form water exactly as is produced when the gas is burning in the open air; but at the same time, during the act of formation of this water by the oxygen of the peroxide of barium, there is a solid to be heated to redness. We will now heat the peroxide of barium. I have wrapped it up in talc. You see now that water is being produced, and gradually as the heat gets up you will see that the action will become much more perceptible. This tube is rather too small for me to apply as much heat as I desire. The water is now being formed in the presence of a solid. What a brilliant amount of light the gas gives out on account of the solid being at the same time heated to redness. You see, therefore, that when we form exactly the same product under the conditions under which a solid becomes heated, a large amount of illumination takes place. I want to show you that in another way, and in a very instructive way. I have here a means of passing hydrogen through this row of bottles. I now can pass hydrogen through these various vessels, which contain various volatile liquids. Now, this hydrogen will, on its passage through the liquids, suck up portions of these various preparations, and we shall charge the gas with solid matter, and in this way obtain an illuminant. The liquids through which it passes are chlorochromic acid, chloride of antimony, and benzole. The first two will give solid oxides to be heated to redness; the latter will give solid carbon, and the hydrogen in all cases becomes illuminating. Unfortunately, however, I cannot continue this instructive experiment, for some air has entered into the bottle since the commencement of the lecture, and produced an explosive atmosphere.

The fact which I want you to notice is that there are illuminants in coal gas, which are illuminants because they contain so much carbon—that in proportion to that carbon they are illuminating; that as that carbon is small in quantity, they are merely diluents, and dilute the gas without in any way illuminating it.

And now I must explain to you what is the action of these diluents. These diluents which are described on the diagram, and which you have seen, are the oxygen, and the carbonic oxide. Their object is to sweep the gas out of the retort, and prevent the illuminating gases being decomposed by the heat. In distillation a large quantity of the illuminating gases is being produced, but they may be decomposed by the red-hot vessel; and unless there were those diluents formed at the same time to sweep out these illuminating gases, it would be impossible for the gas to preserve the highest quality.

I will now, before we go into any further experiments, describe to you the general conditions of the coal manufacture. First, we have to try to get a large amount of illuminating ingredients mixed with enough diluents to protect them in their formation, and to enable them to be burnt without smoke and without smell; and second, we have to try and remove the noxious gases and impurities.

The first condition or process in the manufacture is distillation. For this purpose there are certain retorts which are represented on that first diagram. These retorts may be made of iron, as in our experiment, or they may be made of earthenware as they are represented in the diagram. In these retorts is placed coal, which varies in amount from 12 cwt. to one ton, according to the size of the retorts. The fire overlaps the retorts, as it is doing in this case of the gas manufacture which is now going on as experimentally, and heats the coal gradually. The substances which are formed are partly tar, which comes over as the tar is now coming over into this condenser, partly water, and partly the gas which is also going over. If you follow these retorts you will see that there are certain stand-pipes. These stand-pipes conduct the gas up into what is called the hydraulic main. The stand-pipes are generally about five inches in diameter, and dip into a large cylinder or pipe, which is fifteen or sixteen inches in diameter. There is a curving over as you observe, so that the pipe dips into tar water, which condenses in this hydraulic main. By this arrangement the ends of the pipe are sealed up by the water in the main, but can bubble through it. The gas comes over here, and the surplus tar passes over into what is called the tar-well by means of this small pipe which conducts away the tar and water into the tar-well. And now the gases, having come out of the retorts, pass through the series of pipes which are represented in the next diagram. The object of those pipes is to cool the gases. They expose a large surface to the cooling influence of the atmosphere. Sometimes water is poured on them, but usually they are merely exposed to the air. This condenses the coal-tar and water which the gas still retains in suspension. Now, the gases pass after that through what is termed an exhauster. The use of the exhauster is this—that in passing through that system of pipes a considerable friction is caused, and that friction would retard the flow of the products were it not that this exhauster is used, which prevents the friction keeping the gas back into the retorts. If the gas were retained for any time in the retorts, the heat would decompose the illuminating gases and convert them into diluents, and, therefore, this exhauster is employed. After passing through the exhauster, the gas traverses what is termed the scrubber. This scrubber is merely a large cylinder filled with coke, which is sometimes dry and sometimes has a quantity of water passing over it. This washes the gas and removes many of the impurities from it. It acts mechanically also, by taking away the tar and removing it from the gas. The gas having passed through the scrubber, it now goes through a very important piece of apparatus which is termed the purifier, and which I must now show you here. You see here a vessel containing different shelves. These shelves are covered with lime, and the lime has the power of absorbing two of the constituents of the gas, which are very injurious: first, the carbonic acid; and secondly, the sulphuretted hydrogen, both of which are serious impurities. The milk of lime, or lime, which is employed for this purpose takes away the sulphuretted hydrogen, which in itself has a bad smell, and which, in its combustion, produces sulphurous acid and decolourises drapery and other matters when it comes in contact with them; and the lime also removes the carbonic acid which, even when present to the amount of only one per cent., diminishes the illuminating value of the gas six per cent. But the ammonia is not removed by this operation.

In recent years, another plan has been employed for purifying gas, and it is to this I would like to draw your attention. The new process consists of passing the gas through a mixture of sawdust and iron. The oxide of iron takes away the sulphuretted hydrogen by producing water and forming sulphide of iron; and after it has acted for some time, the passage of air through the mixture restores the sulphide to the state of oxide depositing sulphur, so that the purifying agent can be repeatedly used till its pores get choked with sulphur.

I have here the means of showing you how completely this plan of oxide of iron mixed with sawdust purifies the gas; and it is this which, not entirely, but to a great extent, is employed to the exclusion of the lime purification. I have here a bent tube containing oxide of iron and sawdust. The coal gas which I turn on is forced to pass through a saturated solution of sulphuretted hydrogen, so as to become fully charged with that noxious gas. I first allow the gas to pass, not through the iron, but at once through a solution which I have here as a test for sulphuretted hydrogen. In this solution I have a little nitro-prusside of sodium, which is an extremely delicate test for sulphuretted hydrogen—so delicate, that if I were to take a lock of lady's hair, dissolve it in an alkali, and put it into this liquid, it would immediately assume a purple colour. You see [after passing the unpurified gas into the test water] the solution has now become of a purple colour, showing the presence of sulphuretted hydrogen abundantly in the gas which we are employing. Now, having shown you that, I will turn this off and pass the gas through the oxide of iron and sawdust intervening; and you will observe that, at all events for a considerable time, it will pass through the solution and produce very little coloration. It has produced a trace. We are passing it too quickly, The least quantity does it, but, you see, not nearly so rapidly as before the gas passed through the purifying mixture. The smallest quantity—the most minute trace passing will produce the coloration, but you notice that scarcely a sensible coloration is produced, and we get nothing at all like this effect [referring to the coloration caused by the unpurified gas]; so that the oxide of iron has the power of taking out the sulphuretted hydrogen, and producing sulphuret of iron, and relieving the gas from the presence of this noxious ingredient. There is another substance, however, present as an impurity which this process does not remove; it does not remove the bisulphide of carbon, or the compound of carbon and sulphur, which is always present in gas. The bisulphide of carbon, CS_2, which is present in coal gas, has lately been removed by passing it over heated lime; the water of the lime is decomposed, and sulphuretted hydrogen and carbonic oxide produced; and then this sulphuretted hydrogen can be removed by the ordinary lime-purifier in the manner which is shown in this experiment. Dr. Smith has, within the last few weeks, introduced a second plan for removing the carburetted hydrogen by passing the gas through a solution of oxide of lead in sawdust. I need not follow the gas through the various other mechanical contrivances for collecting it and distributing it through towns. After the gas is purified it then passes through the gas-meter, where it is measured, into the gas-holder from which it is distributed to towns. There is an ingenious arrangement here, which is interesting. The diagram shows a gas governor or register which regulates the quantity of gas which is to be given out at various times during the day. If you look at that little diagram in the centre, you will see that the amount of gas used varies according to the time of day. During the day it is almost a dead level; about nine o'clock, at this time of the year, the gas begins to be lighted, and you see how rapidly it goes up till about eleven o'clock; people go to bed about that time, and then it as rapidly descends till about day-break, when it goes up a little further. Now, the plug by rising and falling determines the amount of gas which shall be given out during the different hours, and according as it is lowered in the tube, or is allowed to ascend, so the quantity of gas escaping into the town is regulated.

I want you now, for a moment, to consider what is the chemistry of the ordinary candle, not that I am going to do what has been so often and so successfully done here by Dr. Faraday, but I propose merely to draw your attention to a very important discovery in the manufacture of candles, which has been introduced within recent years. If candles had followed instead of preceded gas manufacture it would have been said that they were the greatest discovery of modern times. A properly constructed candle is merely a portable gas-works, requiring not costly or complicated apparatus; it is a means by which a very pure gas is produced little by little, as we desire to burn it, and in this respect forms an interesting illustration of the subject I have brought before you.

Candles and lamps differ only by one being fed with a liquid oil, the other having an oil liquefied for it as is desired. The heat of the candle liquefies a certain portion of oil which is drawn up by the wick, and is there converted into a gas, and is burned. The earliest candles that were introduced were, no doubt, torches. We read of Ceres instituting the search for her daughter Proserpine by the light of two burning pines, which were merely a rude substitute for our modern invention. The history of the candle is tempting, but I cannot enter upon it. I would simply draw your attention to this diagram, by which you will see the manner in which it acts as a portable gas-works. Here I have a diagram of the candle. This represents the liquefied fat which is drawn up into the pores of this carbonised wick, which you must consider as so many small gas-retorts. The fat or the wax is constantly distilled, and forms the gas which burns in the ordinary flame of the candle, the gas being produced as it is required, and needing no purification. If it were possible to take the most illuminating ingredient of coal gas, which is olefiant gas,—that ingredient which contains 85 per cent. of carbon,—if it were possible to take that illuminating ingredient and to condense it into a solid, we should have the highest conditions for the manufacture of coal-gas. Liebig, as early as 1841, said in one of his letters that it would certainly be esteemed one of the greatest discoveries of the age if any one should succeed in condensing coal gas into a white, dry, odourless substance, portable, and capable of being placed upon a candlestick or burned in a lamp. This was in 1841. In 1851, at the Exhibition, Mr. Young exhibited a substance termed "paraffin," that had formerly been made from peat, or from the distillation of wood in small quantities, and he exhibited a single candle made from it. Now, this paraffin is nothing but olefiant gas in a solid form, that is to say, it is isomeric: it is of the same composition exactly as olefiant gas, and is simply olefiant gas, if you will allow the "bull," in a solid state. When coal is distilled at a lower temperature than that necessary to form gas, there first comes over an oil, which contains in solution a solid. This oil itself is called paraffin oil, it is in reality of the same composition as olefiant gas, that most illuminating gas which I showed you. When it is cooled it deposits a solid substance known as paraffin. Now, it is very interesting to observe that all these three are the same in composition. This oil is liquid olefine, the solid body is also an olefine, and is termed paraffin. The ordinary olefiant gas, which gives an illuminating character to our coal gas, is the same substance in a gaseous state; or, rather, is not the same substance, but a substance of the same composition. In 1851 I was so struck with the one candle that was exhibited in the Exhibition that I gave one of the Friday evening lectures here upon the subject, and stated that it was probably the germ of an industry which would become a very important one. It has now grown so large that the Bathgate Chemical Works, for the manufacture of paraffin and paraffin oil, rank among the largest chemical works in the world. If you will go now to the Exhibition of 1862 you will see enormous blocks of this solid wax produced from coal. Here is the coal from which it is derived—the bog-head coal: it certainly does not look much like coal, and has promoted great discussion as to whether it is a coal or a schist. This bog head coal, and other coals, when slowly distilled, produces an oil, from which this beautiful solid wax called paraffin is prepared. It is, as I have explained, of the same composition as olefiant gas, and from it are now produced those beautiful wax candles which we ordinarily burn, and which are the perfection of the manufacture of coal gas, because each of these contains the illuminating material of coal gas in a condensed and solid form, so that when the candle is burned little by little, this olefine is changed from its solid state to its gaseous state, and is consumed. This paraffin is a beautiful wax, melting at 120 or 130 degrees; it produces a beautiful white light, on account, in fact, of producing the true olefiant gas. The oil also has the same qualities. You observe it burning here, and you must distinguish this from what are termed the paraffin oils which are now ordinarily sold in commerce, and which come from Canada and other parts; they contain various volatile bodies which take fire at ordinary temperatures, and which are extremely dangerous; they may be as dangerous as camphine or benzole on the application of a light. Paraffin oil made from coal does not burn at ordinary temperatures, it only burns in the presence of a wick, and is perfectly safe, carrying up, by the slow capillary attraction of the wick, a certain quantity of the oil in contact with the heated surface,—olefiant gas being thus gradually produced, so that you have the true perfection of an illuminating gas formed in the lamp.

In the next lecture I propose to follow out that tar and water which are now in the condenser, and to show you what beautiful utilities they have been converted into; we shall take the ammoniacal salts produced from the water, and the beautiful coal-tar colours which are formed from the tar.

AN ARTIFICIAL SUBSTITUTE FOR INDIA RUBBER AND GUTTA PERCHA.

BY S. WALTON.*

Numberless attempts have been made to produce a material possessing the qualities of India-rubber, and this material, together with gutta-percha, has been distorted into all forms, and has been compounded, in a most heterogenous manner, by a host of experimentalists seeking to produce a cheaper material, but no valuable results have been arrived at. The cheapest base for experiment had, I humbly submit, been neglected. It is well known that linseed nut and poppy oils possess that nature, which distinguishes them from lubricating oils, of becoming concrete on exposure to the atmosphere; that is, that when spread in a thin layer on a surface of wood or iron, they dry or change into a thin skin. This change which is erroneously called drying, is produced by the absorption of oxygen and the disengagement of carbonic acid, and is, in reality, only a change of their elementary constitution.

This property of absorbing oxygen rapidly is not considerable in the crude or raw linseed oil, but it is very greatly increased by boiling the oil, that is, exposing a large quantity of raw oil to a strong heat in a cauldron, with a small per centage of metallic oxide of lead added. It is then called "varnish," and has a more viscid character, and is also rather more highly coloured. A layer of this oil requires from 6 to 24 hours to dry or change into a skin-like substance, according as the state of the atmosphere is more or less favourable.

I cannot do better than give to you a detailed account of the circumstances which combined to bring this subject before my notice. Whilst engaged, about two years ago, in a series of experiments on the manufacture of artificial leather, it was of the greatest importance to the success of the material that it should have a coat of fine varnish, which, whilst drying quickly, possessed the flexibility of India rubber. Copal varnish has always been accounted the best varnish, but made with drying oil combined with gum copal at a high temperature, it will not, of course, be dry until the action of oxidation has reduced the oil contained therein into a solid film. Whilst revolving in my mind this knotty difficulty, and presenting every phase of it to careful thought, it suddenly occurred to me that if the oil was first dried into a skin, like those I had often seen on paint cans, but, like other people, had before considered as waste, was dissolved in a volatile solvent, like India rubber sheet—that the semi-resinous material would immediately on the evaporation of the solvent, resume, like India rubber, the form it was in prior to solution. By dipping panes of glass into linseed oil, and allowing the films or layers to dry, then re-

*Journal of the Society of Arts.

peating the process, I imitated the manufacture of India rubber from the milk, and thereby produced a solid elastic substance, composed of many layers of perfectly oxidised oil. Up to this stage I had done nothing new or original, for the oil sheet manufacturers have for more than a century waterproofed linen by layers of oil. But to treat this semi-resinous matter and render it available to purposes of manufacture, will be admitted to be perfectly new, and I now proceed to describe the invention. Having accumulated a quantity of solid oxidised oil by drying it upon extensive surfaces of any kind, such as prepared cloth, stretched in frames, as described in my patent of the 27th January, 1860, I then scraped or peeled it off by suitable means.

At first, as before stated, my attention was solely directed to the attainment of a speedily-drying, flexible varnish at a moderate temperature, but very few experiments with this oxidised oil led me to notice its rubber-like qualities, which I at once conceived might, with further manipulation, and with some combinations, be developed more fully, and become a very valuable substitute for that article.

Encouraged by success at every step, I proceeded, and soon found that by crushing the solid oxidised oil obtained in sheets as described in my patent, and working it thoroughly in hot mixing rolls, I produced a substance which required only the cohesive nature, which in the early part of this paper we noticed as existing so strongly in India rubber. The addition of a small proportion of shellac soon gave that which was wanting, and I found in my power a material singularly like caoutchouc when worked into dough, and which could be rolled on to fabrics in the same manner and with the same facilty—giving a perfect waterproof cloth, unlike oil cloth, but having the rubber finish and flexibility. Pigments could easily be added to give colour; the addition of resins gave other, or rather varied proportions of adhesion, useful as affording the means of uniting fabrics as by rubber. Fibre, whether flock or cork, mixed in and rolled into sheets, gave me samples of kamptulicon and other floor cloths.

These experiments were made more than two years since, and some of my earliest samples are now on the table before you—together with many of more recent date which I have yet to refer to; and besides them you have similar productions in rubber, which will enable you to make a comparison. Although I had thus accomplished more than my first anticipations, my primary object was yet unrealized, and I had, day by day, proofs of how entirely I was dealing with a substance of which the characteristics were entirely unknown to us. Various were the solvents tried to dissolve it. Obtained from oil it was unaffected by oil; no longer did it retain any unctuous matter, one of the greatest proofs practically of which is, that whilst any oil or greasy matter will destroy India-rubber very speedily, yet they have no effect on this; the two may be well combined. For a long time was I baffled in every attempt to find a solvent. Any heat short of carbonising it had no effect on the material, and here was evident a great advantage over rubber for practical purposes, if other desiderata were accomplished. At length I was able to dissolve this converted oil in alcohol and wood spirit—thus did I obtain the first varnish. Sufficient success had thus attended my labours to justify, at any rate in my own, perhaps sanguine mind, my patenting the discovery in England, France, Belgium, and America, and taking and fitting up works for the production of the material. But yet much remained to be achieved; the process was slow, the solvents were expensive, and did not offer all that was desired in the way of varnish. It was also desirable to obtain a medium state answering to the India rubber cement or dough capable of being worked by the guage-spreader which I have this evening described to you, and in which it would dry as rapidly, that is, within a few minutes of its passing the machine, this last requisition creating no small part of the difficulty. Some months more of diligent experiment led to more definite results, and at length I was enabled, by experiments which involved much time and labour, to perfect the solution in the distillates of coal, preferring the usual rubber solvent, naphtha. Thus was the material brought still further into a state so nearly resembling rubber solution or cement, that even those most accustomed to the manufacture thereof could not distinguish one from the other, and in all respects it could be treated in the same way. Samples of the varnish, of the cement, and of the dough, I have also the pleasure to present to your notice. I would here remark that the success of this discovery is mainly due to the perseverance of my partner, Mr. Richard Beard, junr., who, with the same energy he devotes to the business department of our works, more especially under his care, has rendered me great assistance in these and later experiments.

Not only has this singular product been thus assimilated to rubber for uses on fabrics, or combined with fibre for floor cloths, but still more strange, it is capable of being worked with pigment and vulcanised exactly as India rubber has been described to be, and forms a hard compound like vulcanite and ebonite, excepting that the sulphur is not necessary. Pieces thus hardened are also placed on the table before you.

Having now explained the means of obtaining, treating, and applying this oxidised oil—its wonderful similarity to rubber must, I think be apparent to all. I then submit that the process of solidification of the oil is identical with the drying and solidification of the rubber on the clay moulds I have in this paper referred to, with this difference, that with the rubber it is an evaporation of the fluid which holds the particles in suspension, in order that they may coalesce, and thus, of course, there is a loss of weight, whereas with the oil there is an increase of weight (ascertained by accurate experiments) from the absorption of oxygen. Chevreul confirms this point in his researches on oil painting.

The applications of my prepared oxydised oil are not limited to its uses as a substitute for rubber, as will be seen by the following list, but before passing on to its other applications, we will notice its advantages over rubber. 1st. The great difference in price which must ever exist from the facility with which one can be produced in the natural state over the other, for abundant as are the various trees yielding caoutchouc, the difficulty of collection, and scarcity of labour in regard to quantity obtained, must always keep up the price of natural rubber, whilst the linseed from which the oil is obtained can be so easily and cheaply cultivated.

2nd That being unaffected by oil or grease it is more durable than rubber in many of its applications, especially where used in various manufactures, such as cards for carding wool, printers' blankets, &c. That also for purposes where rubber is injured by temperature, this is unaffected. And last, though not least, its durability, inasmuch as it is free from those elements of decomposition which, it is admitted, are set in action by the very process that it is necessary for the rubber to undergo in course of manufacture, not to notice the numerous combinations therewith in use, in too many instances, on account of the high price of the pure material.

LIST OF APPLICATIONS.

Surface Fabrics.—Clothing, carriage aprons, cart sheets, sail covers, bath sheets, nursing aprons, sponge bags, &c.

Imitation Leathers.—Carriage lining, chair covers, boot and shoe leathers, trunk covers, saddlery, bags, reticules, &c.

Common Surface Fabrics.—Packing cloths and papers, cart-sheeting, tarpauling, brattice cloths for collieries, &c.

Double Textures.—Clothing, mail bags, hospital sheeting, card cloths, printers' blankets, water and air beds, cushions, &c.

Manufacturing Purposes.—Packing for steam, water, and gas pipes, valves, machine banding, hose pipes, tubing for carrying beer, &c., flax-spinners' bosses, calendering and embossing bowls, cop tubes, telegraph supports, or insulators, tank linings, ship sheathing, roof coverings, shoe soles, &c.

Hard Compounds (of any colour).—Knife and fork handles, surgical instrument handles, surgical and dental appliances, tubing for chemical vessels, picture frames, trays, mouldings, furniture ornamentation, panelling, veneers to imitate marble, ivory, ebony, and other woods, &c.

Miscellaneous.—Washable felt carpets, kamptulicon (of any colour), stair coverings, toilet mats, table covers, &c.

Flexible quick-drying varnishes. Paints for carriages. Painting or printing floor cloth, table cloth, &c., (will dry in a few minutes) enamels of any colour, for enamelling papier maché, metals, &c.

We now pass to the advantages to be derived in the use of the material under consideration, for some of the purposes in the foregoing list, to which boiled oil has hitherto been applied; and first we notice the important article of leather cloth, commonly called American leather cloth. This is prepared by coating the fabric with oil boiled to a thick consistency, mixed with black pigment. This is spread on cotton fabrics, which is placed in a temperature of, say 120 to 150 degrees, for a day, to dry or oxidise the oil coating. For convenience of han ing, these are in twelve-yard lengths, and this operation has to be repeated for five or six successive days, according to the thickness of the coating required, and lastly, in the same manner, a coat of copal varnish is given, each of these requiring the same length of time to dry. Thus seven to eight days were requisite to prepare the cloth for the embossing rollers. By the use of oxidised oil, properly prepared, you have all the same qualities as are obtained by allowing the oil to oxidise on the surface of the cloth, avoiding the consumption of so much heat and time, as well as injury to the fabric itself—with the advantage of being able to spread each coat successively, the solvent evaporating as when used with rubber, while it passes through the machine, the length not being limited to twelve yards, and there remains only to apply a coat of varnish to increase the brightness of the surface. Thus in one day can be done, not only the work of seven, but a greater quantity by working increased lengths. For oil-dressed cart sheets, omnibus and other driving aprons, waterproof packing materials, and a host of other such purposes, this preparation is most suitable. And lastly, we have the important use as a varnish, either as such or to mix with pigment, as a paint. We all know the time requisite for ordinary paint to dry—this we equally well know is the time requisite to dry or rather oxidise the oil in the paint. The spirit, be it turpentine or other solvent, would quickly evaporate. The coats of paint on doors and walls are but coats of oxidised oil, charged with pigment, as perfect and pliable skin as the coating of a fabric, if too much pigment has not been used. If then you complete the oxidation previously, and dissolve the oxidised oil so as to render it fit for application by the spreading machine of the manufacturer, or the paint brush of the painter, when the solvent evaporates, which it does very rapidly, you have a flexible, tough, waterproof coating, which will be dry enough for succeeding coats within half an hour.

In carriage painting, floor cloth manufacture, and kindred articles, months are now consumed, which might well be saved. The patterns of felt on the table are printed with colours thus prepared, and some pieces of wood, painted at the carriage factory of Messrs. Holmes, are also here.

I am conscious how imperfectly my task has this evening been accomplished, but I have shown you how analogous a substance this material is to the elastic gums. In conclusion, I beg to thank you for the kind attention you have given me, and must apologise for the many defects and deficiencies which exist in this paper. Many of them would, I flatter myself, have been obviated but for the disastrous fire which occurred at our works the week before last, at which time I was engaged in preparing these particulars, and this has prevented my carefully reviewing the sheets before submitting their contents to you. Such a fatality will, I am sure, be an adequate excuse, and this must also be given as a reason why so poor a display of samples is placed for your inspection, our stock having been entirely destroyed. And I would add that, not being waterproofers ourselves, the samples are more roughly finished than would be the case if produced by more experienced hands.

We hope to have our works in order in about a month, and then we shall be most happy to demonstrate to any one interested, the applicability of this new material to the purposes specified.

APPLICATION OF ALUMINIUM TO PRACTICAL PURPOSES.

The constant appearance in our jeweller's shop of fancy articles of aluminium is beginning to draw very general attention to that valuable—but not admitted precious—metal. A few years ago (1855) small specimens were handed about and examined as curiosities from Deville, the French chemist's laboratory, with great interest. It is true it had been discovered eight and twenty years before (1827), by Professor Woehler, of Gottingen; but people then heard the announcement of the elimination of the metallic base of clay, with little more than that ordinary indifference with which the description of a merely new element is commonly received. Deville, whose name is everywhere familiar for his many valuable labours, however, in his investigations of its characters, found that it possessed peculiar and curious properties, and he unhesitatingly stated his impression that it was a metal destined to occupy an important position in the requirements of mankind, as soon as means could be found of obtaining it in manufacturable quantities.

In his first statements (1855) he drew attention to its power of resistance to all acids save hydrochloric, to its fusibility, its beautiful whitish-blue colour, and the fact of its undergoing no change of lustre or colour by the action of the atmosphere or of sulphuretted hydrogen. Its density as low as glass, he foresaw would insure many special applications, while superior to the common metals in respect to the innocuousness of its compounds with the feebler acids, and intermediate between them and the precious metals it was evidently a fitting material for domestic purposes. "And when it is further remembered," he added, then, "that aluminium exists in considerable proportions in all clays, amounting in some cases, to one-fourth of the weight of a very widely-diffused substance, one cannot do otherwise than hope that sooner or later this metal may find a place in the industrial arts."

This prevision seems to be realising itself every day, and a forcible proof of the rapid strides made in its economic production is afforded by a comparison of its past and present commercial prices. A few years ago it cost 60*l.* per lb., while from the Aluminium Works recently established at Newcastle, in our own country, it is now supplied at less than sixty shillings. Every step taken in the reduction of the prime cost of a raw material widens the range of its adaptability to ornamental purposes in the arts, or useful applications in the manufactures. It is malleable and ductile, being reducible to very thin sheets, or capable of being drawn into very thin threads. In tenacity, it is superior to silver, and in a state of purity it is as hard. It files readily, and is an excellent conductor of electricity, and combinations of it, with other metals, have already been used with advantage. The most important of these compounds is aluminium-bronze, formed of one part of aluminium with nine of copper. This bronze possesses great malleability and strength, Professor Gordon's experiments giving the following relations of wires of the same diameter: iron, 100; aluminium-bronze, 155; copper, 68. This immense tenacity and strength confer on this bronze admirable qualities for the working parts of machinery where great durability is required, and notwithstanding its higher price than that of ordinary metals, the quantity of aluminium required is so small, that it is said that practically the cost of the bronze does not exceed that of ordinary brass or gun-metal bearings.

Another property of aluminium is its extreme sonorousness, and this has also had very serviceable application in the construction of musical instruments. So highly sonorous is it, that a mere ingot suspended by a fine wire emits, when struck, a clear and ringing sound.

The metal can be beaten out into leaves for gilding, or rolled in the same way as gold or silver, and it can be drawn out into wire fine enough for the manufacture of lace. It is also easily run into metallic moulds, or, for complicated objects, into moulds of sand. It is very finely susceptible of what is technically called "matting," by being plunged into a weak solution of caustic soda, and then exposed to the action of nitric acid. It is also easily polished or burnished by a polishing stone steeped in a mixture of rum and olive oil. When aluminium is soiled by greasy matters it can readily be cleaned with benzine. Soiled by dust only, india-rubber or very weak soap and water may be used.

The process of soldering aluminium also is worthy of note. The solder used is composed of zinc, copper, and aluminium, and the pieces of the article intended to be joined must be "tinned," as in ordinary soldering with tin, with the aluminium-solder itself. The pieces are then exposed to a gas blow-pipe or other flame; but in order to unite the solderings, small tools of the metal itself must be used. Tools of copper or brass, such as are employed in soldering gold and silver, are not permissible, as they would form coloured alloys; moreover, no flux whatever can be used, as all the known substances employed for that purpose attack the metal, and prevent the adhesion of the pieces. The use of the little tools of the aluminium is an art which the workman must acquire by practice, as at the moment of fusion the solderings must have friction applied, the melting taken place suddenly and completely.

In comparing the price by weight of this with other metals, its greater bulk must be borne in mind. Thus comparing it with silver, the bulk of a given weight of aluminium is nearly four times that of the same weight of silver, so that if one ounce of silver were required for an article, four similar articles could be made of one ounce of aluminium. Its lightness is, as we have before observed, one of its principal qualities; the specific gravity of platinum is 21·5, of gold 19·5, tin 7·3, while that of aluminum is only 2·6. The lightness which it communicates to the bronze, whose durability, hardness, and immense strength nearly equal that of the best steel, renders probable its future extensive use in the construction of buildings, the manufacture of ordnance, and other objects where strength and lightness are required to be combined.

Having witnessed how admirably the French have applied this metal to ornamental and fanciful objects, it will be a matter of future interest to watch the developments of its applications, as a British manufacture, to more solid and practical objects.*—*London Review.*

* A very interesting paper on Aluminium, by Mr. P. Le Neve Foster, will be found in the Society of Arts Journal, vol. vii, p. 162.

COLOURED MATERIALS,

CONSIDERED WITH REFERENCE TO THEIR APPLICATION TO INTERNAL DESIGN.

BY J. JOHNSON, ESQ.*

The use of Colour for internal decoration is universally recognized. No apartment is considered complete without it. Form is not sufficient in itself, and painting is the means usually employed to give effect, and render apartments pleasing and satisfactory to the eye. There are many other ways, however, by which variety is obtained for internal decoration. Plastering, papering, and furniture, all add to and increase the effect. These are resources at every one's command, and can be altered or varied according to the taste of individuals.

Then there are imitations of natural materials or inferior substances often introduced very skilfully in the representation of the most beautiful woods, marbles, &c., in every variety. Many writers have condemned this mode of finishing as false and inadmissible, where *truth* is to be regarded in building as in other things. It is difficult, however, to carry into practice many of the theories put forward, even though the arguments in favour of these theories seem plausible, and at the same time almost conclusive. For my part, I admire and respect this manifestation of truth in Building. I should be glad to see it universally adhered to; and I wish that the desire to obtain so much for money was less universal: we might then hope that our ornamentation would be more genuine than it now is. I fear, however, that this will never be entirely accomplished. We have now become so accustomed to admire what is false of a superior order for the sake of ornament, in preference to that which is genuine of an inferior order, that we shall never be able to do without veneering, graining, and the various other imitations of the present day, in some degree.

When anything becomes general, and is understood only as imitation, it is said to be no deception. It is said that the gilding of wood or other material is quite legitimate, because it is no longer understood to mean that the whole substance is gold, but that the gold is only a film put upon some other substance for the sake of giving a more brilliant finish It must be remembered that this film or outer coat of gold is genuine.

If this species of ornamentation be a'lowable in one material, although that be very costly, it seems to me that it is pardonable in any other so long as it is understood. For this reason we must admit veneering to be legitimate, and in many instances stucco and cement, if not graining.

When imitations are resorted to, there are three general conditions which, I think, should be observed. I quote them from a paper read at the Architectural Institute of Scotland by Mr. T. Purdie. They are:—

"1. That they be not employed when the material represented would of itself be out of place or inappropriate.

"2. That no object be painted in imitation of one material which, from its form, construction, or application, was obviously or necessarily composed of another.

"3. That no imitation be employed in positions, where we are entitled to expect that the real material should be used, or where the discovery would create disappointment."

In connection with painting as applicable for internal decoration, the rules observed in the chromatic decoration of the New York Crystal Palace are the most concise and useful I have met with. They are:—

"1. Decoration to be subordinate to construction in all cases.

"2. Features of main construction to be of one prevailing tint.

"3. The prevailing colour of ceilings sky-blue, the monotony prevented by the introduction of orange (the natural complement of blue).

"4. Rich and brilliant tints, in small quantities, to be employed to attract the eye to the articulations and noble portions of the members, rather than to the members themselves.

"5. All natural beauty of colour existing in any material should, if possible, be brought into play by using that colour itself, instead of covering it with paint of another hue.

"6. All ornamentation to be consistent with the construction.

"7. White, in large quantities, in all cases of simple composition, not only to give value, by contrast to a few colours employed, but to reflect light and cheerfulness to the work."

Let us now consider how far the real materials (generally imitated only) may be introduced in ordinary designs, and how far materials of an inferior order may be made beautiful in themselves, without their being any necessity for covering with veneers or painted imitations.

I believe that there are beauties in many of the materials commonly used in the construction of buildings, which may be made to tell in the general design, and produce an equally pleasing and more truthful effect, if properly and carefully arranged, than by any amount of imitation; and when materials, although superior to others in their beauty, of themselves cannot be introduced on account of expense, those used do mostly possess sufficient beauty, and may be made to substitute them in design as well as construction.

When sufficient funds are allowed the Architect or Designer, there is not so much difficulty. There are abundant resources in nature. We find materials of almost every variety of colour and tint. Marble, stone, and wood are to be had in infinite variety; and when wrought into finished and polished surfaces are most beautiful, and far superior to any painted surface which the ingenuity of man can invent or the skill of the artist execute.

Colour is also made successfully to form a part of our Artificial Manufacture, as brick, tile, and the ceramic art generally.

We have recently seen some very successful applications of natural materials, both as to colour and form.

* From the *Universal Decorator*.

No one has, I think, visited the new Church of All Saints in Margaret street, without being struck with the extraordinary and beautiful effect of the decoration. It is universally admitted by persons of acknowledged taste; and those who have no pretensions to Art are able to see that there is a superior beauty to that which they are accustomed to. It must be because the colour of the natural materials is superior to any kind of painted decoration. Yet all the materials used are not of a costly character. Some of the most simple and inexpensive are introduced. Brick, tile, deal, &c., are used, and no attempt made to conceal them.

Who would wish that the stained deal should be painted in imitation of oak? Or that the other materials of a less costly and inferior order should have been painted over, instead of their natural faces being exposed to view? There are beauties in all the materials used. The inferior serve to set off, by comparison, the more costly, and increase the effect. How much greater is our admiration when we can see that the materials used to produce this effect likewise show us the construction, and convince us that all this splendour is not artificial, but real and lasting! This mode of decoration is one which I think should be well studied; and although the limits generally to the expense of other works will not admit of such costly materials being introduced as in the example just named, still a great deal may be done with simple and inexpensive materials; and, by well-studied and careful arrangement of natural colour and effect, as much truth may be expressed.

I think the same rule may be carried out to a great extent, and that successfully, in the internal designing or finishings of our domestic architecture.

Why should light and dark woods be commonly used, in combination with each other, in our joinery? Wood may be stained of various shades from light to dark. The dirt or dust does not show more on stained wood than it does on paint, and can be as easily cleaned and refreshed by periodical coats of varnish. Those parts subject to constant wear and tear can be protected by more durable material, such as finger plates, &c.

Doors made up of light deal panel with darker material for the rails and styles, or varied in the staining, would, I think, look as well as the ordinary graining. Good and well seasoned materials would have to be used, and the joiner's work well fitted and constructed. Mouldings of a superior character, and in some cases gilt, might be used for the panels, &c. Dark and durable woods might be used in parts most exposed to wear and tear.

Treads of stairs might be framed with oak nosings, if not at first, at least when necessary to repair the nosings.

Skirtings varied by using dark and hard woods for the lower part or plinth, lighter wood above, and finished with superior mouldings.

Window boards and nosings of oak.

This must be taken as suggestive only. It would, undoubtedly, be more expensive than the common method of painting, when extreme cheapness is required; but I think it would, in many cases, be better than graining, and cheaper in the long run.

Miscellaneous.

Carburetted Gas in London.

At the last meeting of the city Commission of Sewers, Deputy Lott moved that it be referred to the engineer and the medical officer, to examine and report whether the light from the gas-lamps in the public streets was increased or diminished by the carburetting process recently applied to them, and whether the light thrown upon the footways was not, as he submitted it was obscured by the shadow of the boxes containing the material used in the process. In the course of a discussion on this subject, Mr. Haywood engineer to the Commission, read a letter addressed to him by Mr. Massey, secretary to the Great Central Gas Company, complaining that the Carburetting Company, in applying their process to public lamps within the city, were picking out a lamp here and there for the purpose, to the inconvenience of the company. Mr. Massey also stated that a few days ago, as the Carburetting Company's men were fitting one of their naphtha boxes to a lamp in Queenhithe, it exploded. This, he added, was the third accident of the kind that had occurred within the last three weeks. The directors of the Great Central Company had directed him to call the most serious attention of the Court to an instance of explosion in a bracket lamp in Harrow Alley. Had, he said, one of the numerous lamps fixed in the rear of the same premises ignited, instead of the lamp in question, the great probability was that occuring as it did late in the night, the whole block of houses and buildings used as cattle sheds, would have been burnt down. The owner of the property had made a communication as to the risk she was incurring, and expressing great fear and anxiety for the future. Dr. Abraham said probably the accidents referred to which were exceptional, were due to mismanagement, and therefore preventable. At all events, they were not of a nature to induce the commissioners to abandon the carburetting process, by which a great saving of money was being effected in the public lighting, and which, he believed, would be eventually adopted over the entire metropolis. Mr. H. Lowman Taylor held that the saving of money was at the expense of light, for he had observed on a recent occasion, late at night, a sort of twilight gloom in places where the process was in use. Besides, it was obvious that the boxes containing the naphtha attached to the public lamps, threw shadows on the ground. Dr. Abraham said it was well known, long before the carburetting process was adopted, that at advanced hours of the night, there was always a paucity of gas, consequent upon the companies relaxing their pressure. The subject, on the motion of Deputy Harrison, was eventually referred to the General Purposes Committee, for deliberate inquiry and report.—*London Engineer.*

Valuable Substitute for Metal.

Adamas as a substitute for metal in the manufacture of gas-burners has frequently been mentioned, and it has also been stated that the same substance was equally applicable to various other purposes for which metal has been employed. The use of the "adamas" burners has recently become very general, and Mr. Leoni, the inventor and manufacturer of them, has now succeeded in introducing adamas taps and adamas machine bearings, the working of which has given the greatest satisfaction to those who have employed them. The mode of manufacture consists in reducing the silicate of magnesia to an impalpable powder, and then moulding it into the desired form, and annealing it, the result being that with the greatest facility the utmost precision may be obtained. When employed for taps, the advantage is that an article is produced upon which neither heat nor acids have any effect, at a merely nominal price, and it is anticipated that at no distant period "adamas" steam-cocks will come into general use, to which purpose the material is undoubtedly well adapted, since upon a trial of a couple of ordinary adamas beer-taps (the price of which will be but 1s. or 1s. 3d. to the retail customer) the one began to leak at a pressure of 65 pounds to the inch, and the other stood upwards of 80 pounds, without being affected. But the purpose to which the material may be considered as more especially applicable is for the manufacture of machine bearings, the test which it has stood in this direction being certainly all that could be desired. A steel spindle was run in an adamas bearing for 100 entire days consecutively, at a speed of about 1500 revolutions per minute, yet neither the spindle nor the bearing show the slightest appearance of wear, and several other experimental tests have proved equally satisfactory.

But as a single practical application is preferable to any amount of experimental testing, it may be stated that at the works of Mr. H. Grissell, the well known engineer, a bearing has been for some time in use, and appears to succeed completely. They use it as a fan bearing as a substitute for Babbitt's patent white metal bearing, brass having been previously proved to be quite inapplicable, owing to the great friction and resulting heat, and although the shaft makes nearly 1000 revolutions per minute, it is found that the "adamas" bearing remains quite cool, requires oiling but once a day and shows no appreciable signs of wear. In the position in question the life of a Babbett's bearing is five weeks, and it is confidenty believed that the "adamas" will last for more than as many months.

Aniline in Photography.

Aneline colours, when dissolved in alcohol, and thickened with varnish, have been used with success in tinting albumenized photographs, and are suitable for transparencies on glass.

A New Discovery.

M. Luis Lucas, a gentleman well known for his scientific attainments, on Thursday last received a select circle of visitors at his house, to exhibit and explain the principle of an apparatus of his own invention, by which a physiological fact of great importance is rendered apparent, viz., the direct action of the living frame on the magnetic needle. The apparatus itself is of extraordinary simplicity. A single element of Bunsen's battery has its poles in communication with an electromagnetic bobbin, surmounted by a graduated disc, bearing a magnetic needle which oscillates freely round the centre, as in the common compass. This part of the apparatus is protected by a glass shade; the plate may be raised and lowered at pleasure by a wheel and rack. The conducting wires, after communicating with the bobbin, branch out towards the operator, and are connected together by a loose metal chain. The apparatus being in this state the needle remains perfectly quiescent, until the operator takes hold of the chain, either with one hand or both, when the needle at once begins to move, describing arcs of from ten to ninety degrees. No principle hitherto admitted into physical science can account for this strange phenomenon, and we are compelled to admit a physiological action capable of producing such motion. The experiment was varied in many ways in our presence, and we were ourselves allowed to test our individual power on the needle. That the cause of the motion was of a physiological nature was further proved by the circumstance that the oscillations of the needle varied in intensity according to the persons experimenting, and even according as the same person might be differently affected either by tranquility or a warm discussion, such different states naturally modifying the susceptibility of the nervous system. Stranger still, some persons present produced the oscillations by merely touching the chain with a glass rod about two metres in length, glass being, as our readers know, a non-conductor. Whatever explanation may hereafter be given of M. Lucas's discovery, one fact seems even now indisputable, namely, that the human body may directly influence the needle; what consequences may be evolved therefrom time alone can show.—*Galignani.*

Strange Spontaneous Combustion.

The Woodstock (C. W.) *Times* reports a remarkable spontaneous combustion which occurred recently in that place. It appears that at the close of the day's business operations, the practice of the parties in whose premises the case happened, has been to rub the counter with linseed oil, leaving the oil to penetrate the wood during the night, to be cleaned off in the morning. This is done with cotton rags, formed into a ball secured tightly. In the present instance, the rags or balls of cotton cloth after use were left on the end of the counter, unconnected with any substance that would readily take fire, and the only mischief that resulted was the disfigurement of a portion of the counter. But one of the two balls ignited. The inference is that the one that burned was rather more tightly tied. Had the premises been consumed, the origin of the fire would forever have remained a mystery. From this occurrence a lesson may be gathered, namely, that rags saturated with linseed or in fact with coal oil, and allowed to remain in a compact condition, are liable to take fire. The rags in the case under notice, had not been long in use, and, with the exception of the oil, were free from any other substance.—*American Railway Review.*

Most animal and vegetable oils have a strong affinity for oxygen, and when their surfaces are sufficiently extended they will absorb it so rapidly as to take fire. But coal oils have no affinity for oxygen, and will not absorb it, hence they are not liable to take fire by spontaneous combustion. This property adapts these oils to preserving metal from rust, and to many other uses.—*Scientific American.*

Art and Manufacture.

Flaxman was always proud of his early works in connection with Wedgewood. He felt that, in wedding Art to Manufacture, in producing, for example, his beautiful chessmen, or his exquisitely formed cups, he was aiding in disseminating a taste for Art and a love of the beautiful. It is to be hoped the time will soon come, when every article of domestic use may be obtained of tasteful design; none the dearer because elegant, appropriate, and harmonious. To bring this about, we want, not merely educated Art-workmen, but an Art-educated public. If people will not buy vessels of beautiful form, or carpets of harmonious tints and sensible, truthful patterns, we may be be sure that manufacturers will cease to produce such, and will content themselves with those works of questionable taste which command more favour. *Universal Decorator.*

Phenic Acid.

M. Lemaire has investigated the nature of this substance—one of the numerous products of the distillation of coal-tar. In a paper read before the Academy of Sciences, he stated that anatomical specimens and animals might be preserved in a fresh condition in vessels smeared over on the inner surface with phenic acid, provided that the vessels are hermetically sealed so as to prevent the removal of the air contained in them. The bodies of animals injected with an aqueous solution of phenic acid, may be kept without any alteration in atmospheric air. In this manner, M. Lemaire says, the body of a man may be preserved at an insignificant expense. This acid is also useful as a curative in tinea, scabies, and other diseases. In the latter malady, acetic acid is added to the phenic acid for the purpose of enabling it to penetrate beneath the epidermis to the roots of the hair.—*Am. Gas Light Journal*

Steel for Fire Boxes.

Steel has been for some time successfully used in fire-box plates on the Scottish Central Railway, and Messrs. Cammell and Co.'s steel has been similarly used, for a long time for fireboxes on the Great Western Railway of Canada. On the last named line two boilers for heavy freight engines have been made.

Mineral Oils and their Uses.

A sample of the Canadian oil has been forwarded to Dr. Muspratt for analysis, and he finds each 100 parts to yield upon distillation—of light coloured naphtha, having a specific gravity of 794, 20 parts; heavy yellow naphtha, with a specific gravity of 837, 50 parts; lubricating oil, rich in paraffine, 22 parts; tar, 5 parts; charcoal, 1 part; and loss, 2 parts=100. From this it will be seen that one-half of the crude oil consists of an illuminating fluid of great purity and absolutely safe, and by extracting the lighter spirits from the 794 naphtha, as is stated to be so successfully done by the Asphaltum Company, and leaving more of the paraffine in these naphthas, it would not be difficult to bring into the market, from every 100 gallons of the crude oil, 80 gallons of good quality illuminating oil, and in addition to which there would be the profits derivable from the lubricating oil and the mineral turpentine, so that the treatment of the oil cannot fail to be remunerative to those engaged in the business. At present sulphuric acids and alkalies are, no doubt, dear in Canada and Enniskillen the place at which the wells alluded to are situated has not very great accomodation for getting the oil to market, but these are obstacles which in the course of a few months will have entirely disappeared. So far, all that has been thought of is the rendering of the crude oil marketable principally as an illuminating oil, because in this form it would be most readily saleable in the Canadian market, but some disadvantages would result from treatment in this way, and consequently if a market be secured in Europe the profits would be much larger. The product which Dr. Muspratt inaccurately describes as light-coloured naphtha is really a similar product to that sold as benzole, which is the basis of the very beautiful colours described by Dr. Crace-Calvert, F. R. S., in a paper recently read by him before the Society of Arts. The so-called heavy yellow naphtha is an inexplosive illuminating oil, which would sell readily at the price of the best paraffine oil; it is, in fact, a superior kind of Belmontine oil, and if its more valuable portions were removed by bleaching it would be be difficult to distinguish it from Belmontine. As the raw material for the manufacture of gas, the Canadian oil is especially valuable; in fact, the crude oil can scarcely be distinguished from the hydrocarbon, used by Mr. John Leslie, of Conduit-street, London, for the instantaneous manufacture of gas of high illuminating power, and proposed by him to be exported to all parts of the world. It could even be used as a substitute for coal itself in stoves which are constructed for burning it; usually, however, preference would be given to the manufacture of gas, and then to use the gas as the heating medium. The petroleum oil is also useful as a wood-preserver, and when forced through the pores, as in Boucherie's process, will last for a very lengthened period without showing signs of decay.

Destruction of Small Birds causing Alarm.

For several seasons, and particularly the last, there was found to be a scarcity of breadstuffs in France. This state of things caused great alarm, and memorials were presented from some of the departments to the Minister of Agriculture, the Legislative Chamber and the Emperor. An elaborate report has been made on the subject, in which the destruction of small birds is charged with being one of the leading causes of deficient crops. The destruction of small birds has gone on increasing, and in a corresponding ratio has also proceeded the increase of those insects and reptiles which prey on the crops of grain and all kinds of vegetable food; and on these insect tribes the small birds live. To that degree of alarm has the public mind been brought that inquiry and investigation have been instituted, and have demonstrated the fact that the destruction of the beautiful feathered songsters may, if continued, lead to something like positive famine. This document has been translated and is being circulated in England, to aid in arresting the wanton destruction of birds in that country. It was the subject of a paper recently read before the National History Society of Regate, from which we cut the following:—"Although the sparrows levy a small contribution on the farmer's grain, yet the far greater portion of their food is from injurious insects, and the whole of the food they give to their young is from the tribe of insects. At the beginning of the world man would have succumbed in the unequal struggle if God had not given in the bird a powerful auxiliary—a faithful ally—who wonderfully accomplishes the task which man is incapable of performing—in fact against his enemies of the insect world man would be powerless without the bird."—*Moore's Rural New Yorker*.

Oil Region of Pensylvania.

Appended to a report on the Oil Region of Pensylvania, in the *Oil City Register*, of May 15, is the following recapitulation:

" Number of wells now flowing	75
Number of wells that formerly flowed and pumped	62
Number of wells sunk and commenced	358
Total	495
Amount of oil shipped	1,000,000 bbls,
Amount on hand to date	92,450 bbls.
Present amount of daily flow	5,717 bbls.
Average value of oil at $1 per barrel	$1,092,000 00
Average cost of wells $1,000 each	495,000 00
Machinery, buildings &c., from $500 to $7,000 each	500,000 00
Total number of refineries	25."

The Iron-Plated Navy of France.

The *Revue Contemporaine* states that the plan of the first iron-plated frigates was signed March 20th, 1858, long before the matter was approached by England or any other country. There are now four of these frigates afloat, the *Gloire*, the *Invincible*, the *Normandie*, and the *Couronne*, all of which have been tested at sea, with the most satisfactory result. Each of these has an armament of thirty-six rifled guns, of which thirty-four are in the battery, which is plated with iron from end to end. Two guns only are placed on the upper deck and will carry four miles. The crew is composed of 570 men, the engines are 900 horse power, and the length of the ships is 231ft. Besides these there are four iron-plated batteries, intended not for sea but for harbour defences; they are the *Peiho* the *Saigon* the *Paixhans* and the *Palestro*; these are not yet quite complete. Two more iron-plated frigates, on a plan different to the *Gloire* are building, the *Magenta*, and *Solferino*. Besides these there are ten other frigates of 1000 horse power building in the Imperial dockyards, and six new floating batteries have been ordered by private builders, and are being pressed on with all haste. The iron fleet of France thus consists of 16 frigates, afloat or nearly completed, and ten floating batteries.

Cowper Cole's Cupola Principle.

Arrangements are nearly completed at Her Majesty's dockyard at Sheerness, for the construction of a new iron-cased steamer, to be built on Coles's cupola principle, with two shields. The dimensions of the vessel are as follows:—length between perpendiculars. 185ft.; length of keel for tonnage, 148 ft.; extreme breadth, 42ft.; breadth moulded, 41ft. 9in.; depth in hold, 19ft. 10in.; and burden in tons, 1385. She will draw about 16ft. of water forward, and 17ft. aft. Her stem will be constructed somewhat after the pattern of the *Defence* and the *Resistance* iron-cased frigates. What has been chiefly kept in view in the design of the vessel, is to combine great speed with great power of resistance.

Foreign English.

The following choice specimen of English composition is daily distributed in the Western Annex of the International Exhibition. "Balthasar Danzer, manufacturer of Bellows a Munic, recomends his theuv-pre-du-cing apparatus made for the irrigation of tender plants and calculated fr destroying plant lice. Price L4. s. 15. His second apparatus intended for domestic use serves for the pur pose of destroying bugs batles cock reaches and all other noisome chafers in house a Kitchens Pr: 6s. 6d."

Cohesive Strength of Metals, &c.

Cast iron, 42,000 pounds; iron bar (best Swedish and Russian), 81,000 pounds; ordinary 68,000 pounds. Steel bar, soft, 120,000; razor tempered steel, 150,000 pounds. In steel, and *willow* wood, the *cohesive and repulsive* strength appear to be nearly equal. Oak will suspend much more than fir; but fir will support twice as much as oak, probably on account of the curvature of the fibres of oak. Although iron, at an average, is four times as strong as oak, and 5½ times as strong as deal or fir, yet it is more liable to accidental imperfections; and when it fails it gives no warning of its approaching fracture. Wood, when it is crippled, complains, or emits a sound, and after this, although it is much weakened it may still retain strength to be of service.—J.B.

Microscopic Writing.

Amongst the mechanical marvels of the Exhibition is a machine exhibited by Mr. Peters for microscopic writing, which is infinitely more wonderful than Mr. Whitworth's machine for measuring the millionth of an inch, which excited such astonishment in 1851. With this machine of Mr. Peters', it is stated that the words "Matthew Marshall, Bank of England," can be written in the two-and-a-half millionth of an inch in length, and it is actually said that calculations made on this data show that the whole Bible can be written *twenty-two times* in the space of a square inch.

Substitute for Cotton.

The Conserva Plant.—It is met with in every ditch and pool, especially in old clay pits, and in most slow streams. It is of a soft substance, and in pure water, where the threads grow long, resembling tow. But in muddy waters, where they are short, it is not unlike cotton; which being carefully collected and dried, turns whitish, and has sometimes been used for it, either as wadding, or to make towels and napkins, for stuffing beds, and for making paper. In every country there is a great annual waste of cotton used in wicks for candles and lamps, and, in order to economise cotton for the future, I strongly commend this plant, as a substitute, to the parties most interested.