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DECORATIVE PAINTING.

Our article on this subject,* we are glad to find, has created some interest among a few of our painters. Several have applied at the free Library of the Board of Arts and Manufactures for works which treat on the subject, and others have expressed a desire for some practical hints that might be useful to beginners. One, a native of Germany, thinking our previous remarks imply a slight on what he seems to consider his national art, has written us a long and discursive letter on the subject, which, had it been in shape for this Journal, we would have gladly published.

The species of decoration to which we alluded as having been introduced into the Province by German painters is no more to be likened to the ancient frescoes of Germany, where such exist in its cathedrals and palaces, than one of our lager bier saloons to the palace of the Alhambra. The pseudo-fresco painting, which has been generally accepted as an improvement on anything which may have preceded it in the Province, we said was "a laudable attempt" to supply a defect in our public buildings, namely, the absence of interior ornamentation. We deprecated the selection of mere architectural details for the purpose of a high style of decoration, at the same time admitting a talent for drawing on the part of those who practised this kind of painting.

We thought it patent to every reflecting mind that painting, architecture, and sculpture possessed distinct aims, and objects frequently combined to produce harmonious effects, but not of necessity to repeat, or reflect each other. Yet, oddly enough, our correspondent advocates his favourite style of ornamentation by claiming for it a superiority, not in point of taste, but a greater economy over similar adornments in plaster. He asks, whether it is not as much a sham to construct cornices, pillars, and pilasters of stucco, which, from the nature of the material, cannot support what they would seem to be intended for, as to represent them by painting; and argues that, if they were properly represented by lights and shadows, the effect would be the same, and would be obtained at much less cost. He says, he could paint a cornice in water colour at one-tenth the price of one in plaster, and in oil, which, he remarks is more durable than plaster, at one-fourth of that cost. It is not strange that the perpetrator of one set of shams should fall foul of another labourer in the same rank field. Were we on the subject of architecture, the plasterer, who is generally a wholesale dealer in shams, would not escape severe criticism. For the present, we have only to do with house painting, and are desirous of pointing out, for the benefit of those who may wish to profit by our remarks, some of the abuses at least of the art, if we do not succeed in defining its proper use.

* Page 225.

Truth is said to be the first great principle in art. If we so far forget this important axiom as to pursue a system founded on untruth, we prostitute and debase the art, especially where we lend it for the purpose of apparently implementing architectural construction. We do this when we paint sham pillars, sham cornices, mouldings, panels, and other details, which ought to have been done by the architect in some solid substance. If such things were not necessary, as the fact of leaving them out would tend to show, why not leave the painter to exercise his legitimate calling, where his art might have a fair chance along with that of the architect of being duly appreciated? Surely there are better subjects for the painter's pencil than bad architectural details. If he should be so cramped up in cities that the stones, and bricks, and mortar of our dingy dwellings have crushed out of his mind all other ideas of art, give him a holiday—let him go to the forests and study the autumnal-glow of the maple, the rich brown of the beech, the bright sunny yellow of the linden, and let him bring with him armsful of foliage, and paint their graceful fronds. Let him weave them into coronals, and work them into his arabesques. What have we to do with drab, the universal colour with our house painters? Where is it in nature, unless in the buried sandstone; and, when we bring it to light, does not nature kindly shed over it the bright day colours, or the golden sunset, as if ashamed of its unnatural tint?

Drab, however, is the very life and soul of the house painter. It is drab, drab, eternal drab! It came into use with the Puritans, a gloomy and austere race. It has been ever the badge of the Quakers. There must be, indeed, something congenial to sourness and moroseness in *drab*, for we believe that painters, an unusually musical class, are scarce ever heard to sing or whistle at their work under its influence. We can only account for its extensive use on the ground of its comparative cheapness, being more easily adulterated with gross earthy substances than other pigments.

It is a well ascertained fact that colours have peculiar influence on the human mind. Many highly curious and valuable works have been published on the properties and harmony of colour. It is said that the inhabitants of countries where bright colours abound in nature, and are introduced into apparel, furniture, and other articles are remarkable for great animation aad liveliness of manner.

In France, and Italy, in many parts of Germany, and even in Holland the humblest domiciles are painted outside and inside in the brightest colours. The more pretentious edifices, especially the ancient buildings, are coloured on the brick and stone work, and occasionally gilded in a highly artistic style. It is often a subject of remark by those who have resided sometime on the continent of Europe, and have become accustomed to colour on buildings and in the dresses of the people, that the absence of colour strikes them on their return as extremely dull and gloomy.

It is surprising with how little apparent effort a pleasing and harmonious effect may be produced, by the judicious application of a few simple colours. Our parlours, drawing rooms, and halls, might, at half the expense of the dull oak graining, be enlivened by a few simple touches of chromatic penciling. It would be far from an undignified employment for those members of families who sometimes occupy their time in painting fire-screens, making wax flowers, &c., to pencil, or stencil in some light running ornament or simple diaper on the panels and architraves, after the woodwork had been previously stained or coated by the house painter. A simple wash of size, coloured with amber or other pigment, on the woodwork is all that would be required previously to the diapering or penciling with colour.

Good examples of this kind of decoration may be found in the illuminations of ancient manuscripts and missals: but there are also many specimens of this art from ancient edifices to be found in modern publications. A few books of an elementary kind treating on the subject may be seen at the *Free Library of the Board of Arts and Manufactures* at Toronto, where catalogues of others may also be found.

The house painter would find an infinite variety of interesting study in prosecuting this most beautiful art. He would have free scope for his imagination. He would not be tied down, as he now is, to the formality of vile oak graining, and marbling, and such like shams; but, while retaining the effect of the ancient work, every variety in the detail might be obtained, and a local interest be imparted to it by working in our beautiful Canadian foliage, where it might be introduced with propriety and effect.

The human figure is doubtless a grand and dignified subject to introduce into mural decoration, but this can only be done effectively by first-rate artists, and should not be attempted by ordinary painters. It is generally admitted that figures in modern costume are inadmissable as wanting in pictorical effect, and being rarely applicable in a symbolic sense. The painter's choice, therefore, lies between the Heathen Mythology and the Christian Calendar. It is questionable whether we, as christian people, are strictly justified in our general preference for the sensual deities of the Pagans; but it is nevertheless true that we invariably adopt them in the embellishment of our music halls, and similar temples of amusement. Christian art admits into its composition angels and saints more modestly clothed generally, and, perhaps, on this account less objectionable than the heathen figures; but we cannot evidently disunite them from particular phases of christian worship, else they would, perhaps, form a better class of subjects for our purpose. Unless for for devotional purposes, however, it may be doubted whether there is much advantage in the use of figures in mural painting. They are rarely well executed. The requirements of taste in this respect are, perhaps, better met by pictures in the usual way.

Legends, or quotations from the poets, or other inscriptions illuminated in the manner of the ancient manuscripts would fill up the panels of our Music Halls quite as effectively as figures of pagan goddesses. They would besides convey generally more intelligible meanings. Any one who has seen good specimens of this kind of writing, can easily imagine how rich and beautiful it could be treated for decoration on a large scale. It might with propriety take the place of meaningless scrolls, which are not unfrequently set up as ornaments for their own sake, not having the least connection with the main subject of the design. This kind of ornamental writing is capable of adaptation to almost every species of decoration—to churches, halls, theatres, saloons, and to private dwellings. Appropriate scriptures, sacred or profane, may be easily selected and represented in endless variety of forms and ornamentations.

THE MANUFACTURING DEPARTMENT OF THE PROVINCIAL EXHIBITION.

There are many circumstances connected with the Arts and Manufacturing Department of the Provincial Exhibition, which call for serious attention. We look in vain through these annual expositions of our industry, for a representation of that progress in our manufactures which might have been expected, and which we know to have taken place at London. It is not difficult to account for the absence of many names among the exhibitors, who, if the Exhibition had been held at Hamilton, Toronto, or Kingston, would have been well represented. Manufacturers do not like to send their best specimens to a considerable distance, subjecting them to the three-fold risk of injury by railway carriage to and fro, handling at the Exhibition building, and risk of damage from unavoidable exposure to the crush of many thousand spectators, who have to see all they can during two days.

There is another objection felt by many who are otherwise much interested in our annual displays, and who would do all in their power to assist by contributing articles for exhibition. It is the sheer impossibility of having justice meted out to all, by those who are employed as judges. There can be no doubt that the gentlemen who have officiated from time to time, have uniformily acted according to the best of their ability, based upon the opportunities which have been given them for forming a correct judgment of the merits of each competitor. But how is it possible that in the space of a few hours any men, however intelligent and conversant with their subject, can deal with many hundred articles submitted to their inspection. Very frequently they require information which cannot be immediately procured, and yet they are required to make their awards as if they knew all the circumstances of the case. In a Canadian Exhibition, if two articles are offered for competition possessing apparently equal merits, the decision of the judges would rest upon other considerations than those which meet the eye—if one article were wholly Canadian in its construction down to the nails or hinges, but the other embraced some parts which bore the stamp of foreign manufacture, it is clear that that which was a home production in all its parts, has a claim beyond the other taking advantage of foreign aid.

In order that prizes may be adjudged to those most deserving, and in strict accordance with the objects of the Provincial Exhibition, more time must be placed at the disposal of the judges. Again, very may articles are entered for competition which, although not obtaining a prize, are certainly deserving of public notice, but there is not time enough to draw up such a report as would embrace the merits of nine-tenths of the articles shown ; and, as already stated, the necessary information is often sought for in vain during the day appointed for the awards to be made, and when obtained it is frequently too late, and the competitor retires in disgust.

Another objection to the present arrangement of our Annual Exhibitions, as far as the Arts and Manufacturing department is concerned, is the short period of time allowed for inspection, and the exceedingly unfavourable circumstances under which an inspection has to be made. Many hundreds go to visit our Annual Exhibitions for the express purpose of examining the Arts and Manufactures department, and they would willingly devote several hours to a quiet study of what ought to be a representation of the industry of the country. Exhibitors generally sent their contributions to be seen by the public, their object is to make themselves known by their works, with a view to ultimate peçuniary benefit. They look upon the Exhibition as an advertisement on a large scale, and one which affords them an opportunity for displaying in public what they are prepared to execute in private. The end they have in view cannot be answered by three days of partial exhibition, brief notices in the public press, and frequently no notice at all from those who are appointed to decide upon their merits.

The remedy is simple enough. The Exhibition of Arts and Manufactures should extend over a longer time, and be open at least one week before the Agricultural Department begins. Ample time should be allowed for careful arrangement of the articles contributed, and at least three instead of one day given to the judges to report on the articles exhibited, not those only which are considered worthy of prizes, but those which are deserving of being brought before the public. Every effort should be made to serve the object the exhibitors have in view, and a few lines, embracing a single paragaph, will often prevent dissatisfaction at supposed neglect, and be a just tribute to energy and skill, with which the public ought to be familiar.

There are now four permanent Exhibition Buildings in Upper Canada ; at Toronto, Hamilton, London, and Kingston. At each of these buildings there is, or at small expense might be, room for the display of many specimens of industry and art, which we cannot expect contributors to send far at considerable risk, to be exhibited for two or three days to many thousand persons at once, who necessarily hurry through the building in hot haste, to catch a glimpse of as much as they can in the short time allowed them. Let the Arts and Manufactures department be opened for actual inspection for one week before the articles belonging to the Agricultural department arrive, and there will be no lack of contributions or interest in the display. Next year the Exhibition is to be held at Toronto, and the opportunities for trying the experiment are the best that could be offered in Upper Canada. The building is large and commodious, and situated in the centre of our manufacturing industry. The trial is worth making, and we trust those suggestions will receive attention from these who are influential in arranging the details of the next Provincial Exhibition.

ON THE MEDICINAL PROPERTIES AND USES OF OUR NATIVE MEDICINAL PLANTS.

BY WILLIAM SAUNDERS, LONDON, C. W.

To treat separately of the properties of each of the remedies in the above list would occupy a space by far too great, and exceed the object of the present paper, which is merely to introduce the subject to public attention; still there are some among them of such relative importance as to demand a separate notice. Of these we shall speak first, and sum the others up in classes according to their action on the animal economy. That the general reader may more readily comprehend the objects spoken of we shall use their common in preference to their scientific or botanical names.

Among the most valuable and generally known, both commercially and medicinally, of our native remedies are, Bloodroot, Wild Cherry Bark, Dandelion, Lobelia, Mandrake, Seneca Snake Root, Slippery Elm Bark, Stramonium, Golden Seal, and Black Cohosh. The two last, although well known natives, are not in the list of those exhibited, which for want of time was necessarily very incomplete.

Bloodroot (*Sanguinaria Canadensis*).—This interesting plant is common almost everywhere throughout the Province, growing in loose rich soils and shady situations. It is among our earliest spring flowers, and may be easily recognized by its beautiful peltate leaf and delicate white flower. The root is the only part used in medicine. It is a powerful and valuable remedy, acting in small doses as a stimulant and expectorant, in over doses producing nausea and vomiting. It enters into the composition of many popular cough mixtures, and has been highly extolled by some practitioners as an alterative in torpid conditions of the liver.

Wild Cherry Bark (*Prunus Virgineana*).—The inner bark is the part used, and is strongest when gathered late in the fall. Its taste is agreeably bitter and aromatic, with the peculiar flavor of bitter almonds. This bark unites with a tonic and stimulant a decided sedative influence, and is therefore a valuable agent in cases of debility attended with nervous irritation. In the form of pastile it is used to allay tickling coughs; it is also prescribed as a palliative in the hectic fever of consumption, and as an additional proof of its value, it is a leading ingredient in the most popular patent medicine of the day for coughs and colds, I mean Cherry Pectoral. It is best administered in the form of fluid extract.

Dandelion (*Leotodon dens Leonis*).—This well known plant is found in almost every part of the globe. It is abundant in this country, adorning our fields with its bright yellow flowers from the opening of spring to near the close of summer. The root is the officinal part, and is largely used both in this country and on the continent of Europe in liver complaints and in disordered states of the digestive apparatus. It is generally prescribed in the form of extract, which is best made by evaporating the juice of the fresh root to a pilular consistence.

Lobelia (*Lobelia inflata*).—This powerful remedy was a favorite with the medicine man among the Indians long before the settlement of this country by the whites. It is a well known weed, and is found in abundance in fields, meadows, and woods, in almost every part of Canada. Both the plant and the seeds are used in medicine. They are emetic, and in small doses expectorant and diaphoretic. As an emetic it is a popular remedy in domestic practice in many parts of the country, and in moderate doses is usually safe and prompt in its action. It has been found valuable in croup, and is frequently used in combination with bloodroot and squills for coughs and colds. The plant smoked has proved very useful in spasmodic asthma, the paroxysms of which it often greatly mitigates and sometimes wholly relieves. An oil is prepared from the seeds which is very powerful, and is used both internally and externally.

Mandrake (*Podophyllum Peltatum*).—This plant grows abundantly with us in rich woods and fields, sometimes covering acres of ground with its large palmate leaves. The mandrake was well known to the Indians, and much used by them as a purgative. The root is the only officinal part, and the proper time for collecting it is in the latter end of October, when it will be found full and plump. It is an active and certain cathartic, somewhat resembling jalap in its mode of operation. A resinoid, called *Podophyllin*, is prepared from the root, which contains all its properties in a concentrated form. This is extensively used by all classes of practitioners, and as an aperient and alterative medicine it takes with the eclectic physician the place of mercurials.

Seneca Snake Root (*Polygala Senegæ*).—This plant is more abundant in the southern and western parts of the United States than with us, yet it may be gathered in considerable quantities in Canada in some localities, growing in open rocky or sandy woods and plains. The root only is used. It acts as a powerful stimulant on most of the secretions, and is much valued as an expectorant in combination with squills in coughs and colds. It has proved serviceable in chronic catarah, protracted cases of inflammation of the lungs, and in the secondary stages of croup. It is not indicated where acute inflammation exists.

Slippery Elm Bark (*Ulmus fulva*).—The inner bark is the part used. It is a valuable demulcent and emmollient, and in the form of infusion has been found highly beneficial in inflammation of the mucous membrane of the stomach and bowels. It is a deservedly popular remedy in coughs and sore throat, and in the form of a coarse powder is much used externally for poultices.

STRAMONIUM (*Datura Stramonium*).—This plant, known also by the name of Thornapple, is abundant in all sections of this country. It is large and succulent, and may be easily recognized when full grown by its remarkable seed-vessel, which is thickly covered with sharp thorns. All parts of the plant are medicinal. It is a powerful narcotic, poisonous in large doses. It has been used with success in epilepsy, also in neuralgic and rheumatic affections, and the leaves smoked have acquired considerable reputation in asthma. The seeds are the most powerful.

GOLDEN SEAL (*Hydrastis Canadensis*).—This is a small plant with a simple erect stem, growing from six to ten inches high, bearing two unequal terminal leaves and a simple small white or rose colored flower. It is found plentifully in many parts of the country, growing in rich soil in shady woods and damp meadows. The root only is officinal. It is of a beautiful yellow color internally, and is used by the Indians as a dye. It is a powerful tonic, useful in dyspepsia, chronic diarrhæa, and in all other cases where tonics are indicated. As an external application it has been used and recommended in cancer, both here and in Britain, also in various forms of opthalmic disease.

BLACK COHOSH (*Cimicifuga Racemosa*).—This root is a very popular medicine among physicians of the eclectic school, and is used for a great many different complaints. Among its other properties it is stated to be narcotic, tonic, and anti-periodic. It has lately been introduced to the medical profession in Great Britain by Professor Simpson of Edinburgh, who recommends it very strongly in acute rheumatism, and it is now largely used with, it is said, remarkable success.

As alteratives used for purifying the blood we have, in addition to those already spoken of, a number of valuable roots, as Yellow Dock, Burdock, American Sarsaparilla, Spikenard and Yellow Par. illa. These have all been extensively used, and are very highly spoken of by many. Yellow Dock and Burdock are especially working their way into general use, and probably will eventually supersede in scrofulous and other complaints of a similar character some of the more expensive imported drugs. Of the Burdock both seeds and root are used, and are found to possess similar properties. The American sarsaparilla is preferred by many to the imported; it can be afforded at a much lower price, and may at all times be procured fresh. There is in addition to this a long list of alteratives, whose properties have not been fully investigated, but which probably comprises some valuable agents; these are, Blue Flag, American Ivy, Elder Flowers, Sassafras, White Pine Bark, Prince's Pine, Poke Root and Tamarac Bark.

As astringents, valuable in diarrhœa, dysentery, &c., there are several well known remedies, such as Blackberry Root, Cranesbill, White Oak Bark, Raspberry Leaves, and besides these some others whose virtues are not so generally known. Beth Root, Beech Drops, the roots of the Yellow and White Pond Lilies, Liverwort Leaves, Nettle Root, Wintergreen Leaves, and the bark and leaves of the Witch Hazel.

Our list includes a considerable number of tonic medicines. The Poplar, White Ash, and Prickly Ash Barks, which, together with the buds of the Balm of Gilead, have been used with success in intermittent fevers. Balmony, a valuable remedy for dyspepsia. Bitter Root, which unites diaphoretic and emetic to its tonic properties. Swamp Dogwood, American Gentian, Black Willow Bark, Ginseng, Goldthread (which is also used as a topical application in the sore mouth of infants), Solomon's Seal, Sweet Flag, May-weed, Maiden-hair, Spicewood Twigs, and Vervain Root.

As expectorants for coughs and colds we have, in addition to those spoken of in the former part of this paper, Horehound, Elecampane, and Sweet Cicely; and as carminatives, the virtues of which in the flatulent colic of infants almost every mother is familiar with, there are Peppermint, Catnip, and Spearmint.

Of laxatives, besides the Mandrake already mentioned there are several. Butternut Bark, which is a mild but valuable remedy in habitual constipation, Wild Celandine, Garden Celandine, and White Cohosh. The two last of these are drastic and too powerful for general use.

The value of diaphoretic medicines in many complaints is well known, of these our list is not bare. It includes Boneset, Wild Ginger, Cocash, Blue Lobelia, Saffron, White Snake Root, and Pleurisy Root, the last unites expectorant with its diaphoretic properties.

Of Anthelmintics we have Wormwood and White Indian Hemp; these, although not so agreeable to the taste as the worm candies so popular, are doubtless valuable remedies in some cases. As diuretics there are Cleavers Yarrow, Queen of the Meadow, both root and leaves, Partridge Berry Vine, Horse Radish Root and Stone Root. As antispasmodics the most valuable are Scull-cap, Ladies' Slipper Root, Skunk Cabbage Root, and Cramp-bark. As a narcotic we have Poison Hemlock, which in the form of extract is extensively used; and as emenagogues Pennyroyal, Tansy, Blue Cohosh, Milkweed Root, Motherwort, and Water-pepper. Of demulcents we have two, Comfrey, which is also slightly astringent and the common Mullein, which is likewise used externally in the form of poultice.

LONDON, Oct. 18, 1861.

Canadian Medicinal Plants.

List of Medical Herbs, Roots, &c., all of native growth, exhibited by William Saunders, London, at the Provincial Exhibition, 1861.

Achillea Millefolium (*Yarrow*).
Marrubium Vulgare (*Hoarhound*).
Datura Stramonium (*Stramonium Leaves*).
Artemisia Absinthium (*Wormwood*).
Eupatorium Perfoliatum (*Boneset*).
Gaultheria Procumbens (*Wintergreen*).
Salvia Officinalis (*Sage*).
Adiantum Pedatum (*Maiden Hair*).
Hepatica Americana (*Liverwort*).
Verbascum Thapsus (*Mullein*).
Anthemis Cotula (*Mayweed*).
Leonurus Cardiaca (*Motherwort*).
Galium Aparine (*Cleavers*).
Polygonum Punctatum (*Water Pepper*).
Tanacetum Vulgare (*Tansy*).
Mentha Viridis (*Spearmint*).
Mitchella Repens (*Partridge Berry Vine*).
Rubus Strigosus (*Raspberry Leaves*).
Lobelia Inflata (*Lobelia*).
Mentha Piperita (*Peppermint*).
Eupatorium Purpureum (*Queen of the Meadow Leaves*).
Nepeta Cataria (*Catnip*).
Conium Maculatum (*Poison Hemlock*).
Hamamelis Virginica (*Witch Hazel Leaves*).
Scutellaria Lateriflora (*Scullcap*).
Lobelia Syphillitica (*Blue Lobelia*).
Chimaphila Umbellata (*Prince's Pine*).
Impatiens Pallida (*Wild Celandine*).
Panax Quinquefolium (*Ginseng*)
Asclepias Cornuti (*Milk Weed Root*).
Asclepias Incarnata (*White Indian Hemp*).
Coptis Trifolia (*Gold Thread*).
Asarum Canadense (*Wild Ginger*).
Iris Versicolor (*Blue Flag*).
Podophyllum Peltatum (*Mandrake Root*).
Symphytum Officinale (*Comfrey*).
Convallaria Multiflora (*Solomon's Seal*).
Taraxacum Dens Leonis (*Dandelion Root*).
Verbena Hastata (*Vervain Root*).
Apocynum Androsæmifolium (*Bitter Root*).
Eupatorium Aromaticum (*White Snake Root*).
Sanguinaria Canadensis (*Bloodroot*).
Polygala Senegæ (*Seneca Snake Root*).
Arum Triphyllum (*Indian Turnip*).
Collinsonia Canadensis (*Stone Root*).
Caulophyllum Thalictroides (*Blue Cohosh*).
Datura Stramonium (*Stramonium Root*).
Osmorrhiza Longistylis (*Sweet Cicely*).
Menispermum Canadense (*Yellow Parilla*).
Asclepias Tuberosa (*Pleurisy Root*).
Nymphœa Odorata (*White Pond Lily*).
Aster Puniceus (*Cocash Root*).
Rumex Crispus (*Yellow Dock*).
Rubus Villosus (*Blackberry Root*).
Geranium Maculatum (*Cranesbill*).
Aralia Nudicaulis (*American Sarsaparilla*).
Cypripedium Pubescens (*Ladies Slipper*.
Arctium Lappa (*Burdock Root*).
Cochlearia Armoracia (*Horse Radish Root*.
Phytolacca Decandra (*Poke Root*).
Gentiana Catesbei (*American Gentian*).
Symplocarpus Fœtidus (*Skunk Cabbage Root*.)
Urtica Dioica (*Nettle Root*.)
Acorus Calamus (*Sweet Flag Root*).
Eupatorium Purpureum (*Queen of the Meadow Root*).
Aralia Racemosa (*Spikenard*).
Inula Helenium (*Elecampane*)
Nuphar Advena (*Yellow Pond Lily*).
Dirca Palustris (*Leatherwood Bark*).
Quercus Alba (*White Oak Bark*).
Salix Nigra (*Black Willow Bark*).
Viburnum Opulus (*Cramp Bark*).
Prunus Virginiana (*Wild Cherry Bark*).
Fraxinus Acuminata (*White Ash Bark*).
Juglans Cinerea (*Butternut Bark*).
Hamamelis Virginica (*Witch Hazel Bark*).
Xanthoxylum Fraxineum (*Prickly Ash Bark*).
Larix Americana (*Tamarac Bark*).
Cornus Sericea (*Swamp Dogwood Bark*).
Populus Tremuloides (*Poplar Bark*).
Pinus Strobus (*White Pine Bark*).
Ulmus Fulva (*Slippery Elm Bark*).
Populus Balsamifera (*Balm Gilead Buds*).
Orobanche Virginiana (*Beech Drops*).
Ampelopsis Quinquefolia (*American Ivy Twigs*).
Humulus Lupulus (*Hops*).
Carthamus Tinctorius (*American Saffron*).
Sambucus Canadensis (*Elder Flowers*).
Xanthoxylum Fraxineum (*Prickly Ash Berries*).
Chelone Glabra (*Balmony*).

NEW APPLICATION OF ROCK OIL.

Rock Oil is now so abundantly procured in Western Canada, that its price has been reduced to six cents a gallon at the Railway Station near the wells. Refined oil can be procured for fifty cents a gallon, and will yet be cheaper when the best modes of refining are adopted. Rock oil or Petroleum can be used for carbonizing common illuminating gas, and a saving of from twenty to twenty-five per cent. be effected. The Commissioners of Sewers of the city of London have had the matter investigated, and the report of the gentleman they employed contains the following paragraphs

The patentees stating that, by the application of their process, equal light would be given with half the ordinary consumption of gas, the burners were regulated accordingly.

The lamps experimented upon were twelve in number—six upon the western side, which were fitted with the ordinary batswing burners, calculated to consume, upon the average of the night, 5 cubic feet of gas per hour; and six upon the eastern side, fitted with batswing burners, calculated to consume 2½ cubic feet per hour; the latter burners having attached to them the carburating apparatus of the company. Each of the twelve burners had a metre attached to it, to ascertain the actual consumption. No pressure regulators were fixed upon the lamps.

The registration commenced on the 10th of June, and terminated on the 19th of July inst.—the experiment extending, therefore, over thirty nights—and gave the following results:—That the burners without the carburating apparatus consumed about 4.30 cubic feet per hour. That the burners fitted up with the carburating apparatus consumed 2.09 cubic feet per hour.

No photometer was employed; the equalization of the amount of light given by the two classes of burners, was a matter of judgment. The district inspector of the commission, who saw the light nightly, reports his opinion that the light given was perfectly equal, and his opinion is strengthened by collecting those of certain residents in the neighbourhood. My own opinion is that the light of the 2½-feet burners was, upon the average of the month, inferior, although but very slightly so, to that of the five feet burners. The inspector of the Chartered Company coincides with me in this. No chemical analysis was made of the naptha used, but it is stated by the patentees to have been of the best quality.

My deduction from the experiment is, that with naphtha of equal quality to that used during the warm months of the year, 3 cubic feet of carburated gas may be considered as about equal to 5 cubic feet of gas not carburated.

Assuming this to be data applicable to all seasons of the year, I have estimated the saving to be effected by the process; and, after allowing for the cost of the apparatus, and for periodically filling it with naphtha, and after giving credit, at the present price of the gas supplied to the public lamps, for the quantity not consumed, it shows that the reduction in the cost of each public lamp will be at least 20s. per annum; and, there being 2,825 lamps within the city, that a saving of about £2,825 would be annually effected.

The only disadvantage observed during the experiment was, that the reservoir, as constructed, throws a disk of shadow round the base of the gas-lamp standard; but the depth of shadow is but slight. This disadvantage may be largely rectified by an alteration in the form of apparatus.

It should be understood that I do not pledge myself to any of these figures as exact, for the experiment, as conducted, cannot lay claim to be considered minute or exact in its character; but I believe it may, nevertheless, be taken as giving a close approximation to the truth. It is the mean of the rough results of practice, and the refined processes of the laboratory, from which reliable data are generally drawn. In this case the results of the experiment are supported by laboratory experiments, and, consequently, there seems but little doubt that this mode of applying naphtha to the public lights (for the naphthaization of gas itself is by no means new) may lead to a considerable reduction in the cost of public lighting; but what that reduction ultimately would be, would depend upon points which can only be determined by the application of the process to a considerable number of lamps for some length of time, and at different seasons.

It is important to remind Refiners of Petroleum or Rock Oil, that by pushing the process too far they will obtain an explosive oil, a hydro carbon, having a specific gravity less than 0·800, for all mineral oils with a specific gravity of 0·785 are dangerous, and very many of them highly explosive, so that a light held over them would instantly inflame the whole mass. It is necessary to observe this caution in time, for if any accident should occur from the use of Rock Oil of too low a specific gravity, the general interests of the Refiners would be materially changed. An insurance company would not effect the insurance of buildings where highly refined Rock Oil was used, that is to say, Rock Oil having, so to speak, an explosive specific gravity. Shocking accidents have already occurred in England from the explosion of similar oils.

The carbonizing of the gas of Toronto ought to engage the attention of consumers. In conjunction with the direct manufacture of gas from Rock Oil, a new use will be found for this material.

The Board of Arts and Manufactures

FOR UPPER CANADA.

PROCEEDINGS OF THE BOARD.

The Sub-Committee met at the Board Rooms, Mechanics' Institute, Toronto, on Thursday, October 31st. Present: The President, Vice-President, Professor Hincks, Professor Hind, W. Hay, Dr. Craigie, and T. Sheldrick.

After reading of minutes of former meeting, a letter was read from the Bureau of Agriculture, informing the Committee that arrangements will be made for publishing a monthly list of Letters Patent issued in Canada. Other miscellaneous correspondence was read, and various accounts passed for payment, when the President reported that the Government had appointed as Commissioners for Canada to the International Exhibition of 1862, Sir Wm. Logan, Dr. Tache, the Presidents of the Boards of Agriculture for Upper and Lower Canada, himself as President of the Board of Arts and Manufactures for Upper Canada, and B. Chamberlin, Esq., Secretary (the President having declined to accept the appointment) of the Board of Arts and Manufactures for Lower Canada.

The Commissioners, on their appointment, had at once held a meeting in Montreal, and waited upon the Hon. the Finance Minister in regard to the funds necessary to conduct the Commission. A memorial had also been forwarded to the Government at Quebec, for an appropriation of money for the purpose, to which the Commission is waiting a reply.

Resolved, That the expenses of the President, as Representative of the Board of Arts and Manufactures on the Commission appointed by the Government in connection with the International Exhibition at London, be paid by this Board; subject to the understanding, that in case the Government makes an appropriation, such amount expended be refunded.

The subject of the continuation of the Journal of the Board for the ensuing year, and the form in which it is most desirable to issue it, were discussed, when it was

Resolved, That the monthly issue be continued, on the same terms as during the present year, but with the following improvement: that the *Journal* be stitched and cut, and put in colored covers containing the advertisements, leaving thirty-two clear pages of reading matter in each number.

The Secretary was instructed to correspond with the Secretary of the Board of Arts and Manufactures for Lower Canada on the subject of making the *Journal* a joint publication for the two Boards.

The subject of appointing an Agent to canvass the Upper Province for subscriptions, advertisements, and information, for the *Journal* was discussed, when it was

Resolved, That a Travelling Agent be appointed, for the purpose of obtaining subscribers and advertisements for the *Journal,* and to advocate the interests of the Board, &c.

Resolved, That the President furnish such Agent with a general letter of introduction, defining his relation to the Board; that he visit such localities in Upper Canada as are likely to be interested in the objects of the Board of Arts and Manufactures, and the *Journal;* canvass Mechanics' Institutes, manufacturers and others for subscriptions and advertisements for the *Journal;* and that he endeavour to procure for the purposes of the *Journal* information relative to manufactures, and specimens of manufactures for the Museum, throughout the Province."

The Secretary reported a donation of thirty volumes of Reports of Commissioner of Patents for the United States, embracing the years 1850 to 1860.

Resolved, That the Secretary be instructed to acknowledge the receipt of thirty volumes of Reports from the Hon. the Commissioner of Patents for the United States, with the thanks of the Board therefor.

After transaction of some other routine business, the meeting adjourned.

W. Edwards,
Secretary.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE DURING THE PAST MONTH.

CLASS V.

Catlaogue of officers and students of Harvard University.. 1861–62.

CLASS XVIII.

Report of Commissioners of Patents for the U. S.,	Mechanical,	with Drawings & Illustrations		1	vol.	1850.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	1	"	1851.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	1	"	1852.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	1	"	1853.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	2	"	1854.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	2	"	1855.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	3	"	1856.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	3	"	1857.
" "	Agricultural,	"	"	1	"	"
" "	Mechanical,	"	"	3	"	1858.
" "	Mechanical,	"	"	2	"	1859.
" "	Agricultural,	"	"	1	"	"
" "	Agricultural,	"	"	1	"	1850.

CLASS XX.

Phonetic Journal; Monthly.. *London.*

NOTICES OF BOOKS.

Annals of the Botanical Society of Canada. Vol. I., Parts I. and II.: from 7th December, 1860, *to 8th March,* 1861.

Science in Canada is beginning to be well represented by Societies devoted to the encouragement of its different branches. First in the field was the Literary and Historical Society of Quebec, founded under the patronage of the Earl of Dalhousie, in 1824. Several volumes of the Transactions of the Society have already appeared, and good service would be done to the public if a more liberal distribution of the documents were made, and others printed and published which are understood to be still in the MS. of the archives of the Society.

The Natural History Society of Montreal publish a bi-monthly journal, well and favorably known by the name of the Canadian Naturalist and Geologist. This publication is yearly increasing in interest, importance, and we hope, in a wide-spread circulation. The Canadian Institute of Toronto have for many years published the Canadian Journal of Industry, Science, and Art. This ably conducted periodical is well known throughout America and in England. In conjunction with its sister publication, the *Canadian Naturalist and Geologist,* it is accomplishing a most excellent purpose in diffusing a knowledge and taste for Natural Science in Canada, besides serving as the medium through which the Natural History, Geology, and Meteorology of Canada is presented in an acceptable form to men of science in Europe. Lastly, we have the published records of the youngest Society in Canada devoted to Science, under the form of the Annals of the Botanical Society of Canada.

From the names of those who appear as contributors we have no doubt that it will rapidly win favour and esteem among the students of Botanical Science. Two parts have already appeared in *quarto* form, an obsolete mode of publication, and one which, we venture to predict, will soon be changed to the more acceptable and convenient octavo form. The subjoined table of contents will shew the character of this new and deserving claimant to the best wishes of the friends of scientific progress on this continent.

PART I.

1. Origin of the Society.
2. Opening Address. By the Very Rev. Principal Leitch, D.D.
3. Remarks on the present state of Botany in Canada, and the objects to be attained by the establishment of a Botanical Society. By George Lawson, Ph. D. F. B. S. E., Professor of Chemistry and Natural History in the University of Queen's College.
4. Notes and suggestions relative to the establishment of a Botanical Carden. By G. T. P. Litchfield, M.D.
5. Laws of the Botanical Society of Canada.
6. On the Cornus Florida of the U. S. By Professor George Sackville, M.D., Nashville, Tennessee.
7. On the Botany of the Red River Settlement and the old Red River Trail. By John C. Schultz, F.B.S.C.
8. Contributions to the Local Flora of Kingston. By A. T. Drummond, F.B.A.
9. On the Silk-worm and other fibre-yielding insects, and the growth of their food plants in Canada. By Mrs. Dr. Lawson.
10. On the Hubbard Squash. By Thomas Briggs, Jr.
11. What to observe in Canadian Lichens. By W. Lauder Lindsay, M.D., F.I.S.
12. Tea Culture in India.
13. A new Canadian Dye.
14. Specimens of Materia Medica.
15. Note on the Genus Graphephorum, Desv., and its synonymy. By Asa Gray, M.D.
16. List of Plants collected on the Island of Anticosti and the coast of Labrador, 1860. By John Richardson, of the Geological Survey of Canada.

PART II.

1. Abstract of Recent Discoveries in Botany and the Chemistry of Plants. By Prof. Lawson, *Secretary:* Phosphorus in the atmosphere—Sea-weed as a Manure—Steeps for Seeds—Blanching of Flowers—Paper Materials—New Upright Tomato—Vilmorin's Double Zinnias—Tea Culture—Effects of Narcotic and Irritant Gases on Plants.
2. List of Plants collected on the South and East Shores of Lake Superior, and on the North Shore of Lake Huron, in 1860. By Robert Bell, *Cor. Mem.*
3. Supplementary List of Trees and Shrubs found growing around Lakes Superior and Huron. By Robert Bell, *Cor. Mem.*
4. On the Economical Uses of Sticta Pulmorania, Hoffm. By A. T. Drummond, B A., F.B.S.C.
5. Report on the Hubbard Squash.

Fifth Meeting, 28th March, 1861.

6. Letters from Sir W. J. Hooker and Prof. Balfour, Honorary Members.
7. Suggestions to the Members of the Botanical Society of Canada, with reference to a Colonial Flora, By Sir William J. Hooker, K.H., Honor. Member.
8. On Ascleppias Incarnata L., as a Fibre Plant. By Alexander Logie, F.B.S.C.
9. Lists of Plants found in the neighborhood of Hamilton. By Alexander Logie, F.B.S.C.

TAYLOR'S IMPROVED DOOR BELL.

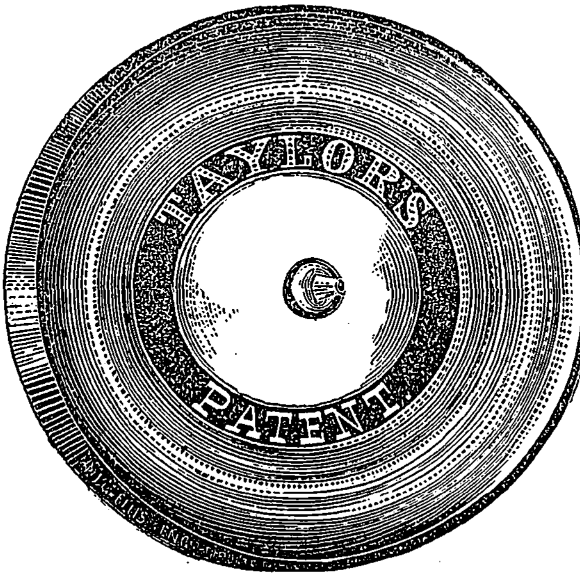

Fig. 1.

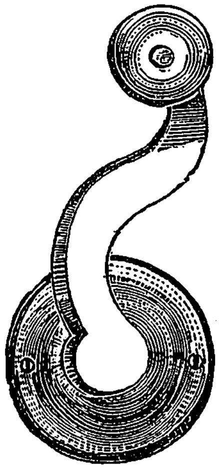

Fig. 2.

Taylor's door-bell has several advantages over the usual bells and door-knockers; it is as easily applied as a knocker, and as a bell it cannot be surpassed. Tenants on removing can take the bell with them as they would their name-plate; it can be applied to doors of from 1 inch to 2½ inches in thickness without alteration, in five minutes. It is also an excellent call-bell for hotels and offices, and needs only to be seen, to be appreciated by all. It was awarded the highest premium at the Provincial Exhibition, held in London, September 1861; also, a diploma at the Union Exhibition, held in Toronto, in October, 1861. The inventor of this door-bell is Mr. E. A. Taylor, of Hillside, Brockville.

Fig. 2 is the handle or crank placed upon the outside of the door, usually where a knocker would be placed. Fig. 1, a bell, saucer-shape, reversed, placed upon the inside of the door, immediately opposite the handle, (fig. 2). With one revolution of the handle (in either direction) the bell (fig. 1,) is struck three times. The mechanism of this invention is extremely simple in its construction, not liable to get out of order (with ordinary use) in *many years*. The bell being reversed, covers the mechanism, and therefore cannot receive any injury, either intentional or otherwise. This improved bell is designed to supersede the door-knockers, and in most cases the usual door-bells which are rung by pulls and wires, and require an expert to hang them, and when hung, are often expensive to keep in repair.

The Board of Arts & Manufactures

FOR LOWER CANADA.

ANNUAL COURSE OF FREE LECTURES.

"THE HISTORY AND LAW OF LETTERS PATENT OF INVENTIONS,"

BY DUNBAR BROWNE, M.A., B.C.L.

(*Continued from page* 266.)

A summary of these provisions will not, I trust, be wearisome or ill-timed:—

Any British subject, residing in Canada, may obtain a patent for the exclusive property of any new and useful invention made by him, for 14 years, such patent not to be void because the whole or any part thereof might have been previously known in some foreign country, unless the same had been patented and described in some printed publication. But an original and true inventor is not to be deprived of his patent right because he may have taken out Letters Patent for the same in a foreign country within six months of or preceding his application for such patent.

A patent may be assigned or granted to an assignee, but the application must be made by the inventor.

The specification and drawings must be in duplicate, one to be deposited in the office of the Agricultural Bureau in connection with which the patent business is transacted, and the other to be annexed to the patent.

When a patent becomes inoperative from inadvertency, accident or mistake, and not through fraudulent or deceptive invention, a new patent may be issued for the residue of the term, the original patent being surrendered. When a patentee has made his claim too broad he may disclaim any part of the invention not really his own, such disclaimer to be considered part of the original patent.

Additions may be made to patented inventions, which will be subjected to revision and restriction as original applications.

Patents may be extended for seven years beyond the original term, on the report of a Board, consisting of the President of the Executive Council, the Attorney General for the part of the Province where the applicant resides, and the Inspector General, if it appear to them that the inventor has not derived from his invention, during the term of the patent, sufficient remuneration. The application or notice of it must be made six calendar months previous to the expiration of the first patent. Persons other than the inventor having purchased, discovered or manufactured machines or other inventions prior to the application for a patent therefor may use the same, without invalidating the patent.

Works of art and designs may be patented for 14 years. I may here remark that previous to the passing of the Consolidated Statutes, this class of patent was only granted for seven years.

Patented articles to be stamped with the date of the patent under penalty of forfeiture, and parties stamping unpatented articles as patented to be liable to fine and imprisonment or both.

The right of patent in Canada does not extend to any invention made in the United States or in any part of British America.

A model must accompany the application, or specimens of the ingredients in case of a composition, and the application and specification must be examined by one of the Attorneys or Solicitors General before the patent can be granted.

Where interferences in applications occur, three experts are to adjudicate upon the matter, one to be chosen by each of the applicants, and the third by the head of the department.

Travellers may import and patent inventions learned by them in their travels, provided such importation be not from the United States or any part of the British dominions.

The fee for a patent is $20, payable at the time of making the application.

Under these two acts, now consolidated, there have been 909 patents granted, making in all 1,199 from the institution of patent laws in this Province to the present day.

Having thus briefly brought before you the history of Letters Patent, and at the same time furnished you with an epitome of the laws which were and are in force on this subject, I now turn to the second part of my subject—the law and practise of patents as now existing in this Province.

We have seen that a patent is not a thing to be claimed of right, but that it is a grant made upon certain conditions introduced into the patent itself, the subject of which is to secure to the public the full enjoyment of such inventions as they may be possessed of, and that at the expiration of the period for which the patent is granted, the invention shall become public property—to secure which end a description and specification describing the construction and manner of working the invention is attached to the patent, so that any mechanic understanding the branch of industry of which it forms a part may, without difficulty, construct and make the same.

Whenever any one succeeds in producing a new invention, he generally asks whether he cannot procure a patent for it, and thereby secure to himself the benefits to be derived from the fruits of his own labor, research and experiment. For the benefit of such I shall endeavor to explain the general requirements and principles of the law, and while avoiding the usual legal technicalities, to lay before you, as briefly as is consistent with the importance of the subject, the law and practice of patents, so that the inventor may be assisted and guided, until such time as having completed his invention he shall place it in the hands of a competent solicitor to prosecute to final sealing.

Among the chief requisites in an applicant for Letters Patent of Invention are—first, that he is a British subject and a resident of this Province; second, that his invention was not known or used here by others before his invention; and, third, that it is not at the time of his application in public view or for sale with his consent or allowance.

Every application consists of a petition to the Governor General, a specification and description and drawings, and a solemn declaration made before a justice of the peace, that the applicant verily believes he is the true inventor of the article or whatever it may be for which he solicits a patent.

The specification and description of the invention must describe, in plain terms, the manner of constructing and the mode of operating it. It must also contain a distinct explanation of the inventor's claim, and a disclaimer of such portion as is not his own invention. Drawings must accompany the specification with written references to correspond to those in the latter. The specification and drawings must be prepared with the greatest accuracy, and must in all cases be in duplicate.

The solemn declaration is substituted for the oath formerly required, and a false declaration is declared to be perjury.

These formalities complied with, the application is ready for presentation, and is sent to the Secretary of the Bureau of Agriculture. It is next sent to the office of the Attorney General for that section of the Province in which the inventor resides, and if the papers submitted are in the form required by the statute, and if the law officer of the Crown who has examined them consider the invention a fit subject for Letters Patent, a fiat or warrant is issued to grant the patent, which in its turn is examined, recorded and delivered to the patentee. Armed with a roll of parchment bearing the signature of the Governor General, and those of the officers of the Executive Council, the inventor becomes inflated with the idea that he has thus received from the Government of Canada an acknowledgment of the validity of his claim, an idea the fallacy of which he only realizes, perhaps, when after having become involved in a series of vexatious lawsuits, he learns that his roll of parchment, instead of being an acknowledgment of the validity of his claim, is worse than worthless, having been instrumental in robbing him of his little stock gathered from the hard-earned proceeds of his labor by the sweat of his brow. 'Tis only then, perhaps, he learns, for the first time, that his invention was known and used here before his discovery of it. This is due to the defective state of the law and to that alone. The Board of Arts and Manufactures for Lower Canada, convinced of the defective state of our law upon this subject, has prepared for submission to Parliament, during its present session, a bill to repeal the enactments now in force, and substituting others collated from the Patent Laws of the different countries of Europe and those of the United States, and which will put us in this respect on a par with the mother country. In reviewing this bill, for the *Scientific American*, Judge Mason, formerly Commissioner of the United States, writes:—"It will, with a few secondary alterations, be a model law, and one worthy the imitation of every nation of Christendom."

It will be seen that the preparation of an application for a patent must be made with great care as to the legality of the form, and with a due avoidance of anything which might afterwards tend to invalidate the patent.

This brings us to consider what is the inducement which leads the Crown to grant Letters Patent. It is the representation of the applicant that he is the first and sole inventor, and the Crown, yielding to such representation and desiring to afford every encouragement to the votaries of those handmaidens of science, arts and invention, concedes to the inventor the sole right of making and using his invention for a given period, subject to certain given restrictions. It follows, therefore, that if the matter or thing claimed by the patentee is not his invention, the grant is null, inasmuch as the consideration on which it was given fails, and this even where the patentee has invented some other thing for which he might have obtained a valid patent, had a fair representation of such real invention been made. In other words, if the patent represents the grantee to be the inventor of that which was really not his own invention, it is invalid.

Patents are obtained for new manufactures, or for the introduction of a new article from a foreign country.

The best definition of what a patent is granted for, is to be found in the Austrian law, and is as follows:—

A new product of industry; or, a new means of production; or, a new method of production.

The term manufacture, used in regard to inventions, is one whose meaning has been the subject of much discussion, but the repeated interpretations of this broad term by many eminent judges, who have adorned the English bench, have accurately defined it. Lord Kenyon said, "a manufacture was something made by the hands of man." Lord Tenterdon considered it denoted "a thing made which is useful for its own sake, and vendible as such, as a churn, or a medicine, or an engine or instrument to be employed in making some previously known article, or in some other useful purpose, as a steam-engine to raise water, or it might, perhaps, extend also to a new process to be carried on by known implements or elements acting upon some known substances, but producing it in a cheaper or more expeditious manner, or of a better and more useful kind. But no merely philosophical or abstract principle can answer the word manufactures, something of a corporeal and substantial nature, something that can be made by man from the matter subjected to his art and skill, or, at the least, some new mode of employing practically his art and skill, is requisite to satisfy the word." The term manufactures may be construed to mean the machine when completed, or the mode or manner of constructing the machine, and in strictness, it is presumed, it cannot be considered to be the product of mechanical means, and therefore it has no relation to the principle of the construction—the combination of the parts—the method of effecting that combination—of the principle of its action, or the process by which it is effected, and all which have been decided by the Courts of England to be proper subjects for the grant of Letters Patent.

Scientific principles or purely scientific theorems, cannot be patented even if the principle or theorem admit of a direct application to industrial objects, but, nevertheless, I find that in 1845 a patent was granted in Lower Canada to John Maitland, of the City of Toronto, distiller, for the invention of "a new principle of distillation and rectification, by means of a new still condenser and rectifier"—and that in 1848 another was granted to Henry Ruttan, of Cobourg, Esquire, for the invention of "the true philosophical principles upon which buildings may be ventilated; and also of machinery by which the ventilating air may be warmed." This latter patent, however, was afterwards surrendered.

Patents may be obtained for every new application of such principles or theories as lead to the creation of a new industrial product, or produce some new means or a known means in a new way; but it must be observed that it will not do to claim generally the application or manner of applying such principle, but some specific manner of doing it must be detailed; and though one person may discover a particular principle another may apply it to a particular thing, and such application will be a fit subject for the grant of a patent.

Method is a matter very nearly akin to principle, being the placing together of several things and the performance of several operations in the most convenient order. It may also mean a contrivance or device, as may an engine, for method and engine are synonimous terms.

Inventors, therefore, cannot be too careful in the selection of their terms, as a misapplication of them may sometimes vitiate a patent for a really good invention. Thus in looking over the published list of patents I find that a very large proportion of them are alleged to be for new methods, whereas really the inventions does not consist of the method of production so much as it does for the product itself. (Page 155.)

One of the points of greatest importance in the invention is novelty, for that is one of the chief considerations for the grant of a patent. The mere fact of the patentee having been the inventor of the thing patented is not sufficient to sustain a patent, for if it can be proved that the invention was in use, or that a description of it was published in any printed publication previous to the application for a patent, even though the patentee was not aware of such use or publication, and that because the public cannot be excluded from the right of using that information of which they were in possession previous to or at the time of the application for a patent. In a trial affecting a patent when the question of want of novelty was raised, the principal question for the consideration of the jury would be, whether in case of publication it had been such as to make the description a part of the public stock of information.

An inventor possessed of a secret invention who shall for a period of years retain the monopoly and sell the produce of his invention publicly, cannot afterwards take out a patent for it, since he would thus derive more benefit than could be obtained during the lawful period of fourteen years, a system which, if encouraged, would materially retard the progress of science and art.

In the case of *Bernier* v. *Beauchemin* for infringement of patent right, decided by the Court of Queen's Bench, appeal side, last year, it was decided that a patent granted for an invention applied for after it had been publicly used by the inventor was bad, although there was no proof that the invention was used by others before his discovery of it. This decision therefore sets at rest the question of the right of the inventor under our existing laws to make use of his invention before patenting it, and points out the necessity for affording the inventor a limited protection to fairly test his discovery before incurring the expense of a patent.

Although the publication of a description of an invention prior to the obtaining of a patent would invalidate the grant, yet the existence of a single copy of a work brought from some depository where it had long lain in obscurity, would afford a very different inference than would the production of an encyclopædia or other work in general circulation. In order to secure the vacation or annulling of a patent on the ground of want of novelty, the evidence must be of a direct nature. It will not even suffice that it is of a strong inferential nature, it must be direct and positive. In the case of a simultaneous invention, he is presumed to be the first inventor, and is entitled to the benefits of the invention, who first publishes and presents it to the public under the protection of Letters Patent. Two patents may be granted for the production of the same thing, provided the means of production are different, for though the process is similar the manner of effecting it may be different and does not amount to the vacation of a patent. From this it results that a patent for a machine, each part of which was in use before, but in which the combination of the different parts is new, and a new result is produced, is good, because there is a novelty in the construction. One patent may be taken out for several inventions, provided they relate to one and the same object, as component parts or operative means, but if it afterwards appear that one or any part of the invention is not new this defect will not only invalidate the patent for that particular part but also for the whole of the several inventions; for if it be proved that there is no novelty in one of the alleged inventions or improvements the consideration of the grants fails equally as though the whole were faulty, and the patentee is not established. So the benefit of the remaining inventions comprised in the Letters Patent; in other words, a patent which is too large is not only void for the excess but is void altogether.

With regard to improvements, an application to be valid must distinctly disclaim all parts of the invention which were in use prior to an application for a patent, for without such a disclaimer the patent would be vitiated in the same way as when the claim is for several articles one of them not being new. When an improvement on a patented article has been made the patentee of such improvement is not at liberty to use the original patent without the permission of the first patentee, and the first patentee cannot use the improvement without the permission of its patentee.

Having thus considered what is understood by novelty in a patent, the next point to be considered is what constitutes publication, and what are the effects of which it may be productive. By publication is meant use in public, so as to become the knowledge of others than the inventor contra distinguished from the use by the latter in his own character, which public use, though not general, will invalidate the patent.

If an invention be made in secret, under injunction, by one party for another, such use will not be construed to be a publication, for the public cannot take any advantage of it, inasmuch as it never was vested in them. And in my opinion this use or publication is not limited to Canada, for if it be proved to have been publicly used elsewhere, the effect is the same. So an exposure for sale, or view, or examination previous to the application for a patent, will vitiate the grant. It will thus be seen that an inventor cannot be too cautious about exhibiting his invention previous to his application for a patent, for though each exhibition may be made to but one person, even if that person assist in completing it, if a disclosure be made by him it will be sufficient to throw open the invention to the public and to invalidate the patent.

We have thus considered what are fit subjects for Letters patent, and the course to be adopted by the inventor who desires to secure a valid patent, we shall now treat of the patent or grant itself.

As soon as an inventor has discovered and completed an invention, and satisfied himself of its patentability and validity, the next thing for his consideration is the entitling of it, which, though apparently an unimportant matter, is one of the hinges on which the whole patent hangs. The greatest care must be taken to select such a title as will not cover too much and yet be sufficiently large to embrace all matters which can be legitimately brought within the scope of the invention, not only for the purpose of securing to the discoverer the fruits of his invention, but to prevent infringement by such imitations as the law would not decree to be merely colourable, whereby the patentee would be deprived not only of the profits of his invention, but the time and money which he may have expended in perfecting the same would be entirely lost. It is therefore suggested that a sound practical title without being too restrictive in its terms would be sufficient to warn the public of the probable object of the invention. Protection against fraud should even be a sufficient reason for construing any particular point or matter of time with strictures; and perhaps no subject presents such temptations or facilities for fraud as the entitling of patents. Many patents have been vitiated by inappropriate or insufficient titles, which did not give an intelligible idea of the invention. One instance is cited, which is that of a brush called in the title a tapering brush, whereas the invention consisted in the inequality in length of the bristles (*Rese* v. *Metcalfe*, Starkie).

In the case of *The King* v. *Wheeler*, the title described the patent to be a new and improved method of drying malt; when the patent, as appeared by the specification, was for a method of giving to malt when dried a new quality, viz., a power to impart colouring matter, for which misdescription the patent was held to be void on the ground of deceit.

Another title was held as being too general, because the invention being for an improvement in the old street lamp, the title designated it as an improved method of lighting cities, towns and villages. Another was declared void whose title described it as a machine for giving an edge to knives, scissors, &c., because it was not applicable to scissors.

As a title to a patent is a matter of such great importance, it should therefore only be adopted upon the nicest deliberation, and under the advice, in all cases, of competent persons; for it frequently happens that the very right to the invention depends upon the title selected for it.

The specification need not be in any particular form, so long as it discloses first, the nature of the invention, and secondly, the manner in which it is operated or performed. The expressions should be plain and easy of comprehension, while at the same time the greatest care must be taken that the manner by which the object of the invention is effected shall be accurately stated and in sufficient words, for if there is a want of clearness in the specification so that the public cannot afterwards at the expiration of the patent avail themselves of it, much more if there is any studied ambiguity so as to conceal from the public that of which the patentee is for a time enjoying the exclusive use, the patent itself will be completely void. A specification of improvements must claim the improvements only and not the entire article as improved.

The description must be confined to the invention. No extraneous matter must be introduced to obscure it. It must be minute without perplexity, and luminous without being overwrought.

Mistakes are sometimes innocently made by inventors in this matter, and not with any intention of misleading the public, and in such cases the law comes to their aid and allows them to fyle a disclaimer or renunciation of that part which has been in use or of which a description has been published before the inventor's application for a patent. Such disclaimer, however, cannot have a retroactive effect so as to relieve the patentee from the results of any infringements which have arisen out of the patent previous to the fyling of the disclaimer.

It is a great error to suppose that the introduction of the words "for other useful purposes," "other materials may be used," or "any other substance from which the thing can be obtained," gives greater breadth or security to a patent. Such expressions are not only perfectly useless but may throw doubts on the invention, and hazard the validity on the ground of obscurity and incorrectness. In the case of a patent for paper-making the action was dismissed because the plaintiff in his specification said "the cloth may be made of any *suitable material*, but I *prefer* it to be made of linen warp and woollen weft," whereas he was not aware of any other substance to answer the purpose.

The plural must not be used for the singular or the patent may be invalidated.

The specification and the patent are linked together by the patent, and the title and specification must be read together, and the latter must support the former.

In enforcing a claim the patent and specification are taken as one instrument, and are construed upon the principles of good faith. The description of the invention is of course to be taken from the specification, for its very object is to set out the process by which the invention is to be accomplished.

It is a principle of law that the patentee does not claim things which he knows to be in common use, unless he makes a distinct claim for them in the specification, in which case the presumption would be rebutted by the fact.

The specification is not to be interpreted by persons unskilled in the branch of art of which the invention forms a part, and therefore if it does not mention a particular thing which a workman skilled in the particular manufacture would know to be necessary, such an omission will not void the patent, but if it contains any untrue statement, though the jury find that a competent workman would not be misled by the error, the patent would nevertheless be void.

If words be used in the specification contrary to their usual signification, but if the meaning the patentee had in view can be gathered from the specification, it shall be sufficient.

If a particular process, or manufacture, or machine is described, and the specification is silent as to a particular part, or a combination of parts, it shall be presumed the claim is not for such parts.

The next point for our consideration is to what protection is the patentee entitled, and what is an infringement of a patent right. First, however, of infringement.

The form in which these present themselves are various and must depend upon the nature of the invention. In a process it will be by imitation, in a machine by its manufacture or use, in a vendible article by making and selling. The mere exposure to sale is not a selling, and would be insufficient to satisfy the word vend in the prohibitory part of this patent.

Similarity of structure in the patented article, until the contrary is shewn, would be presumptive evidence, being of the same construction and of the imitation being a piracy.

In the case of a principle, however great may be the improvement introduced, if the adaptation is in the same mode as that suggested by the specification, the difference being the form by which the principle is applied, it will be held to be an infringement for identity of purpose and not of name, is the criterion by which the infringement is to be judged.

When a patent specifies for the use of a particular article, the use of some well known equivalent would be an infringement; but when certain articles are used without intending to infringe the patent, and the party using them does so in ignorance that he is thereby infringing the patent, especially if it is unknown to science that the particular compound would be produced by using the articles which were well known, such use would not constitute an infringement; but after an action, it is presumed, the nature of the articles having been disclosed, there would be a publication to the world, after which the use of the same things would be held to be an infringement of the patent. So also a mere colorable deviation would be an infringement.

Where improvements are claimed, they must also be shewn to be new; an imitation of any part of the invention is sufficient to maintain an action. It need not be shewn that the perfected article imitated in all its parts the original invention; for the substance of the invention and its principle, and not the mere form, are to be looked at.

The sale of a pirated article is sufficient to constitute an infringement.

I have thus briefly considered what is a patent, what are the terms upon which it is granted, and the benefit it confers, as also the liabilities to which the patentee is subjected from an improper or imperfect preparation of his application. From this it will easily be seen that a patent may be obtained for any invention, and that it is not confined to any class or sex, nor does it require to be complicated or expensive.

It will also be seen that the value of a patent depends as much, if not more, upon the manner in which the specification is prepared than upon the merits of the invention itself.

The inventors of Canada are as yet but few in number compared to those of other countries, and yet we possess the same knowledge of sciences as they. To what then is the difference due? This question has often been asked, but the reply is wanting. Encouragement to this class must be held out for society owes much to them. With this view the Board of Arts and Manufactures have opened their library, containing all the English specifications and drawings of patents, as also the reports of the patent commissioners on the various laws in force throughout the world, to which they cordially invite all seeking information on these subjects. They are adding various practical, scientific and instructive works from time to time, and hope shortly to be in a position to open in their new building a museum, where all the improvements in manufactures will be exhibited. The Patent Bill prepared by them has for its object the encouragement and protection of the inventor, and I do not hesitate to say that if it once becomes law our inventors will increase in number and our inventions in value.

Selected Articles.

EXTRACTS

FROM THE ADDRESS OF MR. FAIRBAIRN, PRESIDENT OF THE BRITISH ASSOIATION.

Astronomy.

Our knowledge of the physical constitution of the central body of our system seems likely, at the present time, to be much increased. The spots on the sun's disc were noticed by Galileo and his contemporaries, and enabled them to ascertain the time of its rotation and the inclination of its axis. They also correctly inferred from their appearance, the existence of a luminous envelope, in which funnel-shaped depressions revealed a round dark nucleus. Just a century ago Alexander Wilson indicated the presence of a second and less luminous envelope beneath the outer stratum, and his discovery was confirmed by Sir William Herschel, who was led to assume the presence of a double stratum of clouds, the upper intensely luminous, the lower grey, and forming the penumbra of the spots. Observations during eclipses have rendered probable the supposition that a third and outermost stratum of imperfect transparency encloses concentrically the other envelopes. Still more recently the remarkable discoveries of Kirchoff and Bunsen require us to believe that a solid or liquid photosphere is seen through an atmosphere containing iron, sodium, lithium, and other metals in a vaporous condition. We must still wait for the application of more perfect instruments, and especially for the careful registering of the appearances of the sun by the photoheliograph of Sir John Herschel, so ably employed by Mr. Warren de la Rue, Mr. Welsh, and others, before we can expect a solution of all the problems thus suggested.

Magnetism.

Guided by the same principles which have been so successful in astronomy, its sister science, magnetism, emerging from its infancy, has of late advanced rapidly in that stage of development which is marked by assiduous and systematic observation of the phenomena, by careful analysis and presentation of the facts which they disclose, and by the grouping of these in generalizations, which, when the basis on which they rest shall be more extended, will prepare the way for the conception of a general physical theory, in which all the phenomena shall be comprehended, while each shall receive its separate and satisfactory explanation. It is unnecessary to remind you of the deep interest which the British Association has at all times taken in the advancement of this branch of natural knowledge, or of the specific recommendations which, made in conjunction with the Royal Society, have been productive of such various and important results. To refer but to a single instance: we have seen those magnetic disturbances, so mysterious in their origin and so extensive in simultaneous prevalence—and which, less than twenty years ago, were designated by a term specially denoting that their laws were wholly unknown—traced to laws of periodical recurrence, revealing, without a doubt, their origin in the central body of our system, by inequalities which have for their respective periods the solar day, the solar year, and, still more remarkably, an until lately unsuspected solar cycle of about ten of our terrestrial years, to whose existence they bear testimony in conjunction with the solar spots, but whose nature and causes are in all other respects still wrapped in entire obscurity. We owe to General Sabine, especially, the recognition and study of these and other solar magnetic influences and of the magnetic influence of the moon similarly attested by concurrent determinations in many parts of the globe, which are now held to constitute a distinct branch of this science not inappropriately named "celestial," as distinguished from purely terrestrial magnetism.

Chemistry.

What would now be the condition of calico-printing, bleaching, dyeing, and even agriculture itself, if they had been deprived of the aid of theoretic chemistry? For example, aniline—first discovered in coal tar, by Dr. Hoffman, who has so admirably developed its properties—is now most extensively used as the basis of red, blue, violet, and green dyes. This important discovery will probably, in a few years, render this country independent of the world for dye stuffs; and it is more than probable that England, instead of drawing her dye stuffs from foreign countries, may herself become the centre from which all the world will be supplied.

Light.

It is an interesting fact that, at the same time, in another branch of this science, M. Tournet has lately demonstrated that the colors of gems, such as the emerald, aqua-marina, amethyst, smoked rock crystal, and others, are due to volatile hydro-carbons, first noticed by Sir David Brewster in clouded topas, and that they are not derived from metallic oxides, as has hitherto been believed. Another remarkable advance has recently been made by Bunsen and Kirchoff in the application of the colored rays of the prism to analytical research. We may consider their discoveries as the commencement of a new era in analytical chemistry, from the extraordinary facilities they afford in the qualitative detection of the minutest traces of elementary bodies. The value of this method has been proved by the discovery of the new metals Cæsim and Rubidium by M. Bunsen, and it has yielded another remarkable result in demonstrating the existence of iron and six other known metals in the sun. In noticing the more recent discoveries in this important science I must not pass over in silence the valuable light which chemistry has thrown upon the composition of iron and steel.

Iron.

Although Despretz demonstrated many years ago that iron would combine with nitrogen, yet it was not until 1857 that Mr. C. Binks proved that nitrogen is an essential element of steel, and more recently M. Carou and M. Fremy have further elucidated this subject; the former showing that cyanogen, or cyanide of ammonium, is the essential element which converts wrought iron into steel; the latter combining iron with nitrogen through the medium of ammonia, and then converting it into steel by bringing it at the proper temperature into contact with common coal gas. There is little doubt that in a few years these discoveries will enable Sheffield manufacturers to replace their present uncertain, cumbrous, and expensive process by a method at once simple and inexpensive, and so completely under control as to admit of any required degree of conversion being obtained with absolute certainty. Mr. Crace Calvert, also, has proved that cast iron contains nitrogen, and has shown that it is a definite compound of carbon and iron mixed with various proportions of metallic iron, according to its nature.

Platinum.

Before leaving chemical science, I must refer to the interesting discovery by M. Deville, by which he succeeded in rapidly melting 38 or 40 lb. of platinum—a metal till then considered almost infusible. This discovery will render the extraction of platinum from the ore more perfect, and by reducing its cost, will greatly facilitate its application to the arts.

Geology.

It is little more than half a century since geology assumed the distinctive character of a science. Taking into consideration the aspects of nature in different epochs of the history of the earth, it has been found that the study of the changes at present going on in the world around us enables us to understand the past revolutions of the globe, and the conditions and circumstances under which strata have been formed and organic remains embedded and preserved. The geologist has increasingly tended to believe that the changes which have taken place on the face of the globe, from the earliest times to the present, are the result of agencies still at work. But while it is his high office to record the distribution of life in past ages, and the evidence of physical changes in the arrangement of land and water, his results hitherto have indicated no traces of its beginning, nor have they afforded evidence of the time of its future duration. As an example of the application of geology to the practical uses of life, I may cite the discovery of the goldfields of Australia, which might long have remained hidden but for the researches of Sir Roderick Murchison in the Ural Mountains on the geological position of the strata from which the Russian gold is obtained. From this investigation he was led by inductive reasoning to believe that gold would be found in similar rocks, specimens of which had been sent him from Australia. The last years of the active life of this distinguished geologist have been devoted to the re-examination of the rocks of his native Highlands of Scotland. Applying to them those principles of classification which he long since established, he has demonstrated that the crystaline limestone and quartz rocks which are associated with mica-schists, &c., belong by their embedded organic remains to the lower silurian rocks. Descending from this well-marked horizon, he shows the existence beneath all such fossiliferous strata of vast masses of sandstone and conglomerate of Cambrian age; and, lastly, he has proved the existence of a fundamental gneiss, on which all the other rocks repose, and which, occupying the northwestern Hebrides and the west coasts of Sutherland and Ross, is the oldest rock formation on the British Isles, it being unknown to England, Wales, or Ireland.

The Earth's Crust.

It is well known that the temperature increases as we descend through the earth's crust, from a certain point near the surface, at which the temperature is constant. In various mines, borings, and Artesian wells, the temperature has been found to increase about 1 deg. Fah. for every 60ft., or 65ft. of descent. In some carefully conducted experiments during the sinking of Dukinfield Deep Mine, one of the deepest pits in the country, it was found that a mean increase of about 1 deg. in 71 ft.occurred. If we take the ratio thus indicated, and assume it to extend to much greater depths, we should reach at two-and-a-half miles from the surface strata at the temperature of boiling water; and at depth of about 50 or 60 miles the temperature would be sufficient to melt, under the ordinary pressure of the atmosphere, the hardest rocks. Reasoning from these facts, it would appear that the mass of the globe, at no great depth, must be in a fluid state. But this deduction requires to be modified by other considerations, namely, the influence of pressure on the fusing point, and the relative conductivity of the rocks which form the earth's crust. To solve these questions a series of important experiments were instituted by Mr. Hopkins, in the prosecution of which Dr. Joule and myself took part; and after a long and laborious investigation it was found that the temperature of fluidity increased about 1 deg. Fah. for every 500 lb. of pressure in the case of spermaceti, bees-wax, and other similar substances. However, on extending these experiments to less compressible substances, such as tin and barytes, a similar increase was not observed. But this series of experiments has been unavoidably interrupted, nor is the series on the conductivity of rocks entirely finished. Until they have been completed by Mr. Hopkins we can only make a partial use of them in forming an opinion of the thickness of the earth's solid crust. Judging, however, alone from the greater conductivity of the igneous rocks, we may calculate that the thickness cannot possibly be less than nearly three times as great as that calculated on the usual suppositions of the conductive power of the terrestrial mass at enormous depths being no greater than that of the superficial sedimentary beds. Other modes of investigation which Mr. Hopkins has brought to bear on this question appear to lead to the conclusion that the thickness of the earth's crust is much greater even than that above stated. This would require us to assume that a part of the heat in the crust is due to superficial and external rather than central causes. This does not bear directly against the doctrine of central heat, but shows that only a part of the increase of temperature observed in mines and deep wells, is due to the outward flow of that heat.

Mechanical Science—Canals.

One hundred years ago the only means for the conveyance of inland merchandise were the pack-horses and waggons on the then imperfect highways. It was reserved for Brindley, Smeaton and others to introduce a system of canals, which opened up facilities for an interchange of commodities at a cheap rate over almost every part of the country. The impetus given to industrial operations by this new system of conveyance induced capitalists to embark in trade, in mining, and in the extension of manufactures in almost every district. These improvements continued for a series of years, until the whole country was intersected by canals requisite to meet the demands of a greatly extended industry. But canals, however well adapted for the transport of minerals and merchandise, were less suited for the conveyance of passengers. The speed of the canal boats seldom exceeded from two-and-a-half to three miles an hour, and in addition to this the projectors of canals sometimes sought to take an unfair advantage of the Act of Parliament, which fixed the tariff at so much per ton per mile, by adopting circuitous routes, under the erroneous impression that mileage was a consideration of great importance in the success of such undertakings. It is in consequence of short.sighted views and imperfect legislation that we inherit the numerous curves and distortions of our canal system. These defects in construction rendered canals almost useless for the conveyance of passengers, and led to the improvement of the common roads and the system of stage coaches; so that, before the year 1830, the chief public highways of the country had attained a remarkable smoothness and perfection, and the lightness of our carriages and the celerity with which they were driven, still excite the admiration of those who remember them. These days of an efficiently worked system, which tasked the power and speed of the horse to the utmost, have now been succeeded by changes more wonderful than any that previously occurred in the history of the human race.

Steamers.

Scarcely had the canal system been fully developed when a new means of propulsion was adopted—namely, steam. I need not recount to you the enterprise, skill, and labour that have been exerted in connection with steam navigation. You have seen its results on every river and every sea; results we owe to the fruitful minds of Miller, Symington, Fulton, and Henry Bell, who were the pioneers in the great march of progress. Viewing the past, with a knowledge of the present and a prospect of the future, it is difficult to estimate sufficiently the benefits that have been conferred by this application of mechanical science to the purposes of navigation. Power, speed, and certainty of action have been attained on the most gigantic scale. The celerity with which a modern steamer, with a thousand tons of merchandise and some hundreds of human beings on boards, cleaves the water and pursues her course far surpasses the most sanguine expectations of a quarter of a century ago, and indeed almost rivals the speed of the locomotive itself. Previous to 1812 our intercourse with foreign countries and with our colonial possessions depended entirely upon the state of the weather. It was only in favourable seasons that a passage was open, and we had often to wait days, or even a week, before Dublin could be reached from Holyhead. Now this distance of 63 miles is accomplished in all weathers in little more than three hours. The passage to America used to occupy six weeks or two months; now it is accomplished in eight or nine days. The passage round the cape to India is reduced from nearly half a year to less than a third of that time, while that country may be reached by the overland route in less than a month. These are a few of the benefits derived from steam navigation, and, as it is yet far from perfect, we may reasonably calculate on still greater advantages in our intercourse with distant nations. I will not here enter upon the subject of the numerous improvements which have so rapidly advanced the progress of this important service. Suffice it to observe that the paddle-wheel system of propulsion has maintained its superiority over every other method yet adopted for the attainment of speed, as by it the best results are obtained with the least expenditure of power. In ships of war the screw is indispensible, on account of the security it affords to the engines and machinery, from their position in the hold below the water line, and because of the facility it offers in the use of sails, when the screw is raised from its position in the well to a recess in the stern prepared for that purpose. It is also preferable in ships which require auxiliary power in calms and adverse winds, so as to expedite the voyage and effect a considerable saving upon the freight.

Railways.

The public mind had scarcely recovered itself from the changes which steam navigation had caused, and the impulse it had given to commerce, when a new and even more gigantic power of locomotion was inaugurated. Less than a quarter of a century had elapsed since the first steamboats floated on the Hudson and the Clyde, when the achievements thence resulting were followed by the application of the same agency to the almost superhuman flight of the locomotive and its attendant train. I well remember the completion at Rainhill in 1830, and the incredulity everywhere evinced at the proposal to run locomotives at twenty miles an hour. Neither George Stephenson himself, nor any one else, had at that time the most distant idea of the capabilities of the railway system. On the contrary, it was generally considered impossible to exceed ten or twelve miles an hour; and our present high velocities, due to high-pressure steam and the tubular system of boilers, have surpassed the most sanguine expectations of engineers. The sagacity of George Stephenson at once seized upon the suggestion of Henry Booth, to employ tubular boilers; and that, united to the blast-pipe, previously known, has been the means of effecting all the wonders we now witness in a system that has done more for the development of practical science, and the civilisation of man, than any discovery since the days of Adam.

The Steam Engine.

From a consideration of the changes which have been effected in the means for the interchange of commodities I pass on to examine the progress which has been made in their production. And, as the steam-engine has been the basis of all our modern manufacturing industry, I shall glance at the steps by which it has been perfected. Passing over the somewhat mythical fame of the Marquis of Worcester, and the labours of Savery, Beighton, and Newcomen, we come at once to discuss the state of mechanical art at the time when James Watt brought his gigantic powers to the improvement of the steam engine. At that time the tools were of the rudest construction, nearly everything being done by hand, and, in consequence, wood was much more extensively employed than iron. Under these circumstances, West invented separate condensation, rendered the engine double acting, and converted its rectilinear motion into a circular one suitable for the purposes of manufacture. But the discovery at first made little way, the public did not understand it, and a series of years elapsed before the difficulties, commercial and mechanical, which opposed its application, could be overcome. When the certainty of success had been demonstrated, Watt was harassed by infringements of his patent, and lawsuits for the maintenance of his rights. Inventors, and pretended inventors, set up claims, and entered into combination with manufacturers, miners, and others, to destroy the patent and deprive him of the just fruits of his labour and genius. Such is the selfish heartlessness of mankind in dealing with discoveries not their own, but from which they expect to derive benefit. The steam engine, since it was introduced by Watt, has changed our habits in almost every condition of life. Things which were luxuries have become necessaries, and it has given to the poor man in all countries in which it exists a degree of comfort and independence and a participation in intellectual culture unknown before its introduction. It has increased our manufactures tenfold, and has lessened the barriers which time and space interpose. It ploughs the land and winnows and grinds the corn. It spins and weaves our textile fabrics. In mining it pumps, winds, and crushes the ores. It performs these things with powers so great and so energetic as to astonish us at their immensity, while they are at the same time perfectly docile, and completely under human control.

Textile Manufactures.

The extraordinary developments of practical science in our system of textile manufactures are, however, not entirely due to the steam engine, although they are now in a great measure dependent on it. The machinery of these manufactures had its origin before the steam engine had been applied, except for mining purposes; and the inventions of Arkwright, Hargreaves, and Crompton were not conceived under the impression that steam would be their moving power. On the contrary, they depended upon water; and the cotton machinery of this district had attained considerable perfection before steam came to the aid of the manufacturer, and ultimately enabled him to increase the production to its present enormous extent. I shall not attempt a description of the machinery of the textile manufactures, because ocular inspection will be far more acceptable. I can only refer you to a list of establishments in which you may examine their operations on a large scale, and which I earnestly recommend to your attention. I may, however, advert to a few of the improvements which have marked the progress of the manufacturing system in this country. When Arkwright patented his water-frames, in 1767, the annual consumption of cotton was about 4,000,000 lb. weight. Now it is 1,200,000,000 lb. weight—300 times as much.

Cotton.

Within half a century the number of spindles at work, spinning cotton alone, has increased tenfold; while, by superior mechanism, each spindle produces 50 per cent more yarn than on the old system. Hence the importance to which the cotton trade has risen, equalling, at the present time, the whole revenue of the three kingdoms, or £70,000,000 stg. per annum. As late as 1820 the power-loom was not in existence; now it produces 14,000,000 yards of cloth, or, in more familiar terms, nearly 8,000 miles of cloth per diem. I give these particulars to show the immense power of production of this country, and to afford some conception of the number and quality of the machines which effect such wonderful results. Mule spinning was introduced by Crompton, in 1787, with about twenty spindles to each machine. The powers of the machine were, however, rapidly increased; and now it has been so perfected that 2,000 or even 3,000 spindles are directed by a single person. At first the winding on, or forming the shape of the cop, was performed by hand; but this has been superseded by rendering the machine automatic, so that it now performs the whole operation of drawing, stretching, and twisting the thread, and winding it on to the exact form, ready for the real or shuttle, as may be required. These and other improvements in carding, roving, combing, spinning, and weaving, have established in this country an entirely new system of industry; it has given employment to greatly increased numbers, and a more intelligent class of workpeople. Similarly important improvements have been applied to the machinery employed in the manufacture of silk, flax and wool, and we have only to watch the processes in these different departments to be convinced that they owe much to the development of the cotton manufacture. In the manufacture of worsted the spinning jenny was not employed at Bradford until 1790, nor the power-loom until about 1825.

Alpaca.

The production of fancy or mixed goods from alpaca and mohair wool, introduced to this country in 1836, is, perhaps, the most striking example of a new creation in the art of manufacture, and is chiefly due to Mr. Titus Salt, in whose immense palace of industry, at Saltaire, it may be seen in the greatest perfection. In flax machinery the late Sir Peter Fairbairn was one of the most successful inventors, and his improvements have contributed to the rapid extension of his manufacture. I might greatly extend this description of our manufacturing industry but I must for the present be brief, in order to point out the dependence of all these improvements on the iron and coal so widely distributed among the mineral treasures of our island.

Manufacture of Iron.

Previously to the invention of Henry Cort the manufacture of wrought iron was of the most crude and primitive description. A hearth and a pair of bellows was all that was employed. But since the introduction of puddling the iron-masters have increased the production to an extraordinary extent, down to the present time, when processes for the direct conversion of wrought iron on a large scale are being attempted. A consecutive series of chemical researches into the different processes, from the calcining of the ore to the production of the bar, carried on by Dr. Percy and others, has led to a revolution in the manufacture of iron; and, although it is at the present moment in a state of transition, it nevertheless requires no very great discernment to perceive that steel and iron of any required tenacity will be made in the same furnace with a facilty and certainty never before attained. This has been effected to some extent by improvements in puddling, but the process of Mr. Bessemer—first made known at the meetings of this association at Cheltenham—affords the highest promise of certainty and perfection in the operation of converting the melted pig direct into steel or iron, and is likely to lead to the most important developments in this manufacture. These improvements in the production of the material must, in their turn, stimulate its application on a larger scale, and lead to new constructions.

Ship Building.

In iron shipbuilding an immense field is opening before us. Our wooden walls have, to all appearance, seen their last days; and, as one of the early pioneers in iron construction, as applied to shipbuilding, I am highly gratified to witness a change of opinion that augers well for the security of the liberties of the country. From the commencement of iron shipbuilding, in 1830, to the present time, there could be only one opinion among those best acquainted with the subject—namely, that iron must eventually supersede timber in every form of naval construction. The large ocean steamers, the Himalaya, the Persia, and the Great Eastern, abundantly show what can be done with iron, and we have only to look at the new system of casing ships with armour plates to be convinced that we can no longer build wooden vessels of war with safety to our naval superiority and the best interests of the country. I give no opinion as to the details of the reconstruction of the navy—that is reserved for another place—but I may state that I am fully persuaded that the whole of our ships of war must be rebuilt of iron, and defended with iron armour calculated to resist projectiles of the heaviest description at high velocities. In the early stages of iron shipbuilding, I belive I was the first to show, by a long series of experiments, the superiority of wrought iron over every other description of material in security and strength, when judiciously applied in the construction of ships of every class. Other considerations, however, affect the question of vessels of war; and although numerous experiments were made, yet none of the targets were on a scale sufficient to resist more than a six-pounder shot. It was reserved for our scientific neighbours, the French, to introduce thick iron plates as a defensive armour for ships. The success which has attended the adoption of this new system of defence affords the prospect of invulnerable ships of war, and hence the desire of the Government to remodel the navy on an entirely new principle of construction, in order that we may retain its superiority as the great bulwark of the nation.

Bridges.

We have already seen a new era in the history of the construction of bridges, resulting from the use of iron; and we have only to examine those of the tubular form over the Conway and Menai Straits to be convinced of the durability, strength, and lightness of tubular construction applied to the support of railways or common roads in spans which ten years ago were considered beyond the reach of human skill. When it is considered that stone bridges do not exceed 150ft. in span, nor cast iron bridges 250ft., we can estimate the progress which has been made in crossing rivers 400 or 500ft. in width without any support at the middle of the stream. Even spans greatly in excess of this may be bridged over with safety provided we do not exceed 1,800 to 2,000ft., when the structure would be destroyed by its own weight.

Sanitary Measures.

In former days 10 gallons of water to each person per day was considered an ample allowance. Now 30 gallons is much nearer the rate of consumption. I may instance the waterworks of this city and of Liverpool, each of which yield a supply of from 20 gallons to 30 gallons of water to each inhabitant. In the former case the water is collected from the Cheshire and Derbyshire hills, and, after being conveyed in tunnels and aqueducts a distance of ten miles to a reservoir, where it is strained and purified, it is ultimately taken a further distance of eight miles in pipes, in a perfectly pure state, ready for distribution. The greatest undertaking of this kind, however, yet accomplished, is that by which the pure waters of Loch Katrine are distributed to the city of Glasgow. This work, recently completed by Mr. Bateman, who was also the constructor of the waterworks of this city, is of the most gigantic character, the water being conveyed in a covered tunnel a distance of 27 miles, through an almost impassable country, to the service reservoir, about eight miles from Glasgow. By this means 40 million gallons of water per day are conveyed through the hills which flank Ben Lomond, and after traversing the sides of Loch Chon and Loch Aird, are finally discharged into the Mudgdock Basin, where the water is impounded for distribution. We may reasonably look forward to an extension of similar benefits to the metropolis, by the same engineer, whose energies are now directed to an examination of the pure fountains of Wales, from whence the future supply of water to the great city is likely to be derived. A work of so gigantic a character may be looked upon as problematical, but when it is known that six or seven millions of money would be sufficient for its execution, I can see no reason why an undertaking of so much consequence to the health of London should not ultimately be accomplished.

Mr. Whitworth.

To Mr. Whitworth mechanical science is indebted for some of the most accurate and delicate pieces of mechanism ever executed; and the exactitude he has introduced into every mechanical operation will long continue to be the admiration of posterity. His system of screw threads and guages is now in general use throughout Europe. We owe to him a machine for measuring with accuracy to the millionth of an inch, employed in the production of standard guages; and his laborious and interesting experiments on rifled ordnance have resulted in the production of a rifled small arm and gun, which has never been surpassed for range and precision of fire.

Telegraphs.

A brief allusion must be made to that marvellous discovery which has given to the present generation the power to turn the spark of heaven to the uses of speech; to transmit along the slender wire for a thousand miles a current of electricity that renders intelligible words and thoughts. This wonderful discovery, so familiar to us, and so useful in our communications to every part of the globe, we owe to Wheatstone, Thomson, De la Rive, and others. In land telegraphy the chief difficulties have been surmounted, but in submarine telegraphy much remains to be accomplished. Failures have been repeated so often as to call for a commission on the part of the Government to inquire into the causes, and the best means of overcoming the difficulties which present themselves. I had the honour to serve on that commission, and I believe that from the report, and mass of evidence and experimental research accumulated, the public will derive very important information. It is well known that three conditions are essential to success in the construction of ocean telegraphs—perfect insulation, external protection, and appropriate apparatus for laying the cable safely on its ocean bed. That we are far from having succeeded in fulfilling these conditions is evident from the fact, that out of 12,000 miles of submarine cable which have been laid since 1851, only 3,000 miles are actually in working order; so that three-fourths may be considered as a failure and loss to the country. The insulators hitherto employed are subject to deterioration from mechanical violence, from chemical decomposition or decay, and from the absorption of water; but the last circumstance does not appear to influence seriously the durability of cables. Electrically, india-rubber possesses high advantages, and, next to it, Wray's compound and pure gutta percha far surpass the commercial gutta percha hitherto employed; but it remains to be seen whether the mechanical and commercial difficulties in the employment of these new materials can be successfully overcome. The external projecting covering is still a subject of anxious consideration. The objections to iron wire are its weight and liability to corrosion. Hemp has been substituted, but at present with no satisfactory result. All these difficulties, together with those connected with the coiling and paying out of the cable, will no doubt yield to careful experiment and the employment of proper instruments in its construction, and its final deposit on the bed of the ocean. Irrespective of inland and international telegraphy, a new system of communication has been introduced by Professor Wheatstone, whereby intercourse can be carried on between private families, public offices, and the works of merchants and manufacturers. This application of electric currents cannot be too highly appreciated, from its great efficiency and comparatively small expense. To show to what an extent this improvement has been carried I may state that 1,000 wires, in a perfect state of insulation, may be formed into a rope not exceeding ½ in. in diameter.

ON WASTE.

"*Gather up the fragments—let nothing be lost,*" is a divine injunction for us in every age. We recognize it most strictly, I hope, with regard to our food, but, perhaps, we are not so particular with regard to the fragments that are likely to be lost in our manufacturing operations. If we look abroad upon the world, and see how God is governing the universe—see how he is correlating the powers of nature, and the properties of matter, we shall see, there, indeed, that nothing is lost; we shall find that no force ever assumed by an atom of matter is wasted. Matter is perpetually changing its forms, but whilst changing its forms it is ever subserving some use in nature. Man should study these laws, and examine the works of the hand and finger of the great Creator in the external world, and try to imitate him. It is man's privilege to be created in the image of his Creator; it is his privilege to follow in the footsteps of his Creator. He is placed here the monarch of the world, and it is only as he fails to understand his duties in attaining a knowledge of the laws of the external world, that he suffers pains and penalties. I want to show you that if we imitate in our manufacturing processes the great laws of nature, we shall save much, and we shall also diminish our labour and multiply our sources of happiness on the earth. We can see it in some things more obviously than in others. We can see it in the mineral world. When the workmen is at work on the diamond, he suffers not a grain of its dust to be lost or wasted, but hoards it up for future use. So with the workmen in gold and silver. We find that the particles of dust that escape in various directions are carefully collected;—and it is not less true with regard to vegetable products. We see the shavings and sawdust of the carpenter and cabinet maker carefully collected together for other purposes and uses in the arts and manufacturing operations; and it ought to be no less so in the animal kingdom, in the use of the animal products. With this view, I propose to-night to see whether there have not been some fragments thrown away in the manufacturing operations we have spoken of, that we may point out how that which is now lost may be saved.

There is an anecdote told of a distinguished chemist, who was asked how he had made his great discoveries, and he replied that it was by examining that which other chemists threw away. So many a manufacturer may make his fortune by using that which others throw away.

In the first instance I will call your attention to the chemical, physical, and general properties of the materials of which we have been speaking. We spoke of these to some extent in the first Lecture; we saw that the animal tissues possessed certain properties which made them valuable in the arts, and we found that these substances were formed of certain chemical elements which exhibited definite chemical properties; and we shall see that a result of this study is a knowledge of the application to the arts of life of those substances which would otherwise be lost and thrown away.

I purpose first to examine some of the substances which, on account of their physical properties, are now recovered, and which at one time were regarded as waste. I spoke to you first of silk, and I referred to the way in which the silk is wound off the cocoons, and how it is rolled and afterwards spun, and formed into a variety of garments.

During the operation of spinning there is a quantity of loose silk, which would be entirely lost but that pains are taken to collect it in a rough state; it is then pulled out, and the fibres again reeled, and it is manufactured into the lower kinds of silk. The waste of this process is collected again, and again it is re-reeled and wound; so that not a fibre is lost. After the silk of the cocoons has been wound off, there still remains a quantity of silk upon the used cocoon, which, under the name of "knubs and husks," is imported into this country. The knubs and husks are torn to pieces, and the fibre is reeled and woven into the lower sorts of silks; so that there ought to be no waste in silk at all. I told you, I think, that the Chinese even eat the grub within the cocoon.

I pass on from silk to wool. During the process of spinning and weaving wool, there is a quantity of waste—a quantity of the hair is left; but this is now collected, and applied in a variety of ways. Some of the better kinds of this waste wool can be used and mixed with higher sorts, and are thus worked up. We find that, after the cloth is woven, the ends are cut off, under the name of *list*, which is again torn to pieces and re-wound. There is also from such waste portions an extensive manufacture carried on of the substance known by the name of flock. The wool is ground down to a powder, and mixed with colouring matters, such as vermillion for red, chromate of lead for yellow, arsenite of of copper for green; so that the flocks assume a variety of colours; and these coloured flocks are used for the purpose of manufacturing what are called flock papers. The paper is figured in a variety of ways, and the figures are covered over with size or gum, and the flock is powdered over it: it is then called flock-paper. This process was first patented by a Frenchman named Jerome Lanyer, in 1634, and since this time there has been a considerable manufacture of flock-papers in this country. It has, however, reached great perfection on the continent, and the French have paid particular attention to the patterns. These flocks, then, have been produced by the refuse of the woollen manufacture.

I would here say one word with regard to the colouring matters of flock-papers, as it is a matter of importance. They should not be mixed with poisonous substances. The greens are mostly made with arsenite of copper; and instances have not been rare of persons living in rooms where these green flock-papers have been used; and the consequence has been, that when the paper has been brushed, the particles of arsenite of copper have got into the air, have been taken into the lungs, and produced injurious effects on the system. I do not know that it is so deadly a thing as represented, but it seems an imprudent thing for people to live in rooms covered with these green papers. Wherever these flock-papers are used, they accumulate a greater quantity of dust than other papers, and consequently require to be brushed oftener. It is undoubtedly much the most wise and prudent plan in the case of paint, and in the case of all substances employed in rooms where persons live, that they should not contain poison.

This arsenite of copper has been the source of a variety of suffering in many directions. It is sometimes used to colour confectionary, and I have known children killed by it. The green fields and green trees looking so pretty, with the white sheep feeding on the top of twelfth-cakes, have been known to contain arsenite of copper. I recollect a case of a number of people being poisoned at a dinner-party by eating some nice green *blanc mange*, which had been coloured with arsenite of copper. With yellow orpiment, a sulphide of arsenic, some boys were recently poisoned by eating Bath Buns made yellow by this substance.

Now let me draw your attention to the fact that the wool, after it has been used—after it has been worn, has its analogue in the rags of linen and cotton clothing. You know how desperate has been the condition of the paper manufacturer because he cannot get a supply of rags for his manufacture. The woollen manufacturer has been saved from the same state by a material which is produced under the name of "shoddy," and which is extensively used in the manufacture of clothing of common quality, such as pilot-coats, ladies' mantles, druggets, and the cheaper kind of carpeting. This material is not made of new wool, but of wool that has been worn and afterwards torn to pieces by machinery. This shoddy has various prices in the market, according to the substances from which it comes, and you will find the specimens of the material under various names, such as "black and grey army clippings." I suppose they are the torn up clothes of soldiers, who, probably, have been in the field of battle, and having come back, have sold their clothes second hand. Then we have "seamed middle white," I do not know what kind of cloth that has been. Then "scarlet cloth." Then there is "Hamburg blue stocking shoddy," and shoddy from "black stuffs," from "brown stuffs," from "white serge," from "druggets," and "carpets." I mention these names to show you what a variety of substances are thus torn up, and made again into new cloth. Some forms of this shoddy are called "mungo." Thus we have "blue mungo," "brown mungo," "grey mungo," "claret and white mungos;" and there are now shoddy markets, just as there are woollen markets, and the shoddy markets are increasing every day. One principal seat of this manufacture is Dewsbury, in Yorkshire. It has, however, found its way into Leeds, Wakefield, and to all the large woollen-manufacturing towns Those who are skilled in the knowledge of real woollen cloth can easily distinguish between it and shoddy. This trade has been sometimes objected to on account of its appearing to produce an article of a superior kind with an inferior raw material; but, after all, you will find that these shoddies are not sold at the price of superfine cloths, and are good substitutes for them. The cheap clothing of late years has depended upon the introduction of this shoddy, and, provided the price is not larger than gives the fair profit to the manufacturer, we cannot object to it, as it enables many a man to put on, at least once a week, a decent looking coat, who otherwise would not have a cloth coat at all; and if the wear only answers to the price given, I do not think any one can find fault. However, I have heard a gentleman say he objected to stockings of shoddy, which he could not put on without putting his feet through them, and to coats that split up the first time they were put on. In this case the purchaser must judge for himself, for there is no attempt to sell them as superfine cloth,—they are sold as shoddy. I introduce this subject to you to show you that it is one of the uses of waste substances. I shall show you that even after wool has been manufactured into shoddy, it has still further uses in the arts. It has recently been observed that "there is still some mill waste which cannot be used up again for "shoddy." It is that portion of the wool waste which is so saturated with oil and grease that the fatty matter is heavier than the wool in it: it is called "creasb." This is one one of the most powerful fertilizers. Those farmers who laid it upon land several years ago are seeing the advantage of it every succeeding year; for it it does not give out its strength to the crops all at once though by a chemical process it could be made to yield its nourishment as speedily and be as good as guano to the enterprising agriculturalist. The attention of the agricultural chemist may also be directed to the quantity of liquid manure in the soap suds and washings, &c., which run to waste from the mills. This liquid contains the best fertilizing elements which can be found; indeed, farmers are in the habit of paying £7 a ton for substances which can do less good to their crops than despised 'soap-suds' would do."—*Uses of Animals.*

POWER OF THE MICROSCOPE.

ON NOBERT'S TEST PLATE AND THE STRIÆ OF DIATOMS, BY W. S SULLIVANT AND T. G. WORMLEY.

The limit of the resolvability of lines, or how small a space can exist between lines and still admit of their being separated under the microscope, appears to be an undecided point. Professor Queckett ("Treatise on the Microscope," third edition, p. 238, 1855) asserts that "no achromatic has yet been made capable of separating lines closer together than the $\frac{1}{75000}$th of an inch. In the same work, p. 245, it is stated that Mr. Ross found it impossible to ascertain the position of a line nearer than the $\frac{1}{80000}$th of an inch. We also find on p. 512 that Mr. De La Rue, in his extended examination of Nobert's test plates, was unable to resolve any lines closer than the $\frac{1}{81000}$th of an inch. In Professor Carpenter's work ("The Microscope," second edition, p. 189, 1859), this sentence occurs:—"The well defined lines on Nobert's test plates, have not yet been resolved when they have approximated more closely than the $\frac{1}{85000}$th of an inch."

From the foregoing, it appears that actual experiment fixes the limit of resolvability at about $\frac{1}{81000}$th of an inch. This does not, as is said, vary widely from the deductions of Fraunhofer and others, based on the physical properties of light. In this connection the remark (*op. cit.*, p. 47) of Professor Carpenter may be cited, "there is good reason to believe that the limit of perfection (in the objective) has now been nearly reached, since everything which seems theoretically possible has been actually accomplished."

On the other hand there are authorities who assert that lines much closer than the $\frac{1}{85000}$th of an inch are resolvable. A few years since Messrs. Harrison and Sollitt published (*Microscopical Journal*, vol. ii., p. 61. 1854) their measurements of the striæ of several diatoms, assigning to Amphipleura pellucida striæ as close as the $\frac{1}{120000}$th to $\frac{1}{130000}$th of an inch. These measurements have recently been repeated, and with exactly the same results, by Mr. Sollitt alone (*Mic. Journal.*, viii., p. 51, 1859), who furthermore expresses the opinion that striæ as close as the $\frac{1}{175000}$th of an inch, can, with proper means, be seen. Mr. Sollitt's measurements have been adopted in the Micrographic Dictionary (1860) and most of the modern works on the Microscope, no one, Professor Carpenter (*op. cit.*, p. 188) excepted, suggesting a doubt as to their accuracy; on the contrary, their correctness seems to be expressly recognised by Dr. G. C. Wallich ("Ann. and Mag, Nat. Hist." for February, 1860).

Such being the conflicting testimony and opinion of distinguished microscopists on the capacity of the modern objective for separating lines, it is somewhat surprising—in view of the high state of perfection now attained by the microscope, and of the number of its zealous devotees—that so few experiments have been made bearing on this interesting point.

As a contribution toward that object, we propose to offer presently an analysis from actual measurements, as far as we were able to carry them, of one of those "marvels of Art," Nobert's Test Plates. In such investigations the quality of the instruments used being all-important, we would state that the optical apparatus at our command was ample, consisting of a first-class Smith and Beck microscope stand, a Tolles' $\frac{1}{30}$ objective of 160° angular aperture,—an objective of rare excellence in all respects,—besides $\frac{1}{12}$ths and $\frac{1}{16}$ths of other eminent opticians, both English and American; also a solid eye-piece micrometer by Tolles, and an improved cobweb micrometer of Grunow's accurate workmanship. Smith and Beck's stage scales furnished the standards for fixing the micrometrical values of the eye-pieces. By means of Tolles' amplifier, an achromatic concavo-convex lens between the objective and the eye-piece, an amplification (by the standard of 10 inches) as high as 6000 times was obtained. This high amplification, with sunlight variously applied after passing through a small achromatic lens of long focus, was effective in resolution, and essential to the distinct counting under the micrometer, of the lines of the test plate. The test plate used consisted of 30 bands of lines, each band varying but little from the $\frac{1}{2000}$th of an inch in width, and having its lines a uniform distance apart. On one end of the plate is engraved by Nobert, in parts of the Paris line, the distance apart of the lines composing the first band, and thence on, the distance between the lines of every fifth band, as in the second and fifth columns of the following table:—

Band.	Par. line.	English in.	Band.	Par. line.	Eng. in.
1	0.001000	$\frac{1}{11248}$	20	0.000167	$\frac{1}{67413}$
5	0.000550	$\frac{1}{20471}$	25	0.000143	$\frac{1}{78737}$
10	0.000275	$\frac{1}{40943}$	30	0.000125	$\frac{1}{90074}$
15	0.000200	$\frac{1}{56297}$			

We add the third and sixth columns, giving the distances in parts of the English inch found by multiplying the decimals in the second and fifth columns by ·088815.

Analysis of Nobert's Test Plate of Thirty Bands.

Bands.	Lines in each band.	Parts of an English inch.	Bands.	Lines in each band.	Parts of an English inch.
1	7	$\frac{1}{11110}$	7	15	$\frac{1}{27705}$
2	8	$\frac{1}{13062}$	8	17	$\frac{1}{32250}$
3	9	$\frac{1}{15372}$	9	20	$\frac{1}{37792}$
4	10	$\frac{1}{17950}$	10	22	$\frac{1}{40636}$
5	12	$\frac{1}{20224}$	11	24	$\frac{1}{43063}$
6	13	$\frac{1}{23287}$	12	25	$\frac{1}{47331}$
13	26	$\frac{1}{50000}$	22	37	$\frac{1}{71960}$
14	28	$\frac{1}{52610}$	23	38	$\frac{1}{73190}$
15	29	$\frac{1}{55900}$	24	40	$\frac{1}{74236}$
16	30	$\frac{1}{57519}$	25	41	$\frac{1}{76200}$
17	31	$\frac{1}{58623}$	26	42	$\frac{1}{78105}$
18	32	$\frac{1}{62153}$	27	43	$\frac{1}{81213}$
19	33	$\frac{1}{63328}$	28	44?	$\frac{1}{83917}$
20	34	$\frac{1}{66947}$	29		$\frac{1}{86334}$
21	36	$\frac{1}{68047}$	30		

The figures in the third and sixth columns, showing the distance apart of the lines in each band, are the mean of numerous and slightly variant trials, particularly on the higher bands. Up to the twenty-sixth band there was no serious difficulty in resolving and ascertaining the position of the lines, but on this and the subsequent ones, spectral lines,*—that is, lines each composed of two or more real lines,—more or less prevailed, showing that the resolving power of the objective was approaching its limit. By a suitable arrangement however, of the illumination, these spurious lines were separated into the ultimate ones on the whole of the 26th and very nearly on the whole of the 27th band; but on the 28th, and still more on the 29th, they so prevailed that at no one focal adjustment could more than a portion (a third or a fifth part) of the width of these bands be resolved into the true lines.

The true lines of the 30th band we were unable to see, at least with any degree of certainty; still, from indications, we have no doubt they are ruled as stated by Nobert.

It will be observed that our measurements of the lines on the 1st, 5th, 10th, 15th, and 20th bands vary somewhat from Nobert's registration on the plate, as given in the first table above. Such discrepancies are to be expected, and by microscopists familiar with operations of this kind, are looked upon as unavoidable; but that on the 25th band is rather large to be accounted for in this way. We are unable to explain it, and can only say that our repeated measurements of it were very carefully made.

These experiments, together with those of others before noticed, induce us to believe that the limit of the resolvability of lines, in the present state of the objective, is well nigh established; but that this limit may be carried somewhat higher we are not prepared to doubt, since the handsome advance lately achieved by Mr. Tolles in his $\frac{1}{50}$—combining wide aperture, fine definition, and high amplification—shows that the objective had not, as we were inclined to think, reached the stationary point.—*Amer. J. S.*

LESLIE'S PATENT GAS PROCESS.

Two patents of great commercial importance have been taken out by Mr. John Leslie. The first has for its object improvements in the manufacture of gas. Heretofore, in manufacturing gas from coal and other bituminous mineral substances, it has been usual to sub-

*The tendency of lines near the limit, either way, of the objective's resolving power, to run into each other and produce spectral or spurious lines, is readily shown by a low objective on the lower bands. Hence, the mere exhibition of lines is not always conclusive evidence of their ultimate resolution. A practised eye will generally distinguish the false from the true. Recourse to a higher objective often accomplishes the same; but when these fail, the micrometer only, together with a previous knowledge of the actual position of the true lines, can determine whether the lines exhibited are real or spurious. A 1-12th or 1-16th will show the three or four highest bands on this plate regularly and beautifully striped with lines much coarser than the true ones; the same with the 1-30th on the last band.

ject them to the process of destructive distillation, and then to purify the gas obtained. These improvements in the manufacture of gas for the purposes of illumination from parrot coal, cannel coal, boghead coal, and other mineral bituminous matters capable of affording paraffine, consist in subjecting such mineral bituminous matters to distillation at low temperatures, in order to obtain the products distilled over in a condensed liquid form; and then to subject such liquids to processes of purification, in order to fix or remove the ammonia, sulphur and other impurities; and then to subject the purified liquids to destructive distillation, by which very pure gas is obtained. In the manufacture of gas from coal by destructive distillation, as at present practiced in gas-works, it is necessary to employ very extensive, and at the same time, very expensive machinery and processes between the retorts, where the gas is distilled off, and the gasometers, wherein the gas is stored for distribution; and the necessity for the use of such machinery and processes arises from the high temperatures employed in distilling over every vaporizable constituent of the coals employed; by which not only is the illuminating gas distilled off, but also every inferior and deteriorating gases, with products of sulphur and other impure matters, which are prejudicial not only in respect to the illuminating powers of the combined gases, but they are also injurious in other respects. And it is for the purposes of purifying the gases from the sulphur and other impure products that gas-works have heretofore found it necessary to employ such extensive and expensive machinery and processes. In addition to the above objections, large quantities of tar, as well as of very offensive products, result from the present system of manufacturing gas from coal at gas-works, resulting in great waste in regard to the quality of good and pure illuminating gas a given weight of coal is capable of affording. According to this invention illuminating gas may be manufactured from coal and other bituminous mineral in such manner as to dispense with the use of the machinery and processes now necessary in gas-works for purifying the gases after they leave the retorts and before they arrive at the gasometers. It consists in so arranging gas-works as to employ in the manufacture of gas the hydro-carbon products of coal or other bituminous minerals, obtained by distilling such substances at a low temperature, whereby the patentee is enabled to dispense with the machinery and processes used for purifying illuminating gas, obtained by the existing process of destructive distillation of the bituminous mineral. For these purposes, cannel coal, parrot coal, boghead coal and other coal, and other mineral bituminous matters, are distilled at a low temperature, in such manner as to obtain the products in a condensed form in place of in the state of gases; then, when necessary, the resulting fluids are purified, and then such fluids are subjected to the action of heat in a finely divided state, in retorts or vessels to convert them into gas, which is conveyed into gasometers, such as were heretofore used at gas-works, in order that the same may be distributed therefrom, as heretofore practiced. Mr. Leslie prefers to use a cylindrical retort, heated externally by a fire, such retort being caused constantly to revolve slowly. Into this the coal or bituminous mineral is introduced, broken up into small pieces, and the products evolved pass off to the condensing apparatus, which is constantly kept cool by water, and the condensed hydro-carbon products are received into a suitable receiver or vessel. Care is to be taken to keep down the heat of the retort, in order to prevent the production of gases and vapors which will not condense —the object being to obtain only fluid hydro-carbons by the first process of distillation. When using the better classes of cannel coal the hydro-carbons obtained may at once be employed for the manufacture of gas; but when using hydro-carbons (obtained from less pure coal or bituminous mineral) which have nitrogenous and sulphur compounds combined therewith, these are purified in the following manner:—To remove the nitrogen the crude hydro-carbons are washed with dilute acid; dilute sulphuric acid will answer the purpose, but dilute muriatic acid is preferable, prepared by adding five gallons of water to one gallon of the concentrated muriatic acid of commerce; the hydro-carbons are then agitated violently with this diluted acid, using 15 gallons of diluted acid to every ton of the oil. The mixed hydro-carbons and acid is then allowed to stand for twelve hours, at a temperature of 90 degrees to 100 degrees Fahrenheit, and then the layer of acid liquor, which will have separated, must be drawn off. To free the hydro-carbons from sulphur compounds, the patentee uses at the rate of 1 lb caustic soda with one gallon of water, and from 14 to 30 gallons of such solution will be found sufficient to purify a ton of the hydro-carbon fluid. For this purpose the solution is well stirred into the hydro-carbons, and then allowed to settle for some hours, when the purified hydro-carbons may be readily drawn off from the impurities. In order to convert the hydro-carbon liquid into illuminating gas, it is caused to drop into a retort or vessel heated to a good red heat, and the gas is conveyed from the retort into gasometers of the ordinary construction, from which the illuminating gas is supplied to the gas mains, as gas has heretofore been supplied from gasometers. By these improvements not only will gas-works be rendered less objectionable in any neighborhood, but the gas obtained will be more pure, and the cost of production will be greatly reduced.

The second patent has principally for its object the purification of gas after it is manufactured. For these purposes, in distilling coal or other substances, the gas, instead of being conducted off from the upper part of the retort, and thence into the hydraulic main, is caused to descend from the retort, at the lower part thereof, into a chamber, and thence the gas is conducted off by a pipe at the upper part of the chamber to purifiers. Several retorts may be connected with the same chamber, in which case they each have a slide or valve to shut the entrance into the chamber. And in purifying gas, a solution of a salt of copper, preferring the sulphate, is employed to saturate wood shavings, or other porous material, through and amongst which the gas is caused to pass. The purifying matters thus employed are, from time to time, subjected to the passage of of atmospheric air amongst them to re-prepare them for the further purfication of gas therewith. By the kindness of the patentee, we have been enabled to witness some of the remarkable results which are obtained by these processes. A weighed quantity (2½ lbs) of boghead coal was placed in a retort, which was kept slowly revolving over a fire, the temperature never approaching a red heat, and, indeed, scarcely reaching that of melting lead. The slow rotation of the retort preventing any one portion of the coal becoming hotter than the rest; the volatile constituents were all evolved in the liquid form, no gas whatever being produced. In a short time the 2½ lbs of coal had yielded in the receiver 1½ lbs of hydro-carbon fluid, leaving ¾ lb of coke in the retort. As soon as the liquid had ceased to come over, it was carried to an iron retort, which was kept at a red heat by means of a furnace, the arrangement being similar to that employed in gas-works. The 1½ pints of hydro-carbon fluid was then allowed to drop through a funnel tube into this red-hot retort, when the gas-holder which was in connection with it instantly began to rise, and within a minute and a half 25 feet of gas had come into the holder. The next day the luminosity of the gas, which we had seen prepared, was ascertained by means of a photometer. When burning at the rate of *four feet* per hour, it equalled twenty sperm candles. The remarkable character of these results becomes more apparent if we calculate by the ton instead of the pound. A yield of 1½ pints for every 2½ lbs of coal, is equivalent to 168 gallons per ton of 2,240 lbs. Now 168 lbs is almost exactly one cubic yard; and calculating each gallon to produce, almost instantaneously, 128 cubic feet of gas, we have thus 21,504 cubic feet of gas from 168 gallons, the material for the production of which only occupying one cubic yard of space. Besides the greatly increased yield obtained by this process, there are other advantages which recommend it to the serious consideration of gas companies. By its means all the refuse coal which is now completely wasted at the pit's mouth, may be distilled into oil at the collieries. The liquid may be further purified from sulphur and other deleterious substances on the spot where it is made, whence it could be carried up to London, and converted into gas in the space of a few minutes. The advantages of this would be: the coal, being used at the pit's mouth, would cost a mere trifle; all the troublesome work of distillation and purification, with its concomitant evils of poisoning the neighborhood by the offensive odor, could be performed where labor was cheap and ground plentiful, instead of as at present in the heart of London; the expense of carriage of material to London would be considerably reduced, as only the real gas-making constituent of the coal would be transported; and, lastly, the complicated machinery of plant and hands, with the sickening odor with which it is always surrounded, would be in great measure done away with—no purifying apparatus would be needed—and the mehanical labor of converting any quantity of the hydro-carbon fluid into gas being reduced to the capacity of "a man and boy."—*Chemical News.*

BRITISH PUBLICATIONS FOR SEPTEMBER.

	Stg. prices.			
Adams (Rev. C. H.) Schoolboy Honour, a Tale of Halminster College, fcap. 8vo.	£0	3	6	*Routledge.*
Ahn (Frauz) Manual of German Conversation, for English Travellers, 12 mo...	0	2	6	*Trübner.*
All Round the World, edited by W. F. Ainsworth, Vol. 2, 4to....................	0	7	6	*Office.*
Benson (Robt.) Indian Resources Applied to Development of India, 8vo.........	0	1	0	*Smith & Elder.*
Bentinck, (Lord George); a Political Biography, by B. Disraeli, new edit., sm. post 8vo..	0	2	0	*Routledge.*
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Book of Trades (The); or, Circle of the Useful Arts, 13 edit., 16 mo............	0	3	6	*Griffin.*
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——————Companion to, by J. J. Laing, cr. 8vo.	0	1	0	*Winsor & N.*
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Miscellaneous.

How Straw Paper is made.

The art of manufacturing paper of straw has made rapid progress since its discovery. The paper was first made in this city in 1854. Although of a dingy yellow hue, harsh and brittle to the touch, and scarcely to be handled without tearing, its production was deemed the marvel of the age (as, indeed, it was), and the very least of the many glorious auguries of it was, that it should entirely revolutionize the newspaper business in time. In those days the straw was most unscientifically boiled in open tubs, and consequently it was never perfectly freed of its silica; and being silicated it was found almost impossible to wet it down for presswork, so that the paper was either too much printed, or not printed at all, and a growl went up from the reading public of alarm and indignation.

Under various mitigated forms, the evil, nevertheless, continued for years, and the growls grew fainter and fainter as the people's eyes and perverted tastes became accustomed to it.

About eighteen months ago letters patent were secured for various important modifications of the original process. The method of making straw paper is as follows:—

The straw is first passed into a cutter, whereby it is reduced to lengths of from three to four inches. It is then thrown into large vats, and thoroughly saturated with weak alkali. A most unpleasant odor hence arises, somewhat similar to that perceptible in all large breweries, but we are informed it is not prejudicial to the health of the workmen. This operation of mixing is termed "breaking down," and changes the straw in color to a dark biske. It is next filled into large air-tight boilers, fourteen feet in diameter, subjected to a pressure of steam ninety pounds to the square inch, and boiled in another alkali. Each of these boilers will contain eleven thousand pounds of broken straw. It is then ground into pulp, in the same method and by the same machinery that have hitherto been employed in the manufacture of rag paper. It has now been changed to a very dark slate color, and it would be difficult for us to recognize in it any element of the bright yellow straw of an hour since, if we were not previously acquainted with the marvelous nature of the transformation. After this it passes into a series of vats, where, by means of certain bleaching powders, it is brought to a hue of snowy whiteness, and reduced to a proper consistency by water. The mass now bears much resemblance to plaster-of-paris in solution, and is ready to be worked up into paper.

The most interesting process yet remains to be described, but we must pass into another apartment to witness it. At the eastern extremity of the room is a sort of trough, into which the pulpy liquor is pumped by steam power, and from which it flows upon a horizontal sieve of very fine copper wire. The fibres of the pulp at once arrange themselves on this sieve. A species of film is thus formed, which, though not a hundreth of an inch in thickness and largely saturated with water, has sufficient body to answer every purpose. It is next made to pass between a series of wooden rollers, which gradually consolidate and compress its fibres and free it of all the surplus water. By means of heated rollers, through which it is caused to pass, every particle of moisture is at length removed, and it is calendered by being pressed between heavy polished iron rollers. The positions of two small revolving wheels, with cutting services, between which it is caused to move, regulate its width as required, and it is finally wound upon reels, from which it may be cut off into sheets of any length.

The entire operation is so simple that the visitor who has an opportunity of inspecting it cannot fail to comprehend it almost instantly. The machinery, nevertheless, requires to be of exceeding accuracy, and is accordingly rather expensive. Its capacity admits of the production of 9,000 pounds of paper per day, but only about three-fourths of that amount is at present manufactured, or between 180,000 and 190,000 pounds per month. Two thousand tons of straw are yearly consumed here in the manufacture of paper. But forty per cent. of this, however, is available as fibre. The balance passes off into glutinous matter and silica, neither of which being convertible into dollars and cents represents an appreciable value. This immense waste in the raw material is, however, fully compensated for in the advantages of the product. Compared with paper made from rags, straw paper has more body for the same weight, is better adapted for fast presses, and it will not readily tear, and calenders much more smoothly. As to whether it can be produced at a cheaper rate, we shall not take it upon ourselves to state. There are probably not over half a dozen factories in the United States engaged in making it. Two or three of them are situated in New York and another in Cincinnati. There is but one newspaper establishment in Philadelphia which uses straw paper for printing purposes.—*Philadelphia Press.*

Making Paper from Corn Leaves.

We translate the following from *L'Invention* :—

The conversion of the fibres of maize into paper is today an industrial fact confirmed by extensive success, and this discovery cannot fail to influence considerably the price of paper. This discovery, it is true, is not absolutely new; in the Eighteenth century the manufacture was in operation in Italy with remarkable success; but, strange to say, the secret was kept by the inventor, and was lost at his death. Many attempts since made to revive the manufacture have all recoiled before the difficulty of removing from the leaves the silica and resinous matter which they contain, and which obstructs the conversion of the pulp into sheets. Happily, this secret has just been re-discovered, and not, as would have been anticipated, by a chemist, but by a simple Jewish writing-master—M. Moritz Diamant, an Austrian subject—to whom the new industry is going to give a considerable fortune. His process is applied at the present moment on a very large scale, at the imperial manufacture of Schlogelmühle, near Glonitz, in Lower Austria. Although the machinery of the establishment was constructed for working rags, and is not at all adapted to the kind of preparation that corn leaves require, the essay that has been made has had a prodigious success; the paper obtained leaves nothing to be desired in strength, homogeniety, polish and whiteness. In the last point, particularly, the sheet from corn surpasses that from rags, which always contain impurities that can be removed only with great difficulty.

It is Count Carl de Lippe Veissenfeld who operates at this moment the discovery of M. Moritz Diamant, interested, as may well be supposed, in the fabrication of paper from maize.

According to the German Journal from which we have borrowed the preceding details, the principal advantages of this manufacture are the following :—

1. It is not solely possible to produce from the leaves of maize all the species of paper manufactured at this day; but it happens, furthermore, that in several respects this paper is superior to that made from rags.

2. But little starch is required to prepare the paper for receiving writing, which results from the fact that the corn leaves already contain a natural ingredient that takes the place of starch. This ingredient may be easily removed if desired.

3. The bleaching of this paper is effected almost instantaneously by a process the most simple and the most efficacious. It is, furthermore, only feebly colored, and for wrapping paper, bleaching is entirely unnecessary.

4. The paper from maize is stronger—more tenacious —than the best paper made from rags. There is none of the fragility which characterizes paper into the composition of which ordinary straw enters—a fragility which is principally due to the abundance of silica contained in straw.

5. In the process invented by M. Moritz Diamant, no species of machine being necessary to convert the fibers of maize into paper pulp, and this conversion being made by means entirely different from those employed in working rags, there results a great simplification in the apparatus, and consequently a notable reduction in the manual labor and the expense of the manufacture.—*Scientific American.*

British Wool.

Mr. Caird, M.P. (of Michigan Central Railroad notoriety), read at a recent meeting of the Council of the Royal Agricultural Society of England, a paper upon British wool. He remarked that, although there had been an immense increase in the importation from foreign countries and the colonies during the last twenty years, the rearing of sheep for the production of British wool continued to be one of the most profitable branches of our industry. Within the period referred to there had been, no doubt, in the imports from Spain and Germany, a diminution of about 4,000,000 pounds; but at the same time, to compensate for this, there had been an increase from Russia, the Low Countries, Denmark and Portugal, of no less than 20,000,000 pounds. There had been an increase within this period, in round numbers, from Australia, of from 13,000,000 pounds to 54,000,000 lbs.; from South Africa, of from 1,000,000 pounds to 14,000,000 pounds; from the East Indies, of from 4,000,000 pounds to 14,000,000 pounds. At home the increase in the amount of wool produced was equally remarkable. In 1842 the home-grown wool did not exceed 100,000,000 pounds; it now amounted to 120,000,000 pounds. There had been, in short, an augmented supply of wool to the extent of nearly 75 per cent. It had not been followed by any diminution of price to the home producer. Now, the countries in which the production of wool is likely to increase most rapidly, viz., Australia, the East Indies, South Africa and South America, are all unsuitable to the production of the lustrous long wools, for which there is a great demand. The British Islands supply this wool in the greatest quantity. They may be almost said to have a monopoly of it, and there are no countries which can enter into competition with them. Mr. Caird is, therefore, of opinion that the British wool-grower should develope its production as much as possible, and he thinks the supply may be increased by good farming and liberal feeding. The best cross that could at present be adopted on suitable soils would, he adds, be obtained by using the improved Lincoln or Leicester ram, in which the desirable qualities of length, lustre, strength and fineness of wool seemed to be best combined.

Portland Breakwater.

An immense breakwater has just been completed at Portland, on the southern coast of England. The whole work was done by convict labor. It is described as a mole of loose stones, three hundred feet in breadth at the base, one hundred feet in height, and a mile and a half in length. It has cost, in round numbers, £900,000, twice the estimated expense. At the end of mole a first-class fortress will be built.

French Beet-Root Sugar.

According to an official return just published in France, concerning the manufacture of beet-root sugar from the commencement of the season 1860-'61 to the and of the month of April, it appears that the number of establishments in activity were 334, being four more than in the corresponding period of the preceding year. The number of manufactories not at work, but having sugar still in stock, had diminished from twenty-four to fifteen. The quantity made was 97,900,000 kilogrammes, being 27,000,000 less than in the corresponding period of 1860. The quantity delivered for consumption had increased from 6,000,000 to 18,500,000 kilogrammes.

To Remove Ink from Paper, &c.

The process of thoroughly extracting all traces of writing-ink, whether accidentally spilt or written in error, is to alternately wash the paper with a camel hair brush dipped in a solution of cyanuret of potassium and oxalic acid; then when the ink has disappeared, to wash the paper with pure water. By this process cheques have been altered when written on "patent cheque paper," upon which it was supposed by a recent inventor to be impossible to remove writing.—*Septimus Piesse.*

The Separation of Crystallizable from Non-Crystallizable Substances.

The eminent chemist, Graham, Master of the Mint, recently read a paper before the Royal Society in London, on a new mode of separating substances like sugar and salt, which will crystallize, from those such as gum, which will not. Mr. Graham calls the class that will crystallize *crystalloids*, and those that will not, *calloids.*

The *crystalloids* in solution are free from gumminess or viscosity, and are always sapid or have a positive taste.

The solution of *colloids* has always a certain degree of viscosity, and they are insipid or wholly tasteless. Starch, the vegetable gums, tannin, albumen and vegetable and animal extractive matters belong to the class of colloids.

Mr. Graham finds that these two classes of substances may be separated from each other by the mysterious operation of osmose. He constructs a vessel in the form of a seive with a flat hoop of gutta percha and a bottom of animal membrane, like bladder, or of the paper called "vegetable parchment," and pours the solution containing the mixture of the crystalloid and colloid into the vessel to the depth of half an inch, and then floats the vessel on the surface of water. The crystalloid passes down through the membrane by osmose, and the colloid remains. Mr. Graham gives to this mode of separation the very appropriate name of *dialysis.*—*Scientific American.*

The Domes at the Great Exhibition Building.

On the 26th August, the first of the columns which are to support these giant domes was put up, and the contractors undertake to have all complete within six months. The highest portion of these domes will soar some 16 ft. above the Monument of the Fire of London, and persons standing upon the ground within the building will have to cast their eyes up to a height of 180 ft. or 16 ft. higher than the great transept of the Crystal Palace at Sydenham, to reach the under side of these great globes. Wide as is the span of that great transept, it is 80 feet less than that which will be covered by the dome at Kensington. Each of these domes will be supported by eight cast iron columns, 2 feet in diameter, perfectly round, and without any rib, outer projection, or ornament. They will rise to the height of 108 feet, the upper part being of the same diameter as the lower. Each one of these columns will be formed of five separate lengths, joined together by bolts passing through flanges cast on the inside, so that; when completed, the parts where they are joined will not be perceptible, and will have the appearance of an enormous mast, without, however, its tapering end.

Mineral Wealth of Britain.

Eighty million tons of coal are consumed and exported annually in England. 8,000,000 tons of iron ore are raised, producing 3,826,000 tons of pig iron. Of copper ore 15,968 tons are raised in England, which yield 15,968 tons of metallic copper. The total annual value of British minerals and coals is estimated at £26,993,573 sterling, and of the metals or produce of the minerals £37,121,318 sterling.

Ocean Telegraphs.

The tabular statement of the Committee appointed to report on Ocean Telegraphs shows that at the present time 11,364 miles have been laid, but of these little over 3,000 miles are actually working.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor wlll exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURES & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.