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# The Canadian Journal.

TORONTO, SEPTEMBER, 1852.

In the August Number of the Journal we alluded briefly to its objects, and enumerated in general terms the sources from which we hoped to obtain co-operation and support. We now propose to consider more in detail the manner in which that co-operation may be afforded, not, however, intending to restrict in any way the intentions of our well-wishers, but rather with the view of suggesting subjects of enquiry and observation which some of our readers might consider unsuitable to the pages of this Journal, or the objects of the Canadian Institute.

First, then, we attach great importance to the opportunities for observation and discovery presented by railway operations now in progress in various parts of Upper Canada, and would warmly urge upon the gentlemen engaged in the construction of the different lines the importance of accurately recording the many interesting facts which are daily disclosed. We recently noticed in a local paper* a short account of the discovery of an Indian burying-ground by the workmen on the Great Western Railway, in excavating a bank in the neighbourhood of Windsor. "In the burying-ground were found a large number of Indian ornaments, consisting of silver pins, brooches, bracelets, amber bead necklaces, &c., also, red stone pipes, copper camp kettles, and a variety of articles usually buried with an Indian. The place where these things were found was an Indian burying-ground. A great many skulls, bones and skeletons have been disinterred."

With a view to collect accurate and complete information on such interesting revelations as the one to which we have just adverted, the Canadian Institute, in a circular of enquiry dated June 12th, 1852, proposed (and distributed far and wide) a number of queries which we subjoin:—

*Indian Remains.*—Although the subject of Indian mounds and intrenchments has of late years received much attention in the neighbouring States, and it has been shewn by the investigations of Mr. Squier† and others, that they exist in considerable numbers in western New York—particularly in the region occupying the first and second plateaux round Lake Ontario—Upper Canada, a part of the same region geographically, and peopled originally by the same, or nearly allied races, remains to a great degree a *terra incognita* with respect to this enquiry. The Council of the Canadian Institute deem it one particularly worthy of the attention of those persons who, by their pursuits, are brought into contact with such objects; and from the professedly practical character of their body, one of those also upon which authentic and valuable information may be looked for, at the hands of its members, as an early result of its incorporation.

To one county alone, of the State of New York, (Jefferson County,) Mr. Squier was enabled to discover fifteen inclosures or intrenchments, and he has estimated the total number which formerly existed in that state, at from two hundred to two hundred and fifty. "Were these works," he remarks "of the general large dimensions of those of the Western States, their numbers would be a just ground of astonishment. They are, however, for the most part, comparatively small, varying from one to four acres, the largest not exceeding sixteen acres in area. The embankments, too, are slight, and the ditches shallow: the former seldom more than four feet in height, and the latter of corresponding proportions. The work most distinctly marked exists in the town of Oakfield, Genesee County; it measures, in some places, between seven and eight feet from the bottom of the ditch to the top of the wall. In some cases the embankment is not more than a foot in height, and the trench of the same depth. Lest it should be doubted whether works so slight can be satisfactorily traced, it may be observed that a regular and continuous elevation of six inches may always be followed without difficulty."

"In respect to position," adds the same writer, "a very great uniformity is to be observed throughout; most occupy high and commanding sites near the bluff edges of the broad terraces by which the country rises from the level of the lakes. When found on lower grounds, it is usually upon some dry knoll or little hill, or where banks of streams serve to lend security to the position. A few have been found upon slight elevations in the midst of swamps, where dense forests, and almost impassable marshes, protected them from discovery and attack. In nearly all cases they are placed in close proximity to some unfailing supply of water, or running streams. Gateways, opening toward these, are always to be observed, and in some cases guarded passages are visible."

To this clear and concise description little need be added. The enquiries proposed by the Canadian Institute, are the following:—

1. Name of township and number of lot in which any Intrenchment or Mound exists.

2. The area and dimensions, from actual measurement, and if possible, a plan, with sections.

3. A general description of the situation and neighbourhood.

4. Are there any trees growing *on* the artificial earthwork, if so, their size, the number of rings of annual growth in the largest *stump* to be found? To cut a tree down to ascertain this fact, unless they are numerous, would be to destroy a very valuable standing evidence to the antiquity of the work.

5. Are there still, or *were* there, previously to clearing, trees of large size *in* the area of the work?

6. Is the place known to the Indians in the neighbourhood by any name? Have they any traditions respecting it?

7. Are stone axes, arrow-heads, weapons or utensils, ever ploughed up in the vicinity? Is broken pottery common? Have the remains of concealed stores been discovered? Specimens of any of these objects will be highly valued.

8. Are there evidences of the place having been surrounded with posts or pickets?

9. Have utensils or weapons of copper or iron ever been discovered, leading to the inference that the place was occupied since the intercourse of the natives with Europeans began?

10. Specimens of Indian skulls or crania having evidence of antiquity will be valued. But the Council distinctly disown any wish or desire to disturb native burial places of comparatively recent date, and strongly recommend that they be treated with respect.

11. Are there any mounds or tumuli of artificial construction, or any mounds or elevations which from their regularity suggest a suspicion of such an origin, if so, state the same particulars respecting them?

12. Are there any local names of Indian origin in your township or neighbourhood; if so, a list of them, indicating the language to which they belong, their correct pronunciation, their interpretation or meaning, and the local circumstances on which they may appear to be founded, will be highly acceptable?

13. Copies of any noteworthy native drawings or writings, such as those existing on what are called the pictured rocks of Lake Superior and Lake Huron, and generally drawings of any objects connected with the subjects of these enquiries, will be thankfully received.

We solicit the attention of those who are interested in the attractive subject of Indian Remains to the foregoing enquiries. For our own part, we shall at all times be glad to introduce into the Journal wood-cuts of any relic possessing peculiar interest, when transmitted for the inspection of the Institute, or as a contribution to the Museum now in progress of formation.

Another subject of much scientific and economic importance is involved in the collection and publication of accurate descriptions and diagrams of strata, which may be disclosed by deep cuttings, either in the drift formation or in rocks upon which the drift reposes. Fossil remains of large dimensions are not unfrequently found in the drift, and the foundation limestone rocks of the Western part of the Province teem with innumer-

*The *Canada Oak*.

†Smithsonian contributions to knowledge: *American Journal*, Vol. XII, No. 3°.

able relics of former organic life. Much interest has recently been excited by the discovery of the bones of an animal of large dimensions in the neighbourhood of Hamilton, called an 'Elephant,' (Mastodon?) We have seen no scientific description of the remains, although they possess singular interest and have acquired considerable notoriety.

Fossils and minerals of every description, when properly arranged and described in a public Museum, acquire a value which they can rarely or never attain in private hands. In this new and comparatively unexplored country, the scantily furnished Cabinet of an amateur, unless he be professionally interested in mineralogy or palæontology, or possessed of industry to describe the few treasures accident or search may have furnished him with,—lie shorn of more than half their value, because they do not thus contribute to public knowledge, or advance the interests of Science.

Railway operations in Great Britain have given an extraordinary impetus to Geological science during the last twenty years. They have opened up the mineral treasures of the country in marvellous abundance, and every advantage has been taken of the opportunities so frequently offered. It would be a matter of lasting regret if the splendid facilities now within our reach, should be permitted to slide from our grasp without being improved to the uttermost.

The Council of the Canadian Institute in their circular of enquiry already referred to, have endeavored to give a practical and useful direction to the exertions of the members and friends of the Institute by soliciting information respecting the Limestones of Canada. It is unnecessary for us to enlarge upon the economic importance of the material, or enumerate the many useful purposes to which it is applied. It is not generally known however, that the Farmer, the Builder, the Smelter, the Soap-boiler, the Soda-maker, the Candle-maker, the Bleacher, &c., &c., all require it in processes to which special varieties are peculiarly applicable. It is with a view to their classification and analysis, that the Council have determined to institute the subjoined :—

ENQUIRIES REGARDING THE LIMESTONES OF CANADA.

Inasmuch as it does not appear that the Limestones of Canada have as yet been fully examined, by analysis or otherwise, in reference to their economical values, or classified for practical purposes, it has been determined by the Council of the CANADIAN INSTITUTE, to collect for its Museum, in aid of these objects, specimens of Limestones from the various localities within the Province; they accordingly request that all parties who, by residence or information, may be able to assist the Council in this matter, will be pleased to transmit to the Secretary of the Institute, replies to the accompanying questions, with specimens of the Limestones or Limes to which they refer; and to add to those specimens which are selected, as illustrating the economical uses more particularly in view, any which exhibit fossil remains of whatever kind.

The following is a list of the localities in which Limestones are known to exist,* extracted from a paper prepared by W. E. Logan, Esq., F. R. S., the President of the Institute.

Malden—Manitoulin Islands, along the south side—St Joseph Island—coast of Lake Huron, from Cape Hurd to Rivière au Sable (north)—various parts from Cabot's Head to Sydenham, in Owen's Sound; and from Sydenham, by Euphrasia, to Nottawasaga; thence by Mono to Esquesing, and by Nelson to Ancaster—Thorold—Matchedash Bay—Orillia—Rama—Mara, and various parts of Marmora—Madoc—Belleville—Kingston—MacNab—Bytown, and various parts of Plantagenet and Hawkesbury—Cornwall—Isle Bizard—Beauharnois Island—Caughnawaga—Montreal—Isle Jesus—Terrebonne—Philipsburgh—St. Dominique—Grondines—Deschambault—Beauport—Bay St. Paul, and Murray Bay—Upton—Acton—Wickham—Stanstead—Hatley—Dudswell—Temiscouata Lake—Gaspé—Port Daniel—Richmond—Anticosti Island.

Hydraulic Lime is found in the following places:—Point Douglas, Lake Huron—Cayuga, 3½ miles below the village, on the Grand River—Thorold—Kingston—Nepean, near Bytown—Argenteuil.

Magnesian—Exit of Lake Mazinaw—North Sherbrooke, C.W.—Drummond—St. Armand—Durham—Sutton—Ely—Durham—Melbourne—Kingsley—Shipton—Chester—Halifax—Inverness—Leeds—St. Giles Seigniory—St. Mary Seigniory—St. Joseph Seigniory.

Replies to the following questions or other information on the subject will be thankfully acknowledged :—

1st. The number of the specimen referred to (if any be forwarded.)

2nd. The name of the locality (No. of the lot, concession, and name of township and county) from which the same has been taken.

3d. The geological position of the bed, its thickness, dip, superior and inferior strata, the nature of the surface, soil, &c. &c. &c., if known.

4th. The analysis: if it has been ascertained.

5th. Whether it exists in quantity and position to warrant its economical use as an article of commerce, and the facilities for transportation.

6th. Whether it exhibits any hydraulic properties and to what extent.

7th. If Lime has already been manufactured from the stone referred to—transmit a sample—and state the manner of its manufacture—if peculiar—and in what works the same has been used.

We shall advert to other important subjects of enquiry in future numbers of the Journal; in the meantime, we call attention to the admirable paper by Capt. Lefroy, which has especial reference to the highly interesting subject of climate.

* NOTE.—The quantities in the localities indicated are not in every case of a sufficient amount to be profitably available, but they are always of sufficient importance to draw attention to the localities as a possible guide to the discovery of others in the vicinity where quantities may be greater.

### On the Atmospheric Phenomena of Light: by J. Bradford Cherriman, M. A., F. C. P. S.,

*(Fellow of St. John's College, Cambridge, and Dep. Prof. of Mathematics and Natural Philosophy in the University of Toronto.)*

(CONTINUED FROM PAGE 6.)

There is still remaining an extensive class of phenomena known under the generic name of *halo*, and comprehending a great diversity of appearances, about which much difference of opinion has prevailed among philosophers. It is now, however, generally conceded, that the theory proposed by Mariotti, and permitted for a long time to lie dormant, until re-discovered and worked out by Young, is sufficient to account for most, if not all, of the observed facts, its results agreeing with them not only in general character but even in the details of measurement. According to this theory, the phenomena arise from the various refractions and reflections of the rays of light by the crystals of snow or ice in the air; which crystals, as is well known, all exhibit more or less the angle of 60°, their general form being that of triangular or hexagonal equilateral prisms, terminated by plane bases at right angles to their sides.

The following is an account of a *halo* observed near Toronto by Mr. H. Y. Hind, on 8th March, 1847:—

"A ring of a dull orange colour towards its inner boundary, was visible about 24° from the Sun, together with a second ring of fainter colour, distant about 24° from the former. In the circumference of the inner ring, exactly opposite each other, and equally distant from the horizon, were two mock-suns, well defined towards the Sun itself, and of a dull orange colour, but shooting out into a vivid streak of light, some 10° on the opposite side, parallel to the horizon. Two other coloured arcs of more vivid colours than the former, and seemingly of nearly the same radii, touched them in their vertical points, with their convexities turned towards the Sun. At the points of contact, the colours were most distinct, being in those parts towards the Sun of a deep orange, but on the inner boundary of the two latter arcs of an indigo blue, the intervening space of a light green."

The radius of the inner ring, as measured by Captain Lefroy, at Toronto, was 22° 53'.

In another halo, observed February 9, 1851, by Mr. James S. Clouston, C. T., at Moose Factory, we find "a horizontal circle of a whitish colour passing through the sun; a halo round the sun of about 22° radius, at the point of intersection of which with the former were two very bright mock-suns; a second halo of about 45° radius, faintly tinged with the prismatic colours, (and as in the previous one) two arcs touching them at their highest points, convex to the sun, both coloured, but the colours of the second being very vivid like a rainbow; on the horizontal circle, two faint elongated mock-suns, each about 120° (90° ?) on either side of the sun, and a third directly opposite to the sun, and very much elongated." Captain Back describes a lunar halo in which a white cross passed through the moon bounded by a halo of 22°, and having a mock moon in the end of each branch of the cross. In a halo of the sun, observed by Hevelius in 1661, A. D., no less than six mock-suns were seen, as also in another observed by M. Lambert, in June, 1858. At Kiahta, in Siberia, on February 4, 1829, at sunrise, were seen luminous rays issuing on both sides of the sun, (known in that country by the name of the sun's ears,) which extended gradually till they made the complete tour of the horizon, forming a circle in the circumference of which were situated seven mock-suns. But of all recorded halos, the most complex and gorgeous is the one seen at Gotha, on May 12, 1824, and of which a full account may be found in the Ency. Met. Art. Meteorology.

It will be now seen that the term *halo* indicates a phenomenon so complicated as to render its description difficult, no observer having ever yet seen it complete, and the appearances often changing during the time of observation; however, the principal parts of it may be thus defined :—

1. A horizontal white circle passing through the sun and making the complete circuit of the heavens.

2. A vertical white circle, also passing through the sun and terminated by the horizon.

These are produced by reflection of the sun's rays, the former at the faces of the ice-crystals, whose axes are vertical and at the bases of those with axes horizontal; the latter at the faces of the prisms, whose axes are horizontal and perpendicular to the vertical plane through the sun and spectator. The crystals tending to arrange themselves according to the law of least resistance, will naturally be found in greater abundance with their arcs horizontal or vertical, than in any other position.

3. These two circles form the white cross in Captain Back's halo, and at their other point of intersection give rise to a pale and vivid mock-sun, which is consequently just in the opposite point of the heavens to the real sun and at the same height above the horizon.

4. Two other white circles of very rare occurrence passing also through the sun and the above-mentioned image, and equally inclined, tho[ug]h at a variable angle, to the vertical circle (2.) These arise from reflection at the faces of prisms when a considerable number of them happen to have their axes inclined at the same angle to the vertical.

5. Three circular coloured rings, or *halos proper*, surrounding the sun and having radii about 22, 46, and 90 degrees respectively. They all display the prismatic colors, the two interior having red on the inside and violet without, (these being distinguished at a glance from *coronæ* or where the order of colour is the reverse), the third or outermost on the contrary has violet within and red without. Inside the first halo is comparative darkness, but on the outside its violet fades away into the azure of the sky, succeeded again by a darker space just within the second halo, between which and the third is considerable illumination followed by darkness outside the third. Of these the first is produced by rays refracted through two adjacent faces of the prisms in such a position that the refracted ray undergoes the least deviation; the second by those refracted in like manner through a face, and issuing through the base, and the third by rays issuing after one internal reflection exactly as in the primary rain-bow. The results of theory agree in all particulars with regard to these, with the observed facts, but there is mention made in one of Captain Parry's halos of a prismatic circle of 38° radius, and in a halo seen at the Observatory in Toronto, on March 9, 1841, of one of 30° radius; if these were not simple *coronæ* (the order of colours is unfortunately not mentioned in either case), and the measurements be accurate, they must be regarded as facts yet unexplained, and it appears very difficult to frame any hypothesis for them.

6. Two circular coloured axes, generally of great brilliancy, touching the first halo at its highest and lowest points, and turning their convexity towards the sun, being red outside and violet within. These are formed in the same manner as the first halo, by prisms with axes horizontal, and occurring in great numbers. The circles will have the zenith for their centre, their apparent diameters varying with the sun.

7. Two precisely similar rings, touching the second halo in its highest and lowest points, produced, according to M. Galle, in the same manner as the second halo, by prisms whose axes are vertical; but this explanation does not seem satisfactory.

8. Two other circles—very rare—touching the second halo at points distant 60° from its l[o]west point, of which no account has yet been given by theory.

9. Lastly, at, or near, all the intersections of the halos proper with the vertical and horizontal circles (1 and 2), have been observed, at one time or other, images of the sun, mock-sun, or parhelia as they are called, in number eleven. Those of the first and second halo generally appear coloured like the halos themselves, and spread out tails tending away from the sun along the white circles; but in those of the third halo, which are extremely rare, the colours have never been seen, owing to the faintness of this halo. They occur generally a little outside of the exact intersection of the circles, which is successfully explained by Venturi, from the fact of the refraction not taking place exactly in a plane perpendicular to the edge of the prisms.

There may be other varieties of the halo which are not included in the above enumeration; and, indeed, the vast diversity of forms which the ice-crystals may take, and the great number of ways in which they may present themselves to the sun, evidently offer a complication of circumstance that baffles analysis or description. There is still a class of phenomena depending on the atmospheric polarization of light whose examination must be reserved for a future occasion, and also a few of which it may be doubted whether they are due to atmospheric action; thus, not to mention the auroral arch and zodiacal light which some have attempted to resolve into atmospheric phenomena, the dark lines of the solar spectrum and the twinkling of the stars may, with much probability, be thus ref[err]ed. Of the former of these two, no attempt even at explanation has yet been made, and the latter has been the *crux* of optical science for ages. It consists, as may be seen any clear evening, in the star undergoing rapid changes of intensity and colour—

"The fiery Sirius alters here,
And bickers into red and emerald——"

Philosophers, from Aristotle down to Newton, have tried their [h]an[d]s in framing hypotheses, more or less ingenious, to account for this; but later observers have contented themselves with upsetting all previous explanations, and confessing their own ignorance. It was understood, some time ago, that M. Arago had succeeded at length in deducing the facts from the undulatory theory; but his memoir, if ever published, I have unfortunately not seen. Some remarkable appearances, though not difficult to explain, offer themselves during a total eclipse of the sun, of which a very interesting description may be found in Hind's Solar System.

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## Gas Patents, by Henry Croft, D. C. L., Professor of Chemistry in the University of Toronto.

There is scarcely any branch of chemical manufacture which has attracted so much attention, and has been made the subject of such numerous patents as that of coal gas; we mention coal gas alone, for although various proposals have been made, and several carried into execution, for extracting a gas fitted for illumination from numerous other substances; such for instance, as oil, fats, rosin, bitumen, soap-suds, and even water, it does not appear that any one of them can take the place of that from which the gas was originally produced, viz., coal.

Whether we regard the convenience and utility of this illuminating principle, or the enormous saving of expenditure when its use is contrasted with that of all other ordinary combustibles, or the numerous useful applications which have been made; among the most interesting of which may be mentioned the singeing of calico and of thread, formerly effected by much more clumsy contrivances; we cannot but consider this branch of manufacture as one most deserving our attention and worthy of more especial notice.

Many improvements have been effected in various departments of this manufacture, as may be seen from the fact of there having been from sixty to seventy patents or specifications registered in the Patent Office up to the year 1850. Since that time many more have been entered, some of which will be briefly noticed in the present paper.

Although the general application of coal gas to the purposes of illumination may date from the commencement of the present century, yet the knowledge of its properties was obtained at a much earlier period. In letters written in 1688-9, by Mr. Clayton, Rector of Crofton, at Wakefield, in Yorkshire, addressed to Robert Boyle, and afterwards to the Royal Society, we find a tolerably accurate account of the method adopted by the author for preparing a gas from coal, and also of its properties more especially as regards its inflammability.

Between 1770 and 1780 various experiments were made by Hales and Watson on the production of an inflammable gas from coal and other substances, but the first, though unsuccessful, attempt at the application of such product to useful purposes seems to have been made by Lebon in France, during the years 1785-6. The substance employed by him was wood, which does not yield nearly so good a gas as common coal, a fact which may probably account for the failure of his experiments.

In the year 1792, Murdoch lighted his dwelling house with gas, and in 1798 a gas-work was established in the factory of Messrs. Bolton & Watt, with whom Murdoch was connected.

For some years subsequent only a few private factories were furnished with this valuable means of illumination. It was first applied to lighting streets in 1804, when Pall Mall in London was furnished with gas, to replace the clumsy and inadequate oil lamps, which all old residents in that city may remember. Since that period the use of gas for this purpose has become thoroughly appreciated and most widely extended.

Gas which may be applied to the purposes of illumination is frequently found in nature, exuding either from the soil, or rock or passing up with mineral waters. The holy fires of Baku, the natural gas of Fredonia, (on Lake Erie,) the so called burning springs above the British Falls, and at Hamilton, the burning fountain of Dauphiné, as well as many others in various parts of the world might here be mentioned. The gas which is thus evolved is not, however, of the same nature as that obtained artificially from coal, although coal gas does, under certain circumstances, contain a very large proportion of the above mentioned compound, and a very considerable quantity in all cases. The evolution of this gas is not, therefore, to be taken as a proof of the existence of coal, although in the coal mines it is the substance which so frequently produces such calamitous accidents, being generally known by the names of fire damp, marsh gas, &c.* It appears that long before coal gas was employed in England, the Chinese were in the habit of employing the natural product for the purposes of illuminating and heating.

Before entering upon the improvements which have been effected in the manufacture, it may be well to describe, in a few words, the process as originally adopted, and the objects of its several parts. The coal being heated strongly in cylindrical iron retorts, gives off a mixture of various gases, together with certain oils, tar and water holding in solution several salts, principally of ammonia. From these bodies the gas is purified, firstly,—by traversing a large tube or reservoir called the hydraulic main; and, secondly,—by passing through a series of pipes kept cool by a stream of water. The mixed gases are then conducted through the purifiers, which are large vessels filled with a mixture of lime and water; noxious gases, and some which are either not combustible or do not give out any great light when burnt are thus removed, and the so purified gas is then passed off into the gasometer or collecting vessel.

In each of the processes above described great improvements have been effected, while other contrivances have been attached to the factory, either for the purpose of improving the quality and illuminating power of the gas, or of rendering available, for technical purposes, the different products obtained during the process.

The improvements may be classified under three heads:

1st. As regards the quantity and quality of gas produced from a given weight of coal.

2nd. As regards the efficiency and economy of the purifying process.

3rd. As regards the illuminating power of the gas.

The quantity of gas produced depends principally upon the nature of the coal subjected to distillation, the finer cannel coal yielding as much as 18,000 cubic feet of gas for every 100 cubic feet of coal, while poorer kinds do not give more than 9000. The quantity will also depend, to a considerable extent, on the rapidity with which the coal is raised to a cherry-red heat; if the coal be damp, and the heat raised slowly, a large quantity of tar will be produced, much of which will distil off without producing gas. The quality of the gas varies with the duration of the process, during the first hour that substance which gives its strong illuminating power to the gas is found to the extent of 13 per cent., while at the end of 5 hours there is only 7 per cent., and at the end of 10 none at all, and the gas, consequently, when burning, gives out little or no light. Olefiant gas, (the illuminating principle) which burns with a brilliant white light,

* The explosion which occurred some few weeks since, in a well on Queen Street, Toronto, but which was fortunately not attended by any serious consequences, was undoubtedly owing to an escape of this gas from the bottom of the well.

when brought into contact with red hot iron for any length of time becomes decomposed, it deposits either a portion, or even the whole of its carbon, and becomes converted, in the former case, into marsh gas, in the latter into hydrogen, both of which give out but little light when burning. From these considerations it becomes apparent that dry coal should be used, that it should be heated as rapidly as possible, and the process not continued beyond five hours.

The retorts have been the subject of great improvements as regards their shape, nature and arrangement. The old cylindrical iron retorts have given place to flat-bottomed or even kidney-shaped ones, clay vessels have been introduced to save the destruction of the iron, and an arrangement which seems to be perhaps the best is a combination of both plans. Seven clay retorts are heated by a fire placed in the centre of them, the flames play round these vessels and descending heat five iron retorts. It is found that the metal is thus much less acted upon than according to the old plan. According to Lowe's patent one-half of the retort only is charged at one time, and openings are made at each end: the halves are charged alternately. The propriety of this arrangement seems doubtful, owing to the ready decomposition of olefiant gas when in contact with a strongly heated surface as already mentioned. According to Croll's patent one half of the retort is charged with coal, the other half with coke, when the coke becomes red hot, steam is driven in (15 lbs. of water to 1 ton of Newcastle coal) which passing over the red hot coke and becoming decomposed mixes with the gas arising from the coal. The rationale of this process will be mentioned hereafter.

The purification of the gas is perhaps the most important part of the process, and is even, at the present day, constantly undergoing some improvement. The gas as evolved from the retorts contains, among others, the following gases:—Olefiant gas, light carburetted hydrogen (marsh gas,) carbonic oxide and hydrogen. The three latter are, in point of illuminating power, nearly useless, although they may perhaps serve as a diluent for the otherwise too powerful olefiant gas; their removal, therefore, from the mixture would probably not be advisable, even if it were possible.

There are other substances, however, in the mixture, which if allowed to remain would be positively injurious, such as carbonic sulphurous and muriatic acids, sulphocyanogen, sulphuretted hydrogen and ammonia; of these, the first five may be perfectly removed by means of the lime purifiers, whether they be in a free state or combined with ammonia, but this latter substance itself will still remain, and has to be removed by some other contrivance. As the simplest, and perhaps most economical, may be mentioned the use of sulphuric acid, (Croll's patent) the gas either before or after its entrance into the lime purifiers, is passed through dilute sulphuric acid, the ammonia remains behind in combination with the acid, forming a salt (sulphate of ammonia) which is exceedingly valuable as a manure, and has lately been strongly recommended for many horticultural purposes. The quantity of salt thus obtained is not inconsiderable, inasmuch as the gas contains about $\frac{1}{350}$th of ammonia. The gas is stated to be very much improved by the separation of ammonia in several respects; firstly, its illuminating power is increased 5 per cent; and secondly, its corrosive action on brass or copper, jets and pipes is materially diminished. Moreover, by the previous removal of the ammonia, the lime used in the purifiers does not acquire so disagreeable a smell as when not thus treated. Besides the foregoing patented process of Croll, there are numerous others for the removal of ammonia from coal gas, all depending upon bringing it into contact with some substance which may either combine directly with it, or else by a decomposition may effect its removal. For instance, bone dust dissolved in oil of vitriol is sometimes used, yielding a most valuable manure. Various acids, and even neutral salts, (for instance, the common green vitriol, or sulphate of iron) are recommended in Johnson's patent. Philippi and Mallet recommended salts of manganese, which can be obtained in large quantities from the residues in bleaching works. Croll uses sulphurous acid as a purifier, by which rather large quantities of sulphur are obtained; but in all these processes it is still necessary to employ either a wet or a dry lime purifier before the gas is rendered fit for use. The residue from the lime vats has a most detestable smell, and is scarcely to be recommended for agricultural purposes until it has either been roasted, or exposed for a length of time to the atmosphere.

An exceedingly curious and ingenious process has been patented by Mr. Laming by which the purification of the gas is effected by the chemical action of its own impurities on materials which do not require to be renewed at such short periods as is the case with lime. A solution of the chloride of iron is mixed with either lime or chalk, sawdust is then added, and thus a porous mass is prepared in which after exposure to the air, the principal and active ingredients are lime, peroxide of iron, and muriate of lime. The sulphuretted hydrogen is absorbed by the oxide of iron and sulphuret of iron formed, carbonate of lime is also produced, and according to Mr. Laming muriate of ammonia likewise, although the chemical process which effects this formation does not seem to be very clearly made out in his description.

The mixture absorbs the impurities very perfectly, and possesses this advantage, that on being exposed to the atmosphere it has no disagreeable smell, but becomes rapidly oxidized, the sulphuret of iron passing into sulphate, which salt is again decomposed by the chalk, (carbonate of lime) and thus the mixture of itself returns to its original condition, viz., peroxide of iron and chalk. After being used a number of times the salt of ammonia accumulates to such an extent as to impede its action, in that case it only needs to be washed well, in order to restore to the mixture its original efficacy.

*(To be Continued.)*

**Remarks on Thermometric Registers; by Capt. J. H Lefroy, R. A., F. R. S.**

One of the first physical enquiries to which the attention of the occupants of a new country is naturally directed, seems to be, in almost every case, the Temperature of the Air; and this choice is justified, not only by the intimate personal concern we all have in that question, but also by the circumstance that the greater part of the other phenomena of the weather, that is, of meteorology in relation to the business of life, depend more or less immediately upon it. And there is a particular interest in all such observations as date from that great epoch in the physical history of a country, in which it first becomes the abode of civilized man. It then begins to undergo those superficial changes which his industry toils to effect. From such observations must be taken, at a future period, the data for a number of refined enquiries of the greatest interest. By reference to them we learn, or ought to learn, whether we can bring about changes of climate by human agency: whether such changes are always beneficial, and therefore in harmony with the design of the Universe: or sometimes noxious, and therefore in favour of the opinion that there are pre-ordained bounds to the extension of civilized man over the Globe: if we may credit Father Huc, the first result of the extension of Chinese industry into Independent Tartary, has been to render the country uninhabitable: may no such result follow the invasion of Canadian woods by British ploughs, but thus we learn that such a thing is within the bounds of possibility. Again, inseparably connected with the settlement of a country, is the gradual disappearance of whole classes of the animal kingdom. The wolf, the bear, and the beaver have disappeared from Great Britain: the last public reference to the latter, as among the *feræ naturæ* of the British Isles is, as we learn from Mr. Daniel Wilson, in an act of King David I. of Scotland, A. D. 1124; less than a century will doubtless see the extinction of the same species, and some others in Canada; but that which British naturalists and geologists cannot now determine by direct evidence, namely, whether a corresponding change of climate has occurred, may be determined by our posterity if we will only take a little trouble in the matter. And let me not be met here by the old, but ingenious objection, that we are not bound to do anything for posterity since posterity does nothing for us. Posterity does something for us. With posterity lie the hopes and aspirations which are a part of the present rewards of life: it is the guardian of our dearest interests, and we can no more disconnect ourselves from the future than from the past. However, in our circumstances it is not altogether necessary to resort to this argument to justify a reference to the present imperfect state of observation in Canada with a view to its improvement. We have, so to speak, side by side, in this extensive country, the twelfth and nineteenth century. The rude beginnings of settlement, where man shares the soil with the wildest natives of the forest, and nothing has as yet occurred to affect the physical conditions of a state of nature; and the fully developed empire of his industry, where all the local changes likely to occur are already wrought out. Can there be no comparison made between these conditions? It is perfectly possible, but unfortunately the materials do not exist.

Let us suppose the admirable example of the States of New York, Ohio and Massachusetts, to be followed by the Canadian Legislature, or, as it may be, by the different District Councils, in the appropriation of a sufficient sum to supply each District Grammar School throughout the country with accurate meteorological instruments; and that a careful register is kept at each. There would then be about twenty points, in addition to those already existing, at which the mean temperature for every month of the year would in a few years be known, and they would be connected with a large number of stations in the States just named. Situated, as they would be, at various elevations above the sea, a correction would be requisite to reduce them to the same plane, and possibly, also, other corrections; but these applied, we should have a series of stations which ought to furnish, with great precision, the curves of equal monthly temperature, or the *isothermals*, as they are termed, of the respective months, in this region of the American continent. It would be not a little curious and interesting to see these lines when drawn on the map, varying their configuration, as they would probably do, if the observations were perfectly good, according to the character of the country through which they might pass. To see, for example, those belonging to the winter months bending to the north, and those belonging to the summer months bending to the south, when they emerged from an uncleared to pass through a well settled district; to see in like manner the lines connecting places having an equal annual fall of rain or snow, deflected from a symmetrical course by large areas of forest interpolated between thriving settlements and open spaces. What the singular discovery of the very thermometers used by Galileo, and their comparison with modern instruments, has *not* shewn, because Italy has long ago attained its permanent climatic condition, namely, the effect of two centuries of improvement, might thus very possibly be disclosed to our view in a dozen years, nor could any one capable of the pleasure arising from the contemplation of natural laws and operations fail to derive it here. It would be easy, but is probably not necessary, to name other reasons why accurate observations of the thermometer would be highly valuable. I pass therefore, at once, to the question as to what is necessary to give observations this character.

Almost every house possesses a thermometer, in very many cases some sort of regular register is kept. A good many of these registers, sooner or later, get printed. Can anything more be required? Alas! a great deal; nine out of ten of all such amateur registers are not only worthless, but mischievous and deceptive, owing to the neglect of two simple precautions at the outset. First,—To get a good instrument: Secondly,—to establish it in a proper position.

1. *Of Thermometers.*—The common instruments purchased for five or ten shillings at hardware shops, are entirely unfit for our purpose, on the grounds of inaccuracy and want of sensibility. The best form of thermometer is one in which the bulb is cylindrical, or at least elongated, not globular, and blown extremely thin; each degree, at least, should be marked on the scale; in the best instruments the degrees are subdivided; the graduation for general Canadian use should extend from —30° to +110°: in Lower Canada it may occasionally be necessary to employ a thermometer graduated below —30°: mercury thermometers are preferable to those in which the fluid is alcohol, from the property which the metal possesses of varying in volume almost exactly in proportion to the variations of temperature, such is not the case with alcohol, which is also subject to chemical changes capable of affecting its volume. The expansion of these fluids between the freezing and boiling point of distilled water, the latter, under a barometric pressure of 29.992, (760 millimetres) is as follows:—

| | | | |
|---|---|---|---|
| Mercury | $\frac{1}{55.5}$ = 0.018018 | Dulong and Petit. |
| " | $\frac{1}{55.09}$ = 0.018153 | Regneault. |
| Alcohol | $\frac{1}{9.0}$ = 0.111 | |

the volume of each at the freezing point of water being taken as unity. The expansion of volume for one degree will be in proportion, according to the scale we employ, and from these values may be calculated the dimensions which the bulb of the thermometer must have to render expansions of any degree of minuteness, which may be required, visible in the tube. In making standard thermometers of the highest character, the first step is to select a piece of glass tube, and to introduce it into a very small quantity of mercury, filling about half an inch of its length. By blowing gently through a flexible tube, this portion of mercury is made to move onwards in successive steps each of its own length. Should there be any inequalities in the bore of the tube, as is usually the case, the same quantity of mercury will occupy sometimes a longer sometimes a shorter space; the exact space it occupies is measured with all the precision possible in each position, marked on the tube, and afterwards subdivided as much as may be necessary. The scale is thus divided according to *equal capacities of the bore*, a circumstance obviously essential to the accuracy of the instrument. A bulb being next blown on to the tube the thermometer is finished in the usual way. The next point is to determine the value of the divisions on the tube in terms of Fahrenheit's or any other scale. This is done by first immersing the instrument in a mixture of crushed ice with water, and noticing by the aid of a telescope, from a distance, the exact division at which the mercury stands; then suspending the instrument in a vessel of peculiar construction over boiling water, and noticing in the same way the division at which it stands when the air has been completely expelled from the vessel, and it is filled with steam whose elasticity is represented by the barometric pressure at the moment. The temperature of such steam reduced, if necessary, to the standard barometric pressure, is the physical constant which philosophers have agreed to refer to for the upper fixed point on the scale, that of freezing water being the lower fixed point; but there is a slight discrepancy in the data used in England and in other countries. The standard barometric pressure is 29,800 inches in England, measured on a brass scale having a temperature of 62°, and 29,922 inches in France, measured on a brass scale having a temperature of 32°:

the temperature of the mercury is supposed to be 32° in both cases. 29,800 inches at 62° is but 29,791 inches at 32°, there is consequently a real discrepancy of 0,131 inch between the standard barometric pressure in the two countries, and trifling as this quantity may appear to be, it makes the French boiling point nearly a quarter of a degree Fahrenheit higher than the English (0°.24), and like the use of different scales and measures, is one of the anomalies in science which it may be hoped will be removed at no distant day. Let us suppose then that the mercury in a thermometer, graduated as described, stands at 115.7 divisions in ice, and at 616.9 in steam of the standard elasticity. Then, if Fahrenheit's scale be adopted, we have 501.2 divisions to represent 180 degrees, whence each division =0°.2784 Fahrenheit, and the exact temperature corresponding to any division is known. The term *standard thermometer* is improperly applied to any instrument which does not extend from the freezing to the boiling point, and of which the perfect equality of the subdivision has not been established, it is however commonly applied to instruments on which unusual pains have been bestowed, and which have been compared with a true standard. Thermometers manufactured and sold by wholesale have not the slightest pretensions to this character. It is essential that every observer should verify for himself, at least the freezing point marked on the scale of his instrument, by immersing it in pounded ice and water, up to the division 32° on the scale. The best instruments will frequently deviate a little from the truth, owing to a change which the capacity of the bulb undergoes in course of time, the cause of which is still very obscure; an error of one or even two degrees is by no means extraordinary in common instruments. In Canada it is chiefly the graduation below the freezing point which the observer has to suspect, and it is desirable where a standard thermometer cannot be referred to for comparison, to test an instrument by immersing it in a mixture of 1 part common salt, 2 parts snow, thoroughly mixed together and stirred up in a deep cup, when it should sink to —4°; this temperature is however not absolutely constant like the others, but sufficiently so for a useful practical test in the absence of better means. The observer should not in these experiments trust to a single reading, but take a considerable number, with an interval of a minute between them. The cup itself may be placed in an exterior vessel filled with snow. Thermometers are not in general much in error at the summer temperatures.

*(To be continued.)*

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## On the Physical Lines of Magnetic Force; by Prof. Faraday.

On a former occasion, certain lines about a bar magnet were described and defined (being those which are depicted to the eye by the use of iron filings sprinkled in the neighbourhood of the magnet,) and were recommended as expressing accurately the nature, condition, direction, and amount of the force in any given region either within or outside of the bar. At that time the lines were considered in the abstract. Without departing from or unsettling anything then said, the enquiry is now entered upon of the possible and probable *physical existence* of such lines. Many powers act manifestly at a distance; their physical nature is incomprehensible to us: still we may learn much that is real and positive about them, and amongst other things something of the condition of the space between the body acting and that acted upon, or between the two mutually acting bodies. Such forces are presented to us by the phenomena of gravity, light, electricity, magnetism, &c. These when examined will be found to present remarkable differences in relation to their respective lines of forces; and at the same time that they establish the existence of real physical lines in some cases, will facilitate the consideration of the question as applied especially to magnetism. When two bodies, *a*, *b*, gravitate towards each other, the line in which they act is a straight line, for such is the line which either would follow if free to move. The attractive force is not altered, either in *direction* or *amount*, if a third body is made to act by gravitation or otherwise upon either or both of the first two. A balanced cylinder of brass gravitates to the earth with a weight exactly the same, whether it is left like a pendulum freely to hang towards it, or whether it is drawn aside by other attractions or by tension, whatever the amount of the latter may be. A new gravitating force may be exerted upon *a*, but that does not in the least affect the amount of power which it exerts towards *b*. We have no evidence that *time* enters in any way into the exercise of this power, whatever the distance between the acting bodies, as that from the sun to the earth, or from star to star. We can hardly conceive of this force in one particle by itself; it is when two or more are present that we comprehend it: yet in gaining this idea we perceive no difference in the character of the power in the different particles; all of the same kind are *equal*, *mutual*, and *alike*. In the case of gravitation, no effect which sustains the idea of an independent or physical line of force is presented to us; and as far as we at present know, the line of gravitation is merely an ideal line representing the direction in which the power is exerted. Take the sun in relation to another force which it exerts upon the earth, namely, its illuminating or warming power. In this case rays (which are lines of force) pass across the intermediate space; but then we may affect these lines by different media applied to them in their course. We may alter their direction either by reflection or refraction; we may make them pursue curved or angular courses. We may cut them off at their origin, and then search for and find them before they have attained their object. They have a relation to *time*, and occupy eight minutes in coming from the sun to the earth: so that they may exist independently either of their source or their final home, and have in fact a clear distinct physical existence. They are in extreme contrast with the lines of gravitating power in this respect; as they are almost in respect of their condition at their terminations. The two bodies terminating a line of gravitating force are alike in their actions in every respect, and so the line joining them has like relations in both directions. The two bodies at the terminals of a ray are utterly unlike in action; one is a source, the other a destroyer of the line; and the line itself has the relation of a stream flowing in one direction. In these two cases of gravity and radiation, the difference between an abstract and a physical line of force is immediately manifest. Turning to the case of static electricity we find here attractions (and other actions) at a distance, as in the former cases; but when we come to compare the attraction with that of gravity, very striking distinctions are presented which immediately affect the question of a physical line of force. In the first place, when we examine the bodies bounding or terminating the lines of attraction, we find them as before, mutually and equally concerned in the action; but they are not alike: on the contrary, though each is endued with a force which, speaking generally, is of the like nature, still they are in such contrast that their actions on a third body in a state like either of them are precisely the reverse of each other,—what the one attracts the other repels; and the force makes itself evident as one of those manifestation of power endued with a dual and antithetical condition. Now with all such dual powers, attraction cannot occur unless the two conditions of force are present and in face of each other through the lines of force. Another essential limitation is, that these two conditions must be exactly equal in amount, not merely to produce the effects of attraction, but in every other case; for it is impossible so to arrange things that there shall be present or be evolved more electric power of the one kind than the other. Another limitation is, that they must be in physical relation to each other; and that when a positive and a negative electrified surface are thus associated, we cannot cut off this relation except by transferring the forces of these surfaces to equal amounts of the contrary forces provided elsewhere. Another limitation is, that the power is definite in amount. If a ball *a* be charged with 10 of positive electricity it may be made to act with that amount of power on another ball *b* charged with 10 of negative electricity; but if 5 of its power be taken up by a third ball *c* charged with negative electricity, then it can only act with 5 of power on ball *a*, and that ball must find or evolve 5 of positive power elsewhere: this is quite unlike what occurs with gravity, a power that presents us with nothing dual in its character. Finally, the electric force acts in curved lines. If a ball be electrified positively and insulated in the air, and a round metallic plate be placed about 12 or 15 inches off, facing it, and uninsulated, the latter will be found, by the necessity mentioned above, in a negative condition; but it is not negative only on the side facing the ball, but on the other or outer face also, as may be shown by a carrier applied there, or by a strip of gold or silver leaf hung against that outer face. Now, the power affecting this face does not pass through the uninsulated plate, for the thinnest gold leaf is able to stop the inductive action, but round the edges of the face and therefore acts in curved lines. All these points indicate the existence of physical lines of electric force:—the absolutely essential relation of positive and negative surfaces to each other, and their dependence on each other contrasted with the known mobility of the forces, admit of no other conclusion. The action also in curved lines must depend upon a physical line of force. And there is a third important character of the force leading to the same result, namely, its affection by media having different specific inductive capacities. When we pass to dynamic electricity, the evidence of physical lines of force is far more patent. A voltaic battery having its extremities connected by a conducting medium, has what has been expressly called a current of force running round the circuit, but this current is an axis of power having equal and contrary forces in opposite directions. It consists of lines of force which are compressed or expanded according to the transverse action of the conductor, which changes in direction with the form of the conductor, which are found in every part of the conductor, and can be taken out from any place by channels properly appointed for the purpose; and nobody doubts that they are physical lines of force. Finally as regards a magnet, which is the object of the present discourse. A magnet presents a system of forces perfect in itself, and able, therefore, to exist by its own mutual relations. It has the dual and antithetic character belonging to both static and dynamic electricity; and this is made manifest by what are called its polarities, *i. e.* by the opposite powers of like kind found at and towards its extremities. These powers are found to be absolutely equal to each other; one cannot be changed in any degree as to amount without an equal change of the other; and this is true when the opposite polarities of a magnet are not related to each other, but to the polarities of other magnets. The polarities, or the *northness* and *southness* of a magnet, are not only related to each other, through or within the magnet itself, but they are also related externally to opposite polarities, (in the manner of static electric induction) or they cannot exist; and this external relation involves and necessitates an exactly equal amount of the new opposite polarities to which those of the magnet are related. So that if the force of a magnet *a* is related to that of another magnet *b*, it cannot act on a third magnet *c* without being taken off from *b*, to an amount proportional to its action on *c*. The lines of magnetic force are shown by the moving wire to exist both within and outside of the magnet; also they are shown to be closed curves passing in one part of their course through the magnet; and the amount of those within the magnet at its equator, is exactly equal in force to the amount in any section including the whole of those on the outside. The lines of force outside a magnet can be affected in their direction by the use of various media placed in their course. A magnet can in no way be procured having only one magnetism, or even the smallest excess of northness or southness one over the other. When the polarities of a magnet are not related externally to the forces of other magnets, then they are related to each other: *i. e.* the northness and southness of an isolated magnet are externally dependent on and sustained by each other. Now, all these facts, and many more, point to the existence of physical lines of force external to the magnets as well as within. They exist in curved as well as in straight lines; for if we conceive of an isolated straight bar magnet, or more especially of a round disc of steel magnetized regularly, so that its magnetic axis shall be in one diameter, it is evident that the polarities must be related to each other externally by curved lines of force; for no straight line can at the same time touch two points having northness and southness. Curved lines of force can, as I think, only consist of physical lines of force. The phenomena exhibited by the moving wire confirm the same conclusion. As the wire moves across the lines of force, a current of electricity passes or tends to pass through it, there being no such current before the wire is moved. The wire when quiescent has no such current, and when it moves it need not pass into places where the magnetic force is greater or less. It may travel in such a course that if a magnetic needle were carried through the same course, it would be entirely unaffected magnetically, *i. e.*, it would be a matter of absolute indifference to the needle whether it were moving or still. Matters may be so arranged that the wire when still shall have the same diamagnetic force as the medium surrounding the magnet, and so in no way cause disturbance of the lines of force passing through both; and yet when the wire moves, a current of electricity shall be generated in it. The mere fact of motion cannot have produced this current: there must have been a state or condition around the magnet and sustained by it, within the range of which the wire was placed; and this state shows the physical constitution of the lines of magnetic force. What this state is, or upon what it depends, cannot as yet be declared. It may depend upon the ether, as a ray of light does, and an association has already been shown between light and magnetism. It may depend upon a state of tension, or a state of vibration, or perhaps some other state analogous to the electric current, to which the magnetic forces are so intimately related. Whether it of necessity requires matter for its sustentation will depend upon what is understood by the term *matter*. If that is to be confined to ponderable or gravitating substances, then matter is not essential to the physical lines of magnetic force any more than to a ray of light or heat; but if in the assumption of an ether we admit it to be a species of matter, then the lines of force may depend upon some function of it. Experimentally, mere space is magnetic; but then the idea of such mere space must include that of the ether, when one is talking on that belief; or if hereafter any other conception of the state or condition of space rise up, it must be admitted into the view of that which, just now, in relation to experiment, is called mere space. On the other hand, it is, I think, an ascertained fact that ponderable matter is not essential to the existence of physical lines of magnetic force.—*Athenæum.*

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**Canada in 1852: Extract from Notes on Public Subjects, by Hugh Seymour Tremenheere.**

Let any one who has considered these Provinces thus far now glance for a moment at their great and flourishing towns; Hamilton, beneath a bold escarpment and enfolding hills richly covered with the primeval forest; the undulating plain on which it stands diversified with foliage, cultivation and villas; the inlet from the Lake, which forms its harbor, presenting an agreeably varied outline; the villas generally in a thoroughly correct style of architecture, and surrounded by grounds as well kept and as neat as art and care can make them; the streets wide, the houses substantial, the public buildings creditable, the shops and wholesale warehouses showing every sign of a thriving and exuberant trade. Toronto, spreading over a wide and gently rising plateau on the Lake shore, handsomely built, increasing most rapidly, possessing public buildings which in dimensions, in correctness of taste, and in solidity of construction, are surpassed by few of a similar kind in the second rate towns in England; its wealth steadily accumulating, under perhaps the comparatively slow but certain course of the strict business principles and mercantile honor of the "old country"; its numerous neat and well kept villas, and houses of larger pretensions attached to considerable farms at a further distance from the town, attesting the effect of the process. Kingston, also showing signs of prosperity and progress; distinguished, even among the towns in Canada, for the grandeur and correctness of design of its public buildings (market houses, public offices, &c.); occupying an important position at the head of the Rideau Canal; guarded by its strong fort, which combines in the landscape with the varied outline of the town, the inlet forming the small dockyard, the woody islands and the surrounding country. Montreal, alive with commerce, pleasing the eye with the graceful forms of the hills around; some of its old narrow and somewhat picturesque streets reminding one of Europe; its public buildings erected and in progress, equally substantial and creditable. Quebec, with its undying interest, its beauty of position and outline, its crowd of masts along its wharfs, its fleets at anchor below the citadel, or in the "Timber coves" beneath overhanging cliffs and foliage, its quaint old streets, its imposing fortifications, and its busy population.

Let all these circumstances be weighed; the great natural resources of these provinces, the energy now at work in developing them, the inducements thereto held out by the home growth of a consuming population and by the expanding facilities of transport either to the home or to the foreign markets; and it will be seen how extensive a field is there opening for the still further employment of British Capital and labor.

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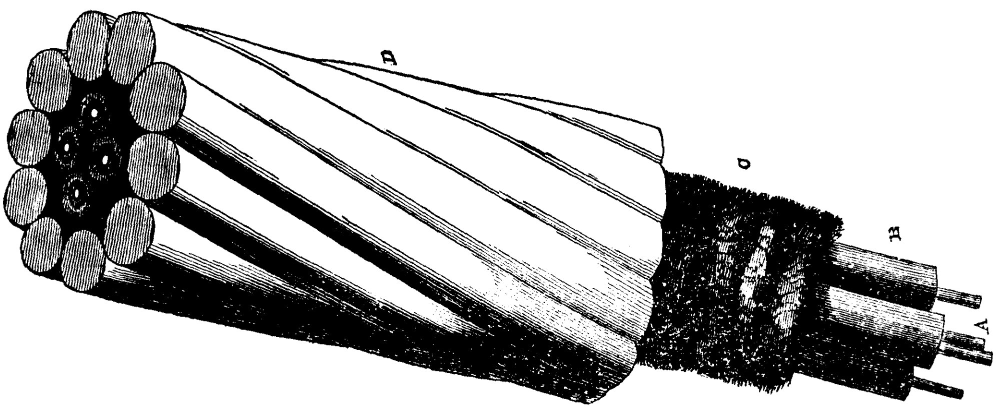
The respect and admiration I conceived for that splendid colony on seeing it from one end nearly to the other, were in no wise diminished by what I witnessed or heard of the French Canadian portion of it; nor were the anticipations of its future progress in any degree lessened. And should any one in this country be disposed to undervalue it, either in itself or as "part and parcel" of the British dominions, I would beg him to go and pass through the length and breadth of that favored and magnificent land. Let him picture to himself its thirty millions of acres of soil, than which finer and richer never came from the beneficent hand of nature; let him survey that splendid river, bearing to the ocean vessels that have navigated its parent water for two thousand miles; let him examine its Canals—those noble works of skill and science that have as it were smoothed the rapid and made a stepping stone of the rocky ridge that throws Niagara over its brow; let him walk through those towns on the margin of those lakes and that river—towns which wealth has already decorated, and which a sober and correct taste, and solid comfort and convenience, have already stamped with a thoroughly English character. Let him then look at the varied and in some parts picturesque scenery, either glowing in the hot summer's sun, or arrayed in the gorgeous tints of an American Autumn, or reposing under the bright and silent winter's sky. Let him see the many and various fruits of the earth pouring into those towns daily, as from the very lap of plenty. Let him think of the genuine English feeling, grounded on the participation of British freedom with the pride of British origin, which pervades the land; and the no less deep and elevated sentiments of French nationality, with which, in singular and beautiful union, a chivalrous loyalty to our Queen is mingled as the colors in a prism, distinct yet united. Let him see and consider these things, and then ask himself if that is a country of which to speak lightly, as one that may possibly be torn, or may one day fall away from the British Crown!

## The Irish Submarine Telegraph.

The success of the Electric Telegraph would have been greatly circumscribed, if means had not been found of passing the electro-current under water. Intelligence would have been transmitted swiftly over continents, and arrested by narrow channels. The instruments of perfecting important discoveries sometimes appear along with the invention. The electro current can be conveyed beneath water by the aid of gutta percha, and this singular material came into the western markets at the precise time when it was required to accomplish this work. The wires of the Electric Telegraph, when stretched on poles by the side of railways, according to the common practice in this country, are wires, although that is entirely imaginative; but, in the case of the subterranean telegraph, information of an evil deed seems to spring out of the earth. But the telegraph has other, more common, and more important purposes to serve, than that of a police assistant. It is not always charged with messages of evil. It carries all the more important missives of the age, and if it ever brings a tale of danger of war, it will as often convey the glad tidings of safety and of peace. Its operations and tendencies are all on the side of inter-national friendships and amity, for it utterly annihilates distance, in one respect, and will maintain yet hourly communications between the most distant regions of the earth

independent of gutta percha; but when they are carried through tunnels, its aid is necessary. The aerial telegraph, although common in Britain, is not universally used. The subterranean system is chiefly practised in Germany. We suspend the wires on poles, and the Prussians cover them up in a trench. The idea of messages overtaking railway trains, passing them with inconceivable rapidity, and preparing for travellers an unwelcome reception at the end of their journey, has become a frequent subject of sentimental writing. It is not quite so startling as those underground messages transmitted with equal rapidity. As the train hurries over the line, the traveller has leave to imagine that his eye detects a slight tremulousness in neighbouring But deep, wide oceans intervene between them, and neither the English nor the German systems of telegraphing are practicable on them. Science had not material whereby to throw a bridge with poles and wires over the Atlantic, while the subterranean system seemed at least equally improbable. The latter, however, afforded suggestions for a subaqueous telegraph. The insulation and protection of the telegraph wires were requisite in the subterranean system, and were fully afforded by gutta percha. The wires had been covered by that strange gum, extracted from an eastern tree, and while this covering did not interfere with the transmission of messages, it effectually shielded the swift messenger on the journey, or perhaps we should describe it with more propriety as the shield of the fragile highway on which that messenger travels. Even scientific men do not always perceive the more obvious facts connected with the matter on which they operate; and, in the first instance, subaqueous telegraphs were proposed of wire, coated with gutta percha alone. That material possesses great powers of resistance; but yet, placed beneath the ocean, sunk a hundred fathoms, or any other number of fathoms deep, and chafed against rocks, even the wrecks of vessels, or many other substances, it would fail. The wire coated with gutta percha was even, we believe, thrown over the British channel, but it did not maintain the communication for more than twenty-four hours. It was now clear that the gutta percha would protect the wires of the subaqueous telegraph, if it could be itself secured against the rough handling which all invading substances experience at times from the ocean. The latter object has been effected by galvanized wires twisted in a spiral form round the gutta percha case, in which a copper wire is enclosed. The telegraph across the channel to the French coast was put down in the month of September last. It has now been in operation from ten to eleven months, and the insulation of the wire is so complete that the communication has been steadily maintained. In June last, a telegraph line was thrown over the Irish channel from Holyhead to Howth. The distance between these points is full sixty miles, and the coast on both sides "rocky and rough." The agitation in favour of an Irish Atlantic steam-packet port caused considerable excitement on telegraphic matters. Wires could easily be suspended from Dublin to Galway along the line of railway; and the difficulties of the channel once overcome, intelligence received on the west coast of Ireland might be transmitted to London with great rapidity. The absolute transmission, if the line were not broken by intervening stations, can scarcely be measured by time. The messenger would not require a second on the way over the wild Irish bogs, which are to be converted into gold, and over the wilder fertile lands of that country, which require no such conversion; for they are already more valuable than gold itself—down beneath that deep and often stormy channel—past the busy towns of the north-west of England, and over all the breadth of the land from Holyhead to Lothbury or Charing-cross. The Irish telegraph would be formed,—that fact was unquestionable after the completion of the French line. Rival companies were, therefore, anxious for the work, and those who carried over the first intelligence were likely to be successful in preserving the business.

The channel between Holyhead and Howth is over sixty miles in breadth, and Howth itself is at a considerable distance from Dublin. The cost of prepared wires must be very heavy; and where a choice can be readily obtained, the narrow crossing of any channel will probably be adopted. The crossing between Portpatrick on the Scottish coast, and Donaghadee in the neighbourhood of Belfast, is not much over twenty miles. The channel is narrowed to little more than ten miles between the western corner of Argyleshire and the eastern extemity of Antrim; but the telegraphic wire would have to be carrried by land for many miles from Glasgow to the point nearest to Ireland on the Argyleshire coast, and again on the Irish coast towards Belfast for a shorter distance, but still one more considerable than from Donaghadee. A company was therefore formed to connect the British and Irish coast from Portpatrick. They have adopted the subterrraneous system from Dumfries onwards through a great breadth of country, forming the south-western shoulder of Scotland onwards to the coast. Upon the Irish shore the Belfast and County Down Railway does not come within ten miles of Donaghadee, and for that distance the railway will render no aid to the telegraph. These operations necessarily occupied considerable time, and, although now completed, yet other parties, by a decided step, telegraphed the wider channel between Holyhead and Howth, while the northern company were digging trenches. One day a gentleman called at the Gutta Percha Company's works, in London, and inquired if they could supply him with one wire, double covered with gutta percha, and eighty miles long, within two weeks. The question was somewhat startling, for the order, taken in connexion with the time for its performance, was out of the common line of business. It was however, accepted, and it was accomplished. Of course the company cover telegraphic wires with gutta percha as part of their business, while their customer probably wished to keep his own secret, and so their department was completed, and the work for some time, and re-covered at works in Newcastle on Tyne, with galvanized wires, before they were made acquainted with its destination. This was the first telegraphic wire which crossed the Irish channel and it wrought well for some time. We have learned, however, that it has been broken, and is irreparable. The report has caused considerable anxiety among commercial men in reference to sub-marine telegraphs; but the circumstances show nothing against them. Even if wires of the description employed should be altogether unsuccessful, the communications will still be formed and maintained. The first engraving shows accurately the form and size of the wire from Holyhead to Howth.



The telegraph wire is insulated within a double covering of gutta percha, and the latter is protected by twelve very small galvanised wires twisted around it in a spiral form. The rope is only of the thickness represented in the engraving, and has a fragile or rather weak appearance for the rough kind of work between Holyhead and Howth.

The villagers of Donaghadee and Portpatrick had long been interested in the intercourse between the two islands. Neither of these places had a natural harbour. The shelter afforded by them for shipping had been almost entirely cut out of rocks. The current in their great ferry resembled "a mill race." The water seemed ever to be in haste to get in, or else to get out and away again, between the narrow points of land where Scotland and Ireland struggle to meet. Immense sums of money, which we should not like to count over, have been expended on this passage, for the benefit of Donaghadee, and Portpatrick in particular, and the world at large, in a more general way. When railways and steam navigation changed this "ferry" a few years ago, the villagers on both sides considered themselves very badly used indeed, by science. They offer a practical example of the propriety of people trusting to the "march of improvement," and waiting on. Another stage promised to restore and secure the more interesting part of the communications between the countries to its old channel. The two villages were to link together—not only two islands—but the eastern and western divisions of the earth. Then, with this renewal of their hopes, came the Holyhead and Howth competition to destroy them. Now, however, the reported destruction of the rival communicating wire has given new confidence to Donaghadee and Portpatrick, and the wiser class of persons in the two quiet villages say that people cannot expect profitably to cross the plans of nature—one of these plans being decidedly in their favour.

A more important section of the community express fears that the submarine lines of communication will always be liable to stoppages, and, from the destruction of wires, will become unreasonably expensive. Neither party have any ground for the opinions of the one, or fears of the other, in any event which has yet occurred. The second engraving, when contrasted with the first, will convey a better idea of what the Holyhead wire should have been, what the Dover one is, and the Donaghadee one, as we believe, will be, than any statement of the differences between them which we could make.

The telegraph in this instance consists of four wires. Each wire is separately insulated in a double covering of gutta percha. The double coating has been adopted to prevent the probability of imperfections in the material. The scheme completely obviates that risk; for it is highly improbable that the deficiency would occur in both coverings at the same point. The four wires, distinguished by the letter A in the engraving, being insulated by the gutta percha B, are not brought into contact with the protecting wires; but are wrapped up with spun yarn, saturated in tar, which protects them from the galvanized wires D. Ten of these wires, of considerable strength and thickness, are twisted round the tarred yarn, which covers the gutta percha in which the four conducting copper wires have been insulated. The adoption of the spun yarn as a covering or shield to the gutta percha, prevents the possibility of accident, from the latter being chafed by the wires. The probability of that accident is not great, but still it exists. We have seen part of a telegraphic wire absolutely twisted into the shape of a knot, while still the gutta percha, faithful to its important trust, maintained perfect the insulation of the copper wire. The galvanized wires in the rope which has maintained the communication with the French coast for the past ten months are very strong; and while the weight of the first specimen was only one ton per mile, the weight of the specimen on that station in actual use, is fully seven tons per mile.

The differences between the two telegraphs are thus apparent. The successful telegraph contains four wires, each doubly covered with gutta percha, wrapped in yarn carefully tarred and twisted round with ten thick galvanized wires, forming a rope of $1\frac{1}{2}$ inches of diameter, and weighing over seven tons per mile. The unsuccessful telegraph contains only one wire, also doubly covered with gutta percha, but not wrapped in yarn, and with its covering of twelve thin galvanized wires, not more than $\frac{1}{2}$ inch in diameter, and one ton per mile of weight.

The galvanized wires are unnecessary as a protection of gutta percha against the influence of ocean water; for we have seen very thin gutta percha netting immersed for five years in brine, but still as firm and tough as on the day of its manufacture. It is doubtful whether the material be not improved by the process.

We have heard that some extensive coils of telegraphic wire, in the form of the second illustration—the successful wire—have been ordered, and are now in preparation at the Gutta Percha Company's Works.

We infer, therefore, that we shall soon hear of more submarine telegraphs. When ten or twenty years have come and gone, a net-work of telegraphing will be laid under many seas, and carried over many lands. Intelligence will pass from nation to nation "quick as the lightning flash." This apparently feeble agency will help to break the barriers which separate mankind. And while it is evolving great benefits to commerce, the instrument which has rendered "subaqueous telegraphing" practicable should not be forgotten. The "savages," we are told, who gather this gum in the forests of oriental isles, and make it up in blocks for the market, put stones and other useless substances into these masses of professed gum, to increase their weight. The civilized are astonished that the "savages" should have learned to cheat. And yet the vice is natural. Kelp-burners sometimes try the same means of money-making. A kelp-owner told us that he was greatly distressed on the subject of Irish kelp, because it contained stones. Cheating is even practised among civilized persons. But if the "savages" are guilty of dishonesty in their gum-gathering, as their help in making submarine telegraphs is indispensable, an effort should be made to bring them out of their savage state. Their gutta percha has been a useful discovery to Europeans, who should try to make its discovery still more useful to the "savages."—*Expositor.*

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## South Wales Railway.

The South Wales Railway bids fair to become one of the great arteries of communication between London and several of the most important countries of the globe.

The terminus, at the best and safest harbour of the kingdom, Milford Haven, has already led to the formation of a company for constructing a class of steam vessels of a size, hitherto deemed impossible. The Eastern Navigation Company, guided by their scientific engineer, Mr. Brunel, we understand, contemplate vessels of 500 feet in length, and of a proportionate power, which will perform the voyage from Milford, *viâ* the Cape, to India in less time than is at present occupied by the overland mail. Other companies contemplate making their port at Milford, which is the most westerly harbour in the kingdom.

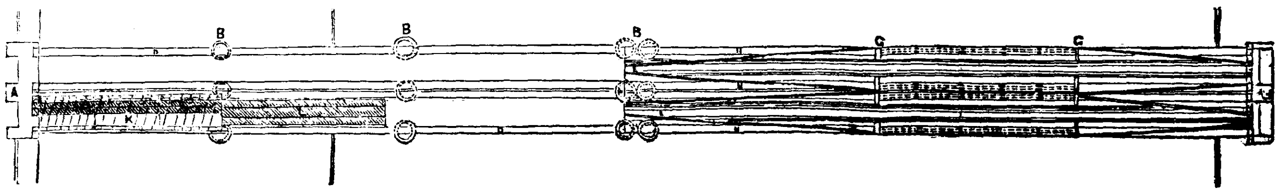
Hitherto an unfortunate break occurred at Chepstow, where passengers had to be conveyed about two miles over a rough country from station to station. On the 19th July this hiatus was abolished by the opening of the stupendous iron Bridge over the River Wye for public traffic; and we may now anticipate that the rich minerals of South Wales—its coals of every available description for steaming and household purposes—will be found in all the midland and London markets.

The railway having to cross a rapid navigable river without interruption to vessels, the Admiralty very properly required that the span over the mid channel should not be less than 300 feet; and that a clear headway of 50 feet above the highest known tide should be given. Bridges of this size are so rare that we propose to illustrate the present one in detail. These works require the highest effort of mechanical and constructive skill. Mr. Stephenson's magnificent Britannia bridge displays one method of crossing wide spans. The present work of Mr. Brunel's is another mode, and shows, as might have been expected, his peculiarly original and bold conception, accompanied by extraordinary economy, by arranging his materials in the form of a large suspended truss, and attaching the roadway to suspension chains kept in a state of rigidity by vertical trusses or struts inserted between the chains, and a circular wrought-iron tube, spanning the river, 309 feet in length.

The bridge is 600 feet long: there are three spans over the land of 100 feet each, which are supported upon cast-iron cylinders, 6 feet in diameter and $1\frac{1}{4}$ inch thick. These cylinders were sunk to an average depth of 48 feet, through numerous beds of clay, quicksand, marl, &c., to the solid limestone rock, which was found to dip at an angle of 45 degrees; it had, therefore, to be carefully levelled horizontally, and the cylinders bedded level. These cylinders were sunk by excavating within them, and pressing them down by heavy weights; in doing which very great difficulties were overcome—immense volumes of fresh water were tapped, requiring a 30 horse engine to pump them out. The quantity very much increased during high water, which rises 44 feet, and in many of the cylinders work had to be suspended until the tide receded. Although the Wye is a tidal river, and therefore salt, no salt water was found in these sinkings. Again, dangers arose from sudden and extensive irruptions of soft river silt, often bursting in with such rapidity that the men had hardly time to escape. Some of the strata were found covered with immense conglomerate boulders, indicating a former river bed. These having been overcome, the cylinders were filled with concrete, composed of Portland cement, sand and gravel, which set in a few days as hard as rock. The concrete is filled up to the level of the roadway, so that, should a cylinder decay, it might be taken out and replaced in sections in safety.

There are six cylinders at the west end of the main span: upon those, a standard or tower of cast-iron plates, fifty feet high, is erected. A similar tower of masonry is built at the east end, upon the edge of the rocky precipice of the Wye. Each roadway being perfectly separate, we will describe that which is now opened.

Fig. 1.




In the annexed diagram, (Fig. 2) the cylinders are B; the standard (E E E) having openings to admit the train to pass. On the west standard is a cross girder of wrought-iron (N) upon which the tubes (I) rest. The tube serves to keep apart and steady the towers; and to the ends of the tube are attached the suspending chains. Now, in an ordinary suspension bridge, the chains hang in a festoon, and are free to move, according to the limited weights passing under them; but this flexibility would be inadmissible in a railway bridge, and the continuity of the rail would be destroyed if a very small deflexion took place when passed over by a heavy locomotive. With a view to give this necessary rigidity, Mr. Brunel has introduced at every third part of the tube a stiff wrought-iron girder, connecting firmly the tube to the roadway girders; and, with the aid of other adjusting screws, the suspension chains are pulled or stretched as nearly straight as desirable. Other diagonal chains connect these points, so that at whatever part of the Bridge an engine may be passing its weight is distributed all over the tube and chains by these arrangements.

The tube is laid upon the iron standards, but is free to move upon rollers at the top of the masonry standard. The expansion on the hottest day yet experienced has not exceeded one inch.

The tube is strengthened within by the introduction of diaphragms or discs at every 30 feet, which renders it both light and stiff.

The roadway girders (D) are formed of a deep thin plate of iron, stiffened at intervals. At the top it has a strong triangular cell to resist compression, and at the bottom a double plate of riveted iron to resist extension.

Between these side road girders are small cross girders (K) (Fig. 1) riveted to them diagonally. Upon the cross girders 4 inch creosoted planks are secured in the contrary diagonal direction (L), so that by crossing each other stiffness is produced. Eighteen inches of gravel are laid over all, and then the ordinary permanent way upon longitudinal sleepers.

The land abutment (A) is built of masonry. In the plan the letters B indicate the supporting cylinder; E E are the tubes; H H the chains radiating from the ends of the tube, which is 9 feet in diameter, to the saddle links on the sides of the roadway at G, where the width is 14 feet.

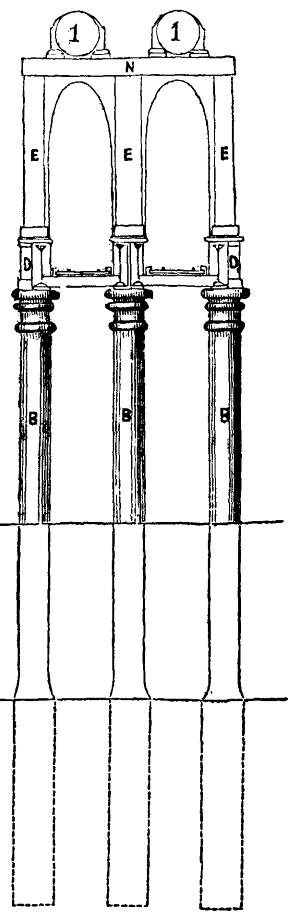



Fig. 2.

The second tube is now complete, and may be seen in the yard near the Bridge: it is expected to be floated next month. The pontoons for carrying one end of the second tube across the river are economically formed of six ordinary iron canal boats, three being placed bottom upwards upon the lower three.

The other end of the tube will be conveyed upon a railway formed upon piles, extending from the land to the six river cylinders; so that while the pontoons are pulled across by powerful tackle at one end, the latter end will be on a carriage rolling upon the railway to its place. Strong temporary erections of timber are constructed upon each side of the river to lift the second tube. We must not omit to mention that the elaborate drawings, instructions, and calculations, connected with this laborious work, were made under Mr. Brunel, by his principal assistant in London, Mr. Robert P. Brereton. The resident engineer of the line of the bridge is Mr. William George Owen, assisted by Messrs. Dibbin and Sayers.

The contractors for the ironwork are Messrs. Finch & Willey, of Windsor Foundry, Liverpool; for the masonry, Mr. Sharpe.

Annexed is a summary of the cast and wrought iron used in the bridge:—

| | Tons. | cwts. | qrs. |
|---|---|---|---|
| Wrought iron, in three spans of 100 feet each, double line | 277 | 0 | 0 |
| Wrought iron in the girders, floor-bearers, and other work of the main span of 300 feet, double line | 278 | 6 | 1 |
| Two wrought iron tubes, each 312 feet long | 302 | 11 | 0 |
| Wrought iron beam on the standard to support the tubes | 20 | 5 | 0 |
| Vertical trusses | 37 | 0 | 1 |
| Tie girders to connect the caps of columns | 1 | 10 | 0 |
| Suspending links in main chains and diagonals | 256 | 5 | 2 |
| Saddles at points of suspension rollers | 41 | 10 | 1 |
| Adjusting screws | 2 | 10 | 0 |
| Rollers of main tube | 7 | 17 | 3 |
| Rollers of girders | 2 | 11 | 3 |
| Bolts | 3 | 15 | 0 |
| Total wrought iron | 1231 | 2 | 2 |

| | Tons. | cwts. | qrs. |
|---|---|---|---|
| Cast iron bed-plates for trusses | 24 | 6 | 1 |
| " standard | 128 | 6 | 0 |
| " caps for columns and parapets | 21 | 0 | 0 |
| " cylinders in the supporting piers | 830 | 0 | 0 |
| Total cast iron | 1003 | 12 | 1 |

| | Tons. | cwts. | qrs. | | | |
|---|---|---|---|---|---|---|
| Wrought iron | 1231 | 2 | 3 | 2234 | 14 | 4 |
| Cast iron | 1003 | 12 | 1 | | | |

Masonry in abutment and pier, 3240 cubic yards.
Total estimated cost of the Bridge when entirely completed, £65,420.

The Bridge has been visited by a great number of engineers from the Continent and the East Indies; indeed, it is only by a personal inspection that the numerous ingenious arrangements can be understood.

The whole seems, when finished, to be very simple; yet engineers will fully enter into the complexity of the design, and the minute and carefully proportioned scantlings given to every part. We would specially call their attention to the cast-iron ring or circle attached to the ends of the tube to prevent collapse; to the wedges introduced under the vertical trusses to adjust the exact tension upon the chain; to the curve given to the tubes themselves, increasing their strength; and to the roller-boxes under the vertical trusses, by which means the road girders are maintained in a position to expand or contract independently of the movements of the main tubes.

The private trial of the Bridge took place on Wednesday, the 14th instant, and was described in our Journal of last week. The public opening of the Bridge took place on Monday last, the 19th. The first train that passed over was the six o'clock train from Swansea. To show the public utility of this great work, it may be mentioned that two years ago the journey from London to Swansea, partly by railway and partly by coach, crossing by a ferry-boat the dangerous passage of the Severn at Beachley, occupied 15 hours. The express trains are now timed to perform the same distance (216 miles) with ease and comfort in five hours.—*Illustrated London News.*

## Portable Lifting Machine.

Portable Lifting Machine.—Scale, One-Fourth.

Fig 1.

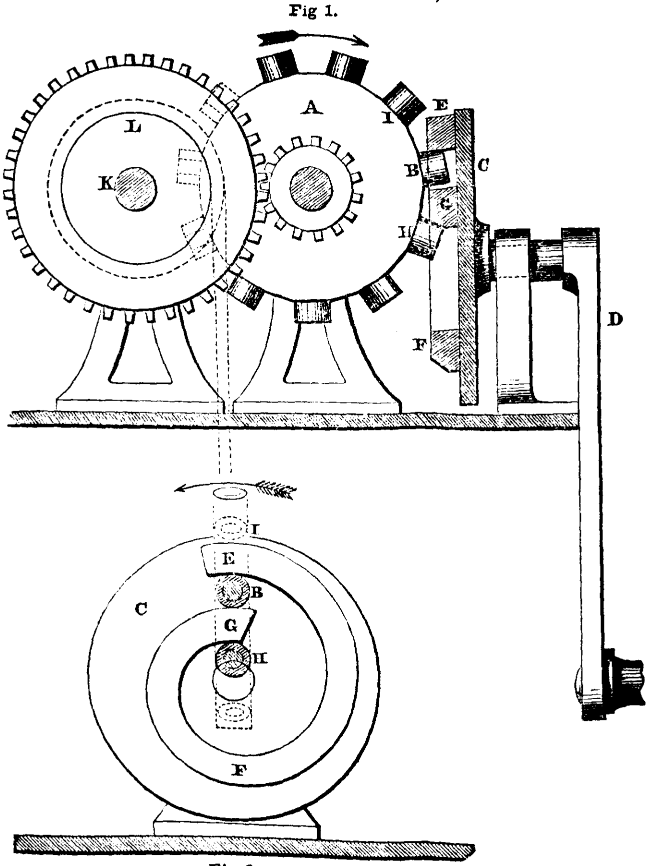



Fig 2.

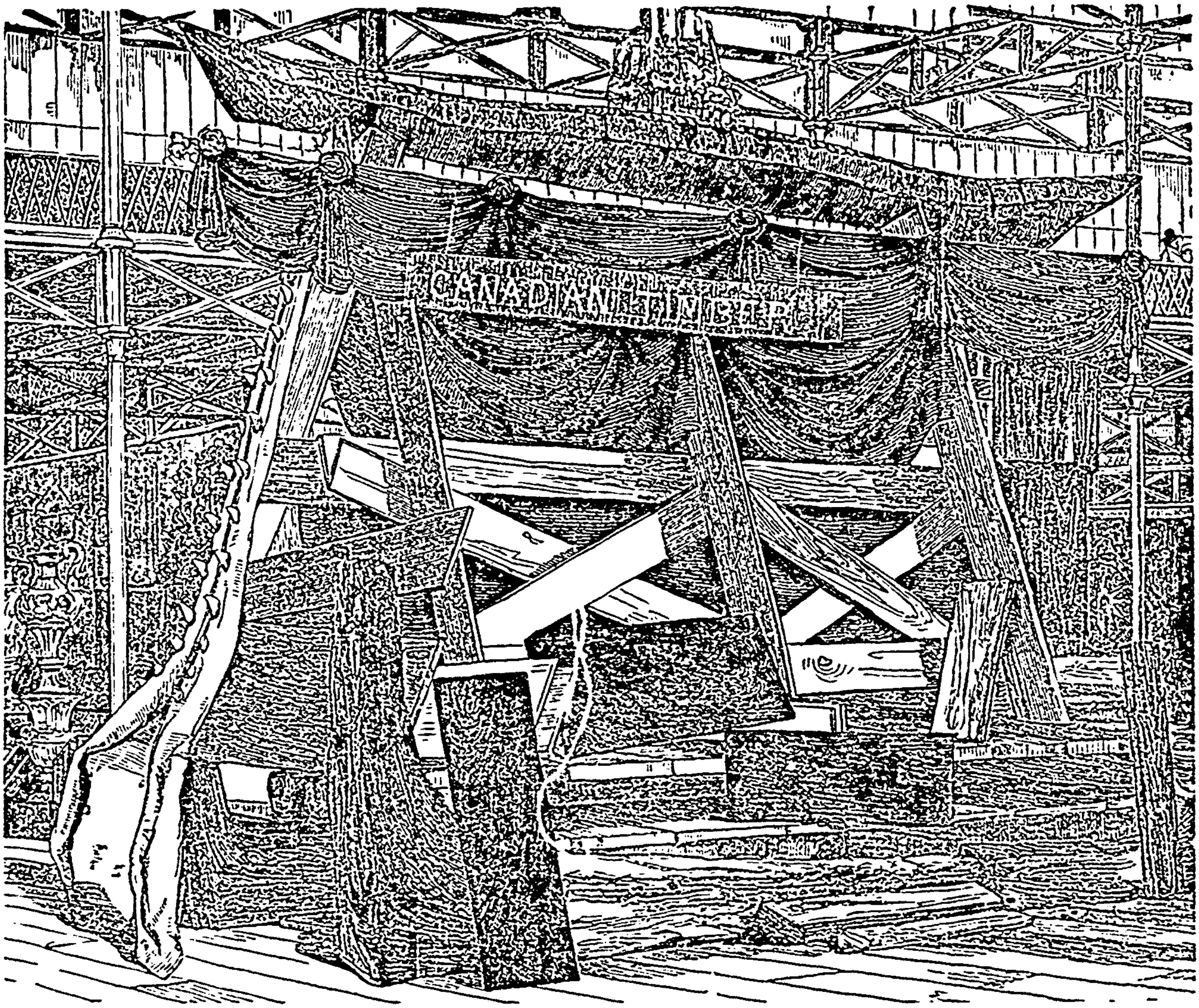
The object of this machine, which is the invention of Mr. Long, hydrometer maker, London, is to obtain, in a portable and simple form, the means of multiplying the power of a man to a very great extent, for the purpose of lifting weights, &c., without the draw-back of heavy friction and wear to which some lifting machines are liable, such as those in which an endless screw works into a toothed wheel. The construction is shown in the annexed engravings, figs 1 and 2. A, is a wheel on which eleven pins B H I, are fixed in the form of teeth, with a friction roller fitted upon each pin. The circular plate C C, is fixed at right angles to this wheel, upon the shaft of the winch D, to which the manual power is applied. On this plate is cast the spiral projecting piece E F G, which makes rather more than one turn upon the plate. This spiral is engaged with the pins B H, on the first wheel, and the difference in the amount of eccentricity of the two ends of the spiral is equal to the pitch or distance between the pins; so that when the plate C, and spiral are turned round one revolution by the handle, the wheel A, is driven round the distance of one pin or tooth.

The driving face of the spiral has a varying bevil, adjusted so as to bear fairly and uniformly upon each pin in succession throughout the entire revolution, as the pin varies its inclination from B to H; the next pin above, I, being then brought down into the position B. The thickness of the spiral, as shown at G nearly fills the space between the two pins at all times, preventing any slip, and the upper pin is engaged a short distance before the lower one is released. The friction roller upon the pin turns round during the motion, rolling, with little friction, along the inner surface of the spiral, which forms an inclined plane, with an inclination of about 1 in 7.

A pinion fixed on the wheel A, is geared into one of three times the diameter on the third shaft, K, upon which is fixed the drum L, for winding up the rope or chain attached to the weight to be lifted. The leverage of the spiral and first wheel being 11 to 1, and that of the spur gearing 3 to 11, makes a power of 33 to 1, and the radius of the winch-handle and of the drum being 6 to 1, the total increase of power obtained by the machine is 200 to 1 nearly; or one man exerting a power of $\frac{1}{2}$-cwt. at the winch could lift five tons, including the friction.

This machine has the advantage of reducing the friction, in consequence of the rubbing action being confined to the revolving of the friction rollers upon their axles, instead of the inclined plane rubbing upon the pins, or the thread of an endless screw rubbing upon the teeth of a worm-wheel, which has only contact at a little more than a line. This has a scraping action, tending constantly to remove the oil from the surface, but in the friction rollers there is a much larger surface in contact to bear the pressure, and this surface being always in contact never has the oil scraped off the surface, and can retain the oil for a much longer time.—*Civil Engineer and Architects Journal.*

## Canada at the Great Exhibition.




CANADIAN TIMBER TROPHY.

(*Extract from the Official Reports published by the Imperial Commissioners of the Great Exhibition of* 1851.)

Of all the British Colonies, Canada is that whose exhibition is the most interesting and the most complete, and one may even say that it is superior, so far as the mineral kingdom is concerned, to all countries that have forwarded their products to the Exhibition. This arises from the fact that the collection has been made in a systematic manner, and it results that the study of it furnishes the means of appreciating at once the geological structure and the mineral resources of Canada. It is to Mr. W. E. Logan, one of the members of the Jury, who fills the office of Geological Surveyor of Canada, that we are indebted for this collection; and its value arises from the fact, that he has selected on the spot most of the specimens that have been sent to the Exhibition, and has arranged them since their arrival in London. The arrangement that he has adopted, which is entirely technical, includes eight divisions, viz:—Metalliferous minerals, and metals obtained from them; Minerals which require complicated operations to render them fit for use; Lithographic limestones and minerals employed in jewelery, and in the manufacture of glass of various kinds; Various kinds of clays and refractory sandstones; Rocks furnishing whetstones, hones, and polishing stones; Rocks and minerals in use for improving soils; Materials used in construction, and rocks serving for architectural decoration; Combustible minerals. All these classes include materials, of great interest, for industrial purposes, and we think it useful to mention some more specially. The ores of iron require notice first of all for their abundance and excellent quality, as the magnetic oxide is worked in upwards of ten different localities. The mines of Marmora, the most important of all, are situated in the west of Canada, and are worked in a mass of ore more than 100 feet thick. The magnetic ores obtained from them are accompanied by pig iron from the works established on the spot, and belonging to the Marmora Iron Company. The Jury has recognized the good quality of their products by making honourable mention of this Company; and the same is awarded to Dr. J. Wilson who has exhibited magnetic iron ores from South Sherbrooke, and phosphate of lime from Burgess. Ordinary mention has also been made of Mr. Lancaster of Vaudreuil, Captain Morin of St. Vallier, Messrs. L. Seer of Eustache, E. Caron of St. Ann, Montmorency, G. Duberger of Murray Bay, and R. W. Kelly of Gaspé, who have exhibited ores of iron and iron ochres of different kinds. Massive hydrous oxide of iron is an important mineral amongst the iron ores of Canada, and is workable in large masses in several localities. We may mention, particularly, that of St. Maurice, which for more than half a century has supplied the iron works and founderies of that name. The Honourable J. Ferrier, the proprietor of the mines, whose products are exhibited in No. 5, has added to the ores, specimens of pig and other iron, besides slags and ashes obtained during the working of the ores. The iron from St. Maurice is of good quality, and the products exhibited show that the establishment proceeds with regularity, in a metallurgical point of view; these considerations have induced the Jury to award a Prize Medal to the proprietor. The exhibition of Canada includes the ores of zinc, lead and copper, from several localities. The ores of copper from Lake Superior and Lake Huron are remarkable for their richness, and that called "Bruce Mine" on Lake Huron has been worked for some years. The Mining Company of Montreal (the proprietors of this mine,) have erected an establishment for working the ores on the spot, according to the methods adopted at Swansea, and the objects sent by this Company exhibit by the side of the ores the various products of smelting, besides the specimens of black and refined copper. Specimens of copper and native silver, from the Island of St. Ignatius, on Lake Superior, are added to these, and the Jury has awarded to the Company a Prize Medal for these various objects. The existence of sprangles and pepites of gold have been proved by actual investigation, in several rivers in the East of Canada, and honourable mention is made of the Chaudière Mining Company who exhibit pepites of native gold collected in the washing of those streams. Messrs. Bodin & Lebert are also rewarded with a mention for the white quartzose sands which they exhibit, which are used with advantage in the manufacture of flint and crown glass. The last award that we have to mention in the case of Canada is the honourable mention adjudged to Mr. Logan who has exhibited iron ores, lithographic stones, minerals, and various rocks. Our colleague has not thought it right to add to these the geological map he has made of Canada, a matter which the Jury greatly regret, not because they would then have been able to adjudge a higher reward for this beautiful work,—for the position of Mr. Logan, as member of the Jury, would render this impossible,—but because of the great interest it would have added to the Canada Exhibition. The lithographic stones exhibited by Mr. Logan belong to a palæozoic rock, occurring at Marmora, where the magnetic iron ore has been mentioned as forming a deposit of enormous thickness. These stones are remarkably homogenous, and fine grained; the degree of finish of the drawings that Mr. Logan has caused to be made upon them giving every promise of the quality being good. The geological position of the stones is interesting, and the reporter is not aware of such material having been previously found in the old rocks, since up to the present time those who practice lithography seek for stones from rocks of the oolitic series. The discovery of Mr. Logan proving that the palæozoic rocks may also furnish good lithographic stones, increases the resources available for this important branch of engraving and drawing. We must also notice, amongst the articles exhibited by Mr. Logan, a cast of the footsteps of an animal discovered in one of the argillaceous schists of the palæozoic period. When the schists were first laid bare to a certain extent, Mr. Logan observed the impression of footsteps repeated several times, and he had the upper bed removed to satisfy himself as to whether they were confined. Their existence, under these circumstances, fully proves that the markings were made at the time of deposit of the bed, and thus carries back the existence of the quadrupedal animal to the earliest silurian epoch. The length of the track discovered was eight feet, and as many as twenty impressions of each foot are traceable. Besides these is an impression between the footmarks, which may be regarded as the trail either of the abdomen or the tail of the animal. It would carry us beyond the proper limits of this report if we were to give even a sketch of the geology of Canada, and those who wish to become acquainted with the subject, must be referred to the report addressed by Mr. Logan to the Governor General of Canada, and published by order of the Legislative Assembly of the colony. We must, however, mention the presence of phosphate of lime and gypsum; the former disseminated in large prismatic crystals in the metamorphic limestones occurring in thick beds at Burgess, while the gypsum is found in many localities forming large irregular masses, intercalated in the upper members of silurian series, especially at Oneida Seneca, on the Grand river. This gypsum has an even fracture, is foliaceous, and a fine white colour, and being very pure, may be used for the manufacture of plaster for casting.

## AGRICULTURAL ENGINEERING, &c.

*Reaping Machines.*—At the dinner following the recent show of the Royal Agricultural Society of England at Lewes (where no fewer than 17 varieties of the reaping machine were exhibited,) Mr. Thompson, the chairman of the York and North Midland Railway, and a great agricultural improver in the north of England, remarked, in the course of his speech: 'Nearly twenty years ago I saw a reaping machine at work in Scotland, which did its work fairly; and, so far back as 1816, a machine was constructed in the north of England, not very dissimilar in appearance to the present machines, the maker of which, not being patronised here, emigrated to America.' Of this ingenious Yorkshire mechanic, this is the first time we have heard; but by common consent the chief merit is assigned to the invention of the Rev. Patrick Bell, now minister of the parish of Carmyllie in Forfarshire. It was produced in 1826, the cutting operation being effected by a series of scissor blades, so working, that, when pushed along a corn field, it cut down the grain as if done by hand, but more cheaply and expeditiously. The Highland Society, upon the report of a committee, awarded the Rev. Mr. Bell a premium of £50 for his invention. Mr. Bell of Inchmichael, the brother of the inventor, adopted and improved the machine, employing it to reap his crops at the expense of only 3s. 6d. the imperial acre. Several others have at different periods been in operation in Forfarshire; but no attempt seems to have been made to introduce them generally over the country. In accounting for this apparent neglect of an important auxiliary to the farmer, Mr. Thompson (whom we have quoted above) alleges, that as the machine did not save the crop with sufficient care, and as at that time the abridgement of manual labour was of less value than it is now, from emigration and other causes, it was not encouraged as in other circumstances it would have been. It is known that several of the machines were sent from Dundee to America in 1831 and 1832, and probably became the models of the American reapers. Indeed, in the opinion of competent judges, there is the closest possible resemblance between Hussey's and Bell's machines.

### Usher's Steam Plough.*

This invention consists, first, in mounting a series of ploughs in the same plane around an axis, so that the ploughs shall successively come into action; and, secondly, in applying power to give rotary motion to a series of ploughs or other instruments for tilling the earth, so that the resistance of the earth to the ploughs or instruments, as they enter and travel through the earth, shall cause the machine to be propelled: thus making the ploughs act in the earth in the same way as paddle-wheels do in the water, by which the vessel is moved along; and the resistance of the earth being greater than the water, the power obtained is proportionably more.

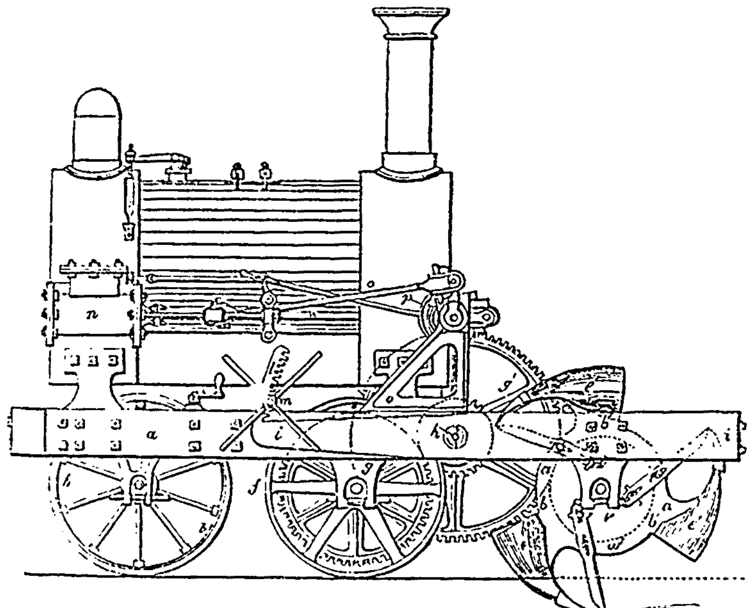


Fig. 1.

Fig. 1 shows a side elevation of the steam machinery; fig. 2 is a plan thereof, the steam-boiler and engine being removed. In fig. 2 the under edge of the mouldboard and share is formed to a curve struck from the centre of the shaft, or axis, on which the ploughs are affixed; *a a* indicate the bed-frame, or carriage of the machine. The fore carriage wheels *(b b)* are mounted on an axle, which turns in bearings *(c)* attached to the swivel frame (D), which moves on the bolts *(d)* for turning the machine round in a small space. A portion of the swivel frame (D) is toothed, and acted upon by the pinion and winch *(e)*. The hind part of the carriage is here shown, supported upon the hollow cylinder or roller *(f)*, composed of two extreme parts *($f^1$ and $f^2$)*, which are wheels similar to *b b*, the intermediate part *(f)* being by preference removable at pleasure, so as to render these bearing parts suitable to different stages of cultivation. This compound cylinder has its axle supported in the bearings *(g)* attached to the lower or to the under side of the carriage frame. The axle of this cylinder carries also at one end the wheel, *h*, to be afterwards noticed. A movable lever frame *(i i i i)* is supported on an axle or shaft (*k*) as a fulcrum. The free ends (*i' i'*) are formed into the toothed segments (*l*), and are concentric to *k;* these segments being acted upon by the two toothed pinions and spindles (*m*), which elevates or depresses the hind part (*i i*) of the lever frame, and all that it carries, at the pleasure of the conductor. On the carriage thus constructed is placed the locomotive boiler, with its engines, the power of which is applied through the medium of connecting-rods (*o*) to the crank-shaft (*p*), supported on two standards (*q*). On the shaft (*p*) there is also fixed the spur pinion, indicated by the dotted circle, *p' p'*, in fig. 1: and this pinion, by taking into the wheel, *r*, mounted on the shaft, *k*, gives motion, at the same time, to the pinion, *t*, which is carried round on the same shaft (*k*). The pinion, *t*, thus actuated, takes into the wheel, *h*, before referred to, on the bearing cylinder, *f;* and it is preferred that the point, *t*, should be applied so as readily to put into and out of gear, with its wheel, though not so shown in the engraving. By this arrangement of parts, a slow progressive motion is obtained for the whole machine; on the one hand, through the cylinder, *f*, and, on the other hand, a separate

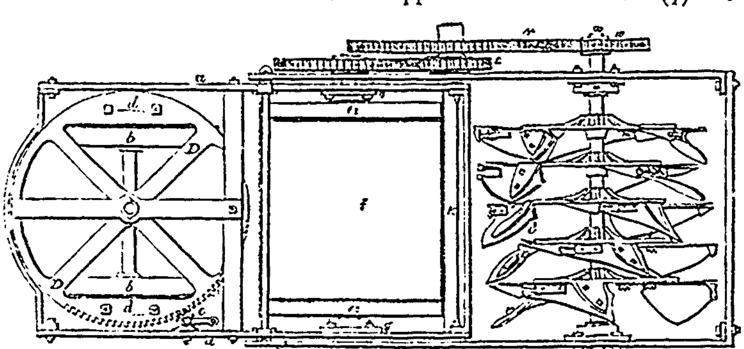


Fig. 2.

* See August number, page 13.

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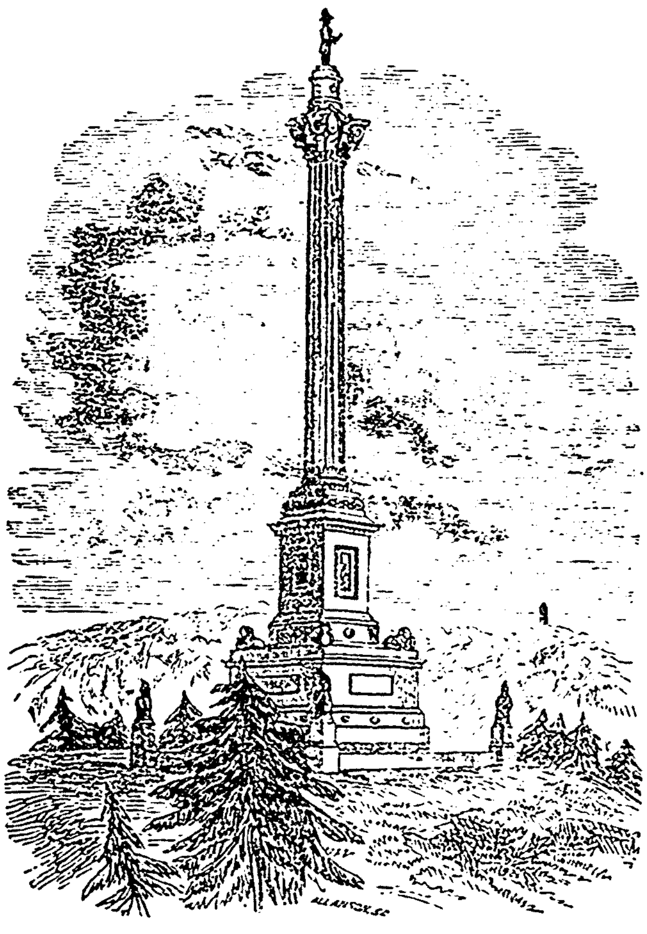
rotary motion, at a certain increase of speed, is communicated through the wheel, *r*, to the pinion, *w*, fixed upon the shaft, *u u*, which last-named shaft has its bearings (*v v*) attached to the movable frame, *i i*. On the shaft, *u u*, are placed a series of plates or projections, fixed at regular distances. Or such plates or projections, with their ploughs, may be placed upon separate shafts, each with its own proper gearing; but it is preferred to place them on one shaft. These plates or projections have affixed to each of them several ploughs, which, in revolving, penetrate the soil, and by their mouldboards elevate and turn over portions thereof: *a a* are the plates or projections fixed upon the shaft, *u*. Each plate (*a'*) has three arms or prolongations (*b b b*), which terminate in the radial direction shown; a further prolongation (*d' d'*) is carried obliquely upon each of these arms. Upon the plate and projections thus constructed is affixed the tilling apparatus, which consists, first, of the part, *c*, which acts the part of the mouldboard or turn-furrow in the common plough; and it is to be fixed by screw bolts, or otherwise, to the prolongation, *d d'*. To the fore part of this mouldboard (*c c*) is affixed a bar of wrought iron, which is also furnished with a lug, by which it is attached to the plate by means of screw bolts, or otherwise; the bar, thus secured, forms a head or share-bearer, as in many common ploughs. To the fore part of the bar the share is adapted, and fixed by its socket. The mouldboard, and also the share, may be varied in form. An adjustable fore-cutter or coulter is affixed in front of each share. It will be seen, that not only the ploughs which are set in the same plane around the axis follow each other into action, but that the ploughs of the other sets (which are affixed around the axis in parallel planes) are arranged and come into action so that two plough-shares will not strike the earth at the same instant.

## ARCHITECTURAL NOTICES.



The Brock Monument.

The Committee for the Erection of the Brock Monument, on the Queenston Heights, invited Architects to compete in the preparation of Designs, by offering a premium of £25 currency to the successful competitor, whose design should be adopted. The meeting of the Committee took place, to receive the designs on the 2nd of last month, at Queenston, and from thence adjourned to the 10th ult., at the Parliament Buildings, Toronto, where a large meeting of the Committee took place, viz.:—His

Honour the Chief Justice; Mr. Chief Justice Macauley, and Mr. Justice McLean; Sir Allan MacNab; Colonel Allen; The Hon. W. Robinson; T. C. Street, Esq., M. P. P.; The Honourable H. Merritt; Colonel McDougal; ——— Thauburn, Esq.; Captain Munro; &c., &c., and others, amongst whom were Dr. McCaul, President of the Toronto University; Captain Lefroy; W. Cayley, Esq.; &c., &c. After the inspection of the several designs submitted, the Committee awarded the premium to W. Thomas, Esq., Architect, of this City, for the best design; which is to be forthwith carried into execution, under his superintendance. A wood-engraving of which we insert.

In the preparation of this design, the endeavour has been to combine Architecture with Sculpture, so as to render it characteristic and appropriate, avoiding plagiarism, but without affecting that novelty of character, which would be injurious to the grandeur of the composition.

The Column, which is of the Roman Composite Order, with its Pedestal, stands on a platform, or sub-basement, of an elevation of 27 feet, at the angles of which are lions rampant, supporting shields with the armorial bearings of the Hero. It will be seen that the sub-basement is distinguished by plainness of character and great solidity, being 38′.0″ square at its base, having on one of its sides a plain polished granite slab, with a suitable inscription to the memory of the departed Hero, in letters of bronze. The sub-basement is placed on a platform slightly elevated, within a dwarf wall enclosure 77′.0″ square, with a fosse around the interior; at each angle are placed military trophies in carved stone 20′.0″ in height. It is proposed that the entrance to the enclosure, and doorway to the interior of the Monument, shall be on the south side, giving access to a gallery, or corridor, 120 feet in extent, round the inner pedestal, by 6 feet 6 inches wide; on the east and west sides of which, in suitable vaults under the floor, will be deposited the remains of General Brock, and those of his Aid-de-Camp, McDonnell. The gallery is lighted by circular wreathed openings. The bold rocky scenery of the Queenston Heights which surrounds the site of this proposed Monument, and the space immediately adjoining, together with the close masses of dense foliage in picturesque clumps, as seen in connection with it, induced the Architect, from repeated observations, so to elevate the column and pedestals, as not to have the general effect deteriorated by these objects, however beautiful they are, as taken separately. The pedestal to the column is 16′.9″ square and 38′.0″ in height, the die having on its enriched pannelled sides appropriate basso relievos. The plinth of the Order, as a blocking course to the pedestal, is enriched with lions' heads and wreaths, continued round each side, with wreathed openings between each, to give light to the interior. The column itself is 95 feet in height and 10 feet in diameter, fluted, and having an enriched base of laural leaves entwined on the lower torus; the base of the shaft is enriched with palm leaves, upon which the flutes terminate. The capital of the column, which is very beautiful, and particularly appropriate, is 12′.6″ in height; on each face will be sculptured a figure of Victory 10′.6″ in height, with extended arms over military shields, as volutes, having on their outward angles lions' heads, helmets, &c., the spaces between the acanthus being wreathed with palm leaves, somewhat after the example of a capital of an antique column at Albano, near Rome. The enriched abacus is 15′.0″ square, in the angles, of which will be formed spaces for persons to stand outside to view the surrounding scenery, to avoid the unsightly appearance of iron railings. Upon the abacus stands the cippus, supporting the Statue, which is to be of cast iron, galvanized, having within a chamber 6′.0″ diameter, for persons to stand in to view the magnificent scenery and interesting objects which the grandeur of the situation affords. Upon the cippus is raised a Statue of the Hero, proposed to be executed in stone, 16 feet high, in proper military costume. From the gallery in the sub-basement is continued to the summit a staircase of stone, of capacious breadth, of 250 steps, worked with a solid stone newel, the entire height lighted by small loop-holes in the fluting of the column. The whole height of the Monument, including the Statue, is 185 feet, to be executed wholly in Queenston stone; but it may be required to select a stone of finer quality for the basso relievos. The comparative heights of some of the principal monuments of the kind, ancient and modern, are as follow:—

| | Entire height. |
|---|---|
| Pompey's Pillar - - - - - - - - | 90.0 |
| Trojan's Pillar - - - - - - - - | 115.0 |
| Antonio Column - - - - - - - - | 123 0 |
| Monument on Fish Street Hill - - - - - | 202.0 |
| York Column - - - - - - - - | 137 0 |
| Napoleon Column, Paris - - - - - - | 132 0 |
| July Column, Paris - - - - - - - | 156 0 |
| Alexander Column, St. Petersburgh - - - - | 175 6 |
| Melville Column, Edinburgh - - - - - | 152.7 |
| Nelson Column, Dublin - - - - - - | 134.0 |
| Nelson Column, Yarmouth - - - - - - | 140.0 |
| Nelson Column, London, from the level of the pavement in Trafalgar Square - - | 171.0 |

Thus, then, there is only one column, either ancient or modern, in Europe, that exceeds the entire height of the proposed Brock Monument, which is that erected in London by Sir Christopher Wren, in commemoration of the great fire in 1666.

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His Royal Highness Prince Albert has honoured the distinguished Director of the Geological Survey, W. E. Logan, Esq., F.R.S., with an autograph letter, (accompanying a beautiful bronze Medal,) acknowledging the valuable services rendered by that gentleman to the Exhibition of Industry of all nations. We have much pleasure and pride in congratulating the President of the Canadian Institute upon this marked acknowledgment of his zeal and energy in so greatly adding to the interest and importance of the Canadian Department of the late Great Exhibition. Subjoined is a copy of the letter:—

Sir,—I have the honour, as President of the Royal Commission for the Exhibition of 1851, to transmit to you a medal that has been struck by order of the Commissioners, in commemoration of the valuable services which you have rendered to the Exhibition, in common with so many eminent men of all countries, in your capacity of juror. In requesting your acceptance of this slight token on our parts of the sense entertained by us of the benefit which has resulted to the interests of the Exhibition from your having undertaken that laborious office, and from the zeal and ability displayed by you in connexion with it, it affords me much pleasure to avail myself of this opportunity of conveying to you this expression of my cordial thanks for the assistance which you have given us in carrying this great undertaking to a successful issue. I have the honour to be, very respectfully yours,

ALBERT.

W. F. Logan, Esq., F.R.S.

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**Notes and Queries.**

1. What is the most northern and what is the most eastern township in Western Canada, in which the Cactus is found?

2. What are the limits of the Black Walnut *(Juglans nigra)* and Sweet or Spanish Chesnut, *(Castanea vesca)?*

3. What is the botanic name of the tree which furnishes the White Wood of Western Canada, and in what district is it found?

## SCIENTIFIC INTELLIGENCE.

### Chemistry and Physics.

*Coating Metals: Henry Grissell's (of the Regent's Canal Iron-works) improvement in coating metals with other Metals.*—Patent dated January 11th, 1851. Enrol'ed July 10th, 1851, (London Patent Journal)—The patentee's improvements in coating metals with other metals are as follows:—

*Coating Iron with Zinc.*—For this purpose the patentees use a bath or vessel of iron, or other suitable material, in which, by means of heat they melt the zinc, and on the surface of the melted zinc place a thick layer of chloride of zinc (prepared by dissolving zinc in muriatic acid, and driving off the water.) or a mixture composed of 8 parts of chloride of zinc, and 10 parts of chloride of potassium, or a mixture of equal parts of chloride of zinc and chloride of sodium, or chloride of potassium When the metal and the salt are in a state of fusion, the iron to be coated with zinc is dipped into the metal, through the covering of fused salt, and becomes coated with zinc. If, however, it is found that a sufficient quantity of zinc has not adhered to the iron a small quantity of sal-ammoniac, in powder, is sprinkled over the iron, which is again dipped into the melted zinc. Under this part of their invention, the patentees claim the use of chloride of zinc applied as above mentioned in the fused state; also of the mixtures of the various salts above enumerated.

*Coating Zinc, Iron coated with Zinc, or other Metal, with a Metallic Alloy.*—For this purpose the patentees use a vessel of iron, or other suitable material, in which the alloy is melted. One of the alloys used by them is composed of zinc 10 parts, tin 26 parts, and lead 5 parts. A layer of chloride of zinc mixed with an equal weight of sal-ammoniac is kept in a state of fusion on the surface of the metal alloy, the temperature of which must not be carried higher than is sufficient to keep the alloy in a fluid state. The metal to be coated is dipped into the melted alloy, but not allowed to remain there longer than is absolutely necessary to receive a coating of the alloy. The patentees use also the alloy called "fusible metal," which they prefer to make as follows: bismuth 8 parts, lead 5 parts, and tin 3 parts; alloys of other compositions will do, provided that their melting points are below 400 deg. Fah. The patentees claim the use, in the manner above stated, of the alloys specified and referred to, and of the method above described for coating metals with such alloys.

*Coating Iron or other Metal with Tin, or Tin alloyed with Lead.*—For this purpose the patentees use a vessel of iron, or other suitable material, in which the tin alloy is melted, and on the surface of the fused metal lay a stratum of chloride of zinc, mixed with about its own weight of sal-ammoniac. The metal to be coated is then dipped into the metal liquid or alloy, until the coating is effected. The patentees state that it will be found advantageous, in the use of this and the preceding processes, to dip the metal to be coated several times, in order that it may come in contact often with the layer of fused salt; also advantageous in the preceding process to dip the iron or other metal into a hot and slightly acid solution of chloride of zinc, previous to immersion in the bath of melted metal. The patentees claim under this head of their invention, the use of a mixture of chloride of zinc and sal-ammoniac forming a saline compound, which is kept in a state of fusion on the surface of the melted tin or alloy, in the process of coating metals with other metals.

*Coating Iron or other Metal with Silver, or Alloy of Silver and Copper.* In this case, the surface of the iron or other metal to be coated is to be amalgamated in the usual way. The patentees prefer to use for the amalgamating process, a mixture of 12 parts of mercury, 1 of zinc, 2 of sulphate of iron, 2 of muriatic acid, and 12 of water; the mixture to be heated, and, when 200 deg. Fah., the iron to be amalgamated is placed in the mixture, and the mercury rubbed on the surface of the iron. The silver, or alloy of silver, is then melted in a crucible, placed in a suitable furnace, and the amalgamated metal is dipped into it until it has a proper coating of silver or alloy employed.

Under this head, the patentees claim the process of coating iron or other metal or silver, or alloy of silver and copper, by amalgamating the surface of the metal to be coated, and then putting it into the melted silver or alloy.

*Coating Iron with Copper, Brass, or any alloy of Copper, with Zinc, Tin, or Lead.*—In this case, the copper or alloy used is melted in some suitable vessel, and on the surface of the melted metal is placed a layer of borosilicate of lead, (composed of 112 parts of oxide of lead, 24 of boracic acid, and 16 of silica) and when the metal and the salt are in a state of fusion, the metal to be coated is introduced through the layer of salt into the melted metal, where it is allowed to remain long enough to acquire a coating of the metal. The patentees sometimes coat the iron with zinc, or with tin, or even amalgamate its surface with mercury, in the way above mentioned, and then proceed to dip it into the melted copper or alloy. Another method of coating iron with copper or brass, is that of exposing it to the vapor of chloride of copper, by placing that substance at the bottom of a copper crucible, in the upper part of which is placed the iron to be coated. The crucible is heated to redness, in a suitable furnace, and the vapors of chloride volatilize and coat the iron with copper. If the iron thus coated with copper be placed in the upper part of a covered crucible, in which metallic zinc, covered with animal and other charcoal, is placed, and heat applied as in the above case, the vapors of the zinc rise, and coming in contact with the copper-coated iron, convert the coating of copper into brass. Instead of chloride of copper, a mixture of metallic copper and sal-ammoniac may be used, or a mixture of oxide of copper and sal-ammoniac.

The patentees claim under this head of their invention, the use of borosilicate of lead, in a fluid state, over a surface of melted copper or brass, or of the alloys above mentioned, in the process of coating iron by immersion; also, the process of coating iron by the action of fused chloride of copper, or the mixtures above named, and of coating with brass by subsequent treatment with vapors of zinc, as above mentioned. —*Silliman's Journal.*

*On Rain Waters.*—M. Chatin makes the following statements as results of his operations:—

1. The chlorides which abound in the rains of maritime countries, are at Paris more abundant than in the waters of the Seine whenever the wind blows from the sea.

2. Sulphates exist in a notable quantity in the rain of Paris and in that of Central France; rain waters, though generally containing less of chlorides than the waters of rivers, usually surpass the latter in the proportion of sulphates.

3. Salts of lime and soda are contained in rain waters in an appreciable quantity.

4. Rain waters are especially distinguished by containing even half a decigramme to a litre of azotized organic matter, which may be represented in its composition by a mixture of ulmate of ammonia and ulmic acid; this ingredient is found also in the lower strata of the atmosphere, (though less at Turin and on the borders of the sea than at Paris and in Maurienne,) whence it is deposited by the dews and mists, and may be separated by washing.

5. Argillaceous earths retain better than lighter soils this principle dissolved in rain waters. The atmosphere, and the rains which wash it, perform an important part in agriculture, in restoring to the soil a portion of soluble mineral and organic matters highly useful to vegetation.

*Dr. Kemp's Electro-Magnetic Engine.*—A summary account of this invention was given in the *Mining Journal* for the 10th of January last; and, as the subject is one of considerable importance, a more extended notice will probably be read with interest. The prodigious and, so far as our present experience goes, unlimited power of an electro-magnet in sustaining weights attached to an armature in contact with it has, in different countries, and at various times, induced inventors to adopt contrivances for pressing this agent into service as a labouring force; and experiments on a small scale have repeatedly led to the most sanguine expectations. A more rigid investigation has hitherto, however, proved the fallacy of these expectations, and the attempt to construct engines on a large scale been abandoned. Prof. Page's machine may, perhaps, be considered an exception to this remark, as it is well known that he has constructed and publicly exhibited a powerful working engine. Practical difficulties, however, seem to have intervened, or we should, doubtless, have seen it in extensive operation, the more especially as the magnificent grant of the American Government in aid of the professor's researches precludes the supposition that they are stopped for want of pecuniary resources.

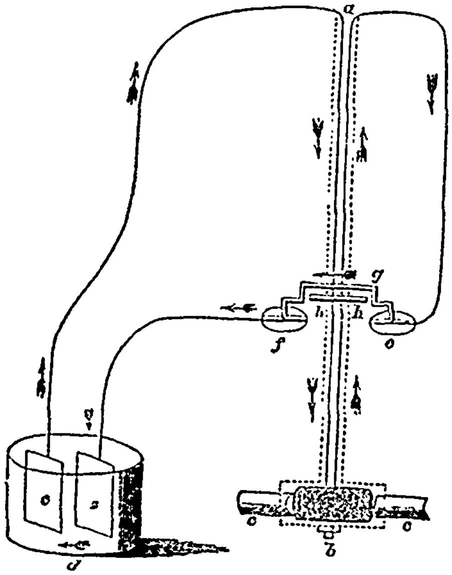
It would occupy too much space to enter into a detailed historical account of electro-magnetic engines. The means adopted, however, may be classed under two heads:—1. Those involving the direct action of an electro-magnet on its armature; and 2, those which employ a secondary action; thus the rotatory engines of Davenport, Jacobi, and the more recent elegant arrangement of Prof. Wheatstone, depend for their action upon a series of armatures, passing successively in front of stationary magnets, or *vice versa*; whilst that of Prof. Page depends upon the tendency of a bar of soft iron to place itself in a state of magnetic equilibrium, with reference to a succession of helical coils, through which, one after the other, the galvanic current is caused to pass. It may, however, be shown by experiment that this latter force, as well as that of an armature, passing in a circle concentric with a row of electro-magnets, is far inferior to that with which an electro-magnet attracts an armature, placed at right angles to its axes. This direct action was the first employed as a motive power; unsuccessfully, however, in consequence of the extremely small distance to which the magnetic energy extends. Could this difficulty be surmounted, no reason can be given why engines of any amount of power may not be constructed. In order to effect this object, Dr. Kemp introduces two contrivances, which may be used separately or conjointly, for the purpose of transferring the magnetic force. In the first place, a series of bars of iron, or armatures, are so arranged that they may successively come within the range of the lines of four of an equal number of electro-magnets, and so placed as that, in the course of their approach to the magnets, they cut the greatest possible number of magnetic curves. A further arrangement provides for the action of these armatures, by stems and stops, upon an armature plate, which is, in its turn, secured to the piston-rod of a cylinder filled with fluid. As the piston ascends, or descends, the fluid is forced into another longer cylinder, provided with a rod, which is brought by any suitable contrivance into connection with a crank, by which machinery may be caused to move. Instead of reciprocating motion, rotatory motion may at once be effected by means of a suitable disc. The whole invention then rests upon two facts, which cannot be disputed—1. That an electro-magnet is capable of attracting a considerable weight for a short distance; and 2, that this force may be transferred to machinery by means of incompressible fluids, or practically such.

Should it be found that this power can be economically applied, immense advantages must accrue from its use. The whole of the space occupied by fuel and boilers will be rendered available for passengers or freightage: and the value of this in one case alone—that of the Asia—will be represented by the enormous sum of £3200, at £4 per ton, for each voyage across the Atlantic. Its perfect safety, and freedom of risk from fire, must also recommend it especially for emigrant ships. In the locomotive department, the compactness and comparative lightness of the electro-magnetic engine must induce its substitution for the motive-power now in use. For canal navigation, this element of lightness must also be a great recommendation; and this species of property, so much depreciated by the competition of railways, may yet be rendered highly productive. For fire-engines, in connection with Gwynne's admirable centrifugal pump, it must be extremely serviceable, as it can be used in localities where, from want of working room, or the presence of irrespirable gases, the ordinary engine would be inadmissable. For all kinds of agricultural machinery, quartz crushing machines, mills, printing presses, and numberless other minor uses, its value must be apparent; whilst the lessening of insurance expenses would, in many cases, pay the cost of the engine, and defray the expenses of its working.

*Coating and Ornamenting Zinc.*—A patent has been taken out by Mr. F. H. Greenstreet, of Albany street, for coating and ornamenting zinc surfaces by means of acids alone, or in combination with other matters. The solution may be applied by sprinkling, dabbing, spreading, or marbling; and the surfaces are capable of further ornamentation by painting. Muriatic acid, diluted with water to about 1·114 specific gravity, gives a light ash colour; chrome yellow, with the same acid, a yellowish grey; Saxony green, mixed gradually with the acid to a paste, and stirred until effervescence ceases, produces greenish iron grey; white lead with the acid, or Kremintz white, gives a grey coating; the acid with sulphur produces a yellowish white. Butter of antimony gives a black colour, but when mixed with the other pigments does not effect them; but makes a good ground work. The surfaces having been coated, should be protected by a coat of varnish. Copal may be used, but the patentee prefers a preparation of wax, as effectually preventing oxidation.

## The Electric Clock.

The following engraving illustrates the application of electricity in moving the pendulum of Mr. Bain's electric clock. The pendulum *a* is drawn in dotted outlines. The bob of the pendulum *b* is a brass box containing a coil of covered copper wire on a bobbin; and *c c* represent permanent bar-magnets projecting from opposite sides of the clock-case in the centre of the pendulum bob: while *d* is a voltaic pair with the current shown by arrows. Dr. Wilson in his work on electricity, gives the following account of the operation:—




"A wire from the copper is conducted to the top of the pendulum-rod, then down its left-hand side to the bob, in which it is coiled many times, and then ascending on the right side to the top of the pendulum-rod, it is brought down within the clock-case, and terminates in a disc *e* made of grooved agate. The black dot in the groove represents a gold stud which forms the termination of the wire from the copper. *f* is a second grooved disc, made, however, entirely of metal, from which a wire proceeds to the zinc. The current thus can only pass, if a metallic bridge stretches from the disc *f* to the gold stud in the disc *e*. This bridge *g g* stands on the grooves in the two discs, the left extremity sliding in the metal, the right extremity in the agate. *h h* is a piece of brass attached to the pendulum-rod, so as to touch the bridge and carry it from side to side. In the diagram the apparatus is not acting. Suppose, however, that the right hand extremity of the bridge touch the gold stud in the agate disc, then the current passes, the coil of wire in the pendulum-bob becomes magnetic, and is carried to the *left* by the action of the bar-magnets. In so doing it slides the bridges off the gold stud, and thereby cuts off the current from itself, and loses magnetism. It returns to the *right* by its own weight, but in so doing it replaces the right end of the bridge on the gold stud, and thus restores the current to the wire and renews its magnetism; and so on *ad infinitum*. Strictly speaking, the edges only of the disc should be shown; they are represented as if seen a little obliquely from above, for the sake of indicating the grooves more distinctly."

**Monthly Meteorological Register, at Her Majesty's Magnetical Observatory, Toronto, Canada West.—August, 1852.**

*Latitude 43 deg. 39.4 min. North. Longitude, 79 deg. 21 min. West. Elevation above Lake Ontario: 108 feet.*

| Magnet. | Day | Barom. at tem. of 32 deg. 6 A.M. | 2 P.M. | 10 P.M. | Mean | Temperature of the air. 6 A.M. | 2 P.M. | 10 P.M. | M'n | Tension of Vapour. 6 A.M. | 2 P.M. | 10 P.M. | M'n | Humidity of Air. 6 A.M. | 2 P.M. | 10 P.M. | M'n | Wind. 6 A.M. | 2 P.M. | 10 P.M. | Rain in Inch. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ° | ° | | | | | | | | | | | | | | |
| b | 1 | 29.610 | 29.661 | " | " | 59.3 | 61.5 | " | " | 0.304 | 0.423 | | | 85 | 72 | | | Calm. | W b S | Calm | 0.015 |
| a | 2 | .717 | .731 | 29.721 | 29.737 | 46.7 | 66.2 | 51.5 | 57.38 | .291 | .443 | 0.375 | 0.363 | 93 | 71 | 90 | 79 | Calm. | N | Calm | 0.075 |
| a | 3 | .673 | .602 | .497 | .577 | 52.4 | 66.3 | 61.4 | 61.05 | .326 | .395 | .414 | .392 | 85 | 63 | 83 | 76 | N N E | S | Calm | - - |
| a | 4 | .425 | .367 | .310 | .375 | 53.9 | 71.4 | 63.2 | 63.88 | .366 | .477 | .438 | .424 | 90 | 64 | 77 | 74 | Calm | E | NE b N | 0.165 |
| c | 5 | .378 | .428 | .507 | .438 | 60.8 | 65.6 | 61.1 | 62.77 | .453 | .479 | .470 | .466 | 87 | 78 | 89 | 84 | E N E | E N E | Calm | 0.255 |
| c | 6 | .528 | .600 | .619 | .583 | 61.0 | 65.7 | 57.8 | 62.32 | .457 | .544 | .445 | .485 | 87 | 88 | 95 | 88 | N b E | Calm | Calm | 1.055 |
| c | 7 | .608 | .551 | .552 | .571 | 59.9 | 73.5 | 62.6 | 66.13 | .447 | .594 | .467 | .509 | 88 | 73 | 84 | 80 | N b W | S S W | Calm | Inap |
| c | 8 | .553 | .541 | | | 60.6 | 71.2 | | | .467 | .535 | | | 90 | 66 | | | Calm. | S | S S W | - - |
| b | 9 | .623 | .619 | .681 | .646 | 63.6 | 71.1 | 63.5 | 65.50 | .501 | .599 | .500 | .531 | 88 | 81 | 88 | 87 | N | S E b E | Calm | 0.765 |
| c | 10 | .731 | .735 | .749 | .739 | 60.0 | 71.6 | 59.9 | 63.73 | .336 | .430 | .366 | .391 | 76 | 56 | 73 | 68 | N | S E b E | N | - - |
| c | 11 | .769 | .777 | .779 | .776 | 57.9 | 72.7 | 55.4 | 63.10 | .342 | .500 | .334 | .385 | 73 | 64 | 75 | 68 | N | S E b S | N E | - - |
| b | 12 | .825 | .778 | .776 | .788 | 55.3 | 73.7 | 61.7 | 65.03 | .378 | .500 | .417 | .426 | 88 | 62 | 78 | 71 | N b W | S | Calm | - - |
| c | 13 | .810 | .755 | .683 | .740 | 55.3 | 75.4 | 63.7 | 66.07 | .387 | .522 | .445 | .455 | 90 | 61 | 78 | 74 | Calm. | S | Calm | - - |
| b | 14 | .631 | .533 | .531 | .560 | 61.3 | 76.5 | 69.9 | 68.98 | .472 | .574 | .481 | .521 | 89 | 65 | 68 | 76 | Calm. | S b W | S S W | 0.055 |
| a | 15 | .591 | .659 | | | 62.5 | 72.1 | | | .511 | .416 | | | 93 | 58 | | | Calm. | N W b N | Calm | - - |
| a | 16 | .937 | .911 | .819 | .895 | 48.8 | 65.6 | 52.1 | 57.12 | .292 | .352 | .350 | .331 | 86 | 58 | 91 | 73 | N b E | E N E | E N E | - - |
| a | 17 | .832 | .809 | .755 | .799 | 59.6 | 70.7 | 55.1 | 61.50 | .317 | .512 | .379 | .422 | 89 | 71 | 85 | 79 | N | S E b S | Calm | - - |
| ab | 18 | .717 | .608 | .621 | .659 | 53.8 | 76.2 | 63.6 | 65.80 | .383 | .568 | .455 | .485 | 91 | 61 | 80 | 78 | Calm | S | Calm | - - |
| a | 19 | .625 | .590 | .662 | .629 | 60.3 | 81.2 | 70.4 | 71.00 | .454 | .691 | .588 | .581 | 88 | 67 | 82 | 79 | Calm | S b W | Calm | - - |
| a | 20 | .714 | .752 | .716 | .711 | 61.4 | 72.9 | 65.7 | 68.05 | .543 | .578 | .515 | .542 | 92 | 73 | 84 | 82 | Calm | E b S | N E | - - |
| a | 21 | .753 | .753 | .760 | .752 | 61.6 | 72.6 | 67.6 | 68.70 | .413 | .635 | .478 | .515 | 75 | 81 | 73 | 79 | N E | E | Calm | - - |
| ab | 22 | .799 | .777 | | | 68.1 | 70.1 | | | .598 | .578 | | | 90 | 80 | | | E | E N E | E | - - |
| c | 23 | .775 | .714 | .712 | .735 | 68.9 | 79.1 | 70.6 | 72.92 | .623 | .745 | .601 | .645 | 91 | 78 | 83 | 83 | E b S | S E b E | Calm | - - |
| c | 24 | .718 | .662 | .655 | .672 | 66.5 | 77.0 | 70.2 | 72.12 | .582 | .722 | .652 | .674 | 93 | 81 | 91 | 88 | Calm | S b E | Calm | 0.110 |
| e | 25 | .633 | .571 | .593 | .557 | 66.1 | 77.3 | 67.1 | 71.10 | .586 | .714 | .571 | .61 | 95 | 82 | 89 | 87 | Calm | S E b S | Calm | 0.170 |
| c | 26 | .468 | .405 | .427 | .427 | 65.7 | 78.4 | 70.5 | 71.15 | .591 | .718 | .552 | .620 | 97 | 76 | 77 | 84 | Calm | S | N E b N | Inap |
| c | 27 | .490 | .550 | .612 | .553 | 61.4 | 68.3 | 57.6 | 63.35 | .412 | .444 | .361 | .415 | 84 | 66 | 78 | 73 | Calm | N W | N | - - |
| c | 28 | .661 | .677 | .700 | .681 | 51.3 | 69.1 | 59.2 | 60.97 | .325 | .429 | .383 | .375 | 78 | 62 | 78 | 71 | N b E | S E | N b W | - - |
| ab | 29 | .761 | .803 | | | 51.9 | 71.6 | | | .298 | .526 | | | 70 | 71 | | | N | S b E | S W b S | - - |
| a | 30 | .917 | .934 | .874 | .895 | 51.0 | 73.5 | 56.8 | 62.65 | .290 | .490 | .348 | .397 | 79 | 61 | 77 | 71 | Calm | S | Calm | - - |
| — | 31 | .894 | .793 | .738 | .798 | 53.3 | 76.4 | 63.8 | 65.20 | .359 | .521 | .453 | .466 | 90 | 60 | 78 | 75 | N b E | S | Calm | - - |
| | M | 29.6901 | 29.6619 | 29.6562 | 29.6671 | 58.35 | 72.60 | 62.59 | 65.35 | 0.425 | 0.516 | 0.457 | 0.481 | 87 | 69 | 82 | 78 | M's 1.93 | M's 6.17 | M's 1.27 | 2.695 |

*Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.*

| North. | West. | South. | East. |
|---|---|---|---|
| 1022.92 | 310.60 | 877.05 | 733.92 |

Mean velocity of the wind - - 3.30 miles per hour.
Maximum velocity - - - - - - 18.8 miles per hour, from 10 to 11 a.m. on 27th
Most windy day - - - - - - 27th: Mean velocity, 8.39 miles per hour.
Least windy day - - - - - - 1st: Mean velocity, 1.19 ditto.
Most windy hour - - - - - - 1, p.m. Mean velocity, 6.25 ditto.
Least windy hour - - - - - -10, p.m. Mean velocity, 1.27 ditto.
Mean diurnal variation - - - 4.98 miles.

A considerable number of shooting stars observed on the nights of the 10th, 11th, and 12th August.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:—

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the Horizontal Force also.

*Thunder Storms.*—4th, distant thunder, at 2 P.M.
5th, distant thunder, at 2 P.M.
14th, thunder, lightning, and rain, from 11 A.M. to midnight.
19th, sheet and forked lightning, 9 to 10 P.M.
24th, thunder, lightning, and rain, from 2—20 to 3 P.M.
26th, thunderstorm—ceased 7-10 A.M. Thunder, lightning, and rain, at 3 P.M.

Highest Barometer - - 29.955, at 8 A.M., on 16th } Monthly range:
Lowest Barometer - - 29.310, at 10 P.M., on 4th } 0.645 inches.
Highest observed Temp. - 81.2, at 2 P.M., on 19th } Monthly range:
Lowest regist'd Temp. - 45.8, at A.M., on 2nd } 35.4
Mean Highest observed Temperature - - 72.59 } Mean daily range:
Mean Registered Minimum - - - - - 56.83 } 15.77
Greatest daily range - - - 24.9 from 2 P.M., of 15th, to 6 A.M., of 16th.
Warmest day - - 23rd - - Mean Temperature - 72.92 } Difference:
Coldest day - - - 2nd - - Mean Temperature - 57.38 } 15.84

The "Means" are derived from six observations daily, viz., at 6 and 8, A. M., and 2, 4, 10 and 12, P. M.

**Comparative Table for August.**

| Year. | Temperature. Mean. | Max. | Min. | Range. | Rain. Days. | Inches. | Wind. Mean Velocity. |
|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | | | Miles. |
| 1840 | 64.65 | 80.1 | 47.4 | 32.7 | 12 | 2.950 | -- |
| 1841 | 64.15 | 83.5 | 46.7 | 36.8 | 9 | 6.170 | -- |
| 1842 | 65.46 | 80.7 | 45.3 | 35.4 | 6 | 2.500 | -- |
| 1843 | 66.01 | 85.5 | 44.4 | 41.1 | 4 | 4.850 | -- |
| 1844 | 63.72 | 82.5 | 44.3 | 38.2 | 17 | imperfect | -- |
| 1845 | 67.35 | 82.5 | 44.4 | 38.1 | 9 | 1.725 | -- |
| 1846 | 67.91 | 86.3 | 50.4 | 35.9 | 9 | 1.770 | -- |
| 1847 | 64.29 | 83.1 | 44.9 | 38.2 | 10 | 2.140 | -- |
| 1848 | 68.64 | 87.5 | 49.3 | 38.2 | 8 | 0.855 | 4.55 |
| 1849 | 65.43 | 79.5 | 51.4 | 28.1 | 10 | 4.970 | 3.76 |
| 1850 | 66.64 | 84.2 | 43.0 | 41.2 | 13 | 4.355 | 4.46 |
| 1851 | 63.59 | 79.8 | 43.6 | 36.2 | 10 | 1.360 | 4.62 |
| 1852 | 65.35 | 81.2 | 46.7 | 34.5 | 9 | 2.675 | 3.30 |
| Mean | 65.62 | 82.80 | 46.29 | 36.51 | 9.7 | 3.025 | 4.11 |

# MISCELLANEOUS INTELLIGENCE.

## DOMESTIC.

### Bytown and Prescott Railway.

This undertaking, which was commenced in the spring of 1851, and has, since then, quietly, unobtrusively, but surely, been advancing towards completion, is destined, ere long, notwithstanding the small share of public notice it has hitherto attracted, to rank as one of the most important lateral railways in the province. Whether viewed as a 'feeder' to the "Main Trunk," or as an *independent track*, connecting the commerce of the Ottawa with that of the St. Lawrence, and opening to the vast region watered by the former of these monarch streams, (which the old "voyageurs" loved to call "La Grande Rivière du Nord") a new channel of trade, via the Ogdensburgh Railway, to the several seaboard cities of the United States, its importance as a great public work can scarcely be over-rated. At some future period, we may lay before our readers a statistical sketch of the "Ottawa country," the capital of which—Bytown—bids fair to rival, in size and commercial importance, the most thriving of our Canadian cities. To us of this more favoured "West," comparatively little is known of that most interesting section of the country; but we have "facts" and "figures" before us to show that, whilst it is little behind us in the ordinary march of improvement and civilization, it has outstripped us in enterprize: its merchants and capitalists having boldly undertaken, not only unaided from any outward resource, but in the face of much selfish opposition, to commence the railway we are speaking of; and which, from all present appearances, is likely to be the first *completed* work of the kind in Upper Canada.

The distance, by this route, from the Ottawa to the St. Lawrence is 53¾ miles. For some 20 miles from Bytown, the road is laid parallel to, and within a short distance of, the St. Lawrence, passes through the flourishing village of Kemptville, and has its southern terminus near the eastern limits of the town of Prescott, opposite to the Ogdensburgh Railway Depôt,—at a point where the St. Lawrence *never freezes up*. The country through which the line runs is of high agricultural capabilities—is rapidly improving—and as a *fall wheat growing country*, we have seldom seen it surpassed, even in the western portions of the province. The features of the ground are highly favourable for the construction of a railway. There are to be no grades exceeding 30 feet in the mile, whilst more than half the road is *level*. Its lineal arrangement shows about four-fifths straight line, in tangents of from 1 to 7 miles. Upon the whole, its capacities, as a freight road, cannot be surpassed in the province, and are such as will admit of the timber of the Ottawa being deposited on the banks of the St. Lawrence in such quantities, and at such rates, as will make Prescott the great lumber mart, not only for a wide tract of our own country, but also for a large portion of the state of New York. The work of grading was boldly commenced last October, and is now well advanced. Much has been done with very little means,—the expenditure thus far having been wholly provided for by the two towns it is destined to connect, affording to many richer communities an example of courageous enterprize, which they would do well to profit by. We observe that the Municipal Councils of the several counties interested in the undertaking have petitioned parliament for aid to bring their work to a successful completion. They have watched whilst others slept, and we heartily wish them the success they merit. We look upon this undertaking as one of such real importance that we shall probably revert to it again, and enter more fully into the details of the project.

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RAILWAY SUSPENSION BRIDGE OVER THE NIAGARA RIVER.—The Bridge will form a single span of 800 feet in length. It is to serve as a connecting link between the railroads of Canada and the State of New York, and to accommodate the common travel of the two countries. It is established by ample experience, that good iron wire, if properly united into cables or ropes, is the best material for the support of loads and concussions, in virtue of its great absolute cohesion, which amounts to from 90,000 to 130,000 lbs. per square inch according to quality. The Bridge will form a straight hollow beam of 20 feet wide and 18 deep, composed of top, bottom and sides. The upper floor, which supports the railroad, is 24 feet wide between the railings, and suspended to two wire cables assisted by stays. The lower floor is 19 feet wide and 15 high in the clear, connected with the upper one by vertical trusses, forming its sides, and suspended on two other cables, which have 10 feet more deflection than the upper ones. The anchorage will be formed by sinking 8 shafts into the rock 25 feet deep. The bottom of each shaft will be enlarged for the reception of cast iron anchor plates, of 6 feet square. These chambers will have a prismatical section, which, when filled with solid masonry, cannot be drawn up without lifting the whole rock to a considerable extent. Saddles of cast iron will support the cables on the top of the towers. They will consist of two parts—the lower one stationary, and the upper one moveable, resting upon wrought iron rollers. The saddles will have to support a pressure of 600 tons, whenever the Bridge is loaded with a train of maximum weight. The towers are to be 60 feet high, 15 feet square at the base and 8 at the top. The compact, hard limestone, used in the masonry of the towers will bear a pressure of 500 tons upon every foot square:—

*Weight of Bridge.*

| | |
|---|---|
| Weight of Timber, | 910,130 lbs. |
| Wrought Iron and Suspenders, | 113,120 lbs. |
| Castings, | 44,332 lbs. |
| Rails, | 66,740 lbs. |
| Cables between Towers, | 534,400 lbs. |
| | 1,678,722 lbs. |

*Weight of Rail-road Trains.*

| | |
|---|---|
| One Locomotive, | 25 tons. |
| 27 double freight Cars, each 25 feet long, and of 15 tons gross weight, | 405 tons. |
| Making a total gross weight of 430 tons which will fall upon the cables when the whole bridge is covered by a train of cars from end to end: and to this 15 per cent weight of pressure as the result of a speed of 5 miles per hour, which is a very large allowance, | 61 tons. |
| Add weight of superstructure, | 782 tons. |
| Total aggregate maximum weight, | 1,273 tons. |

The tension of cables, which result from a weight of 1,373 tons and an average deflection of 59 feet, is 2,310 tons. Since the assumed maximum tension can but rarely occur, it is considered ample to allow four times the strength to meet this tension—that is 8,960 tons. But assuming 2,000 tons as a tension to which the cables may be subjected, five times the strength to meet it is allowed, and an ultimate strength of 10,000 tons provided for. For this purpose, 15,000 wires of No. 10 will be required. At each end of the upper floor the upper cables will be assisted by 18 wire rope stays, and their strength will be equivalent to 1,440 wires; these deducted leave the number of wires in the four superior cables 13,560, the number of wires in the four superior cables 13,560, the number of wires in one cable 3,390, diameter of cable 9¼ inches. The rail-road bridge will be elevated 18 feet on the Canadian, and 28 on the American side, above the present surface of the bank, and above the present structure. It will be the longest railroad bridge, between the points of support, in the world.—*St. Catharines Journal.*

CANALS OF CANADA.—The gross revenue derived from all the Canals of Canada, for 1851, was £79,999, the expenses were £27,335. The number of vessels which passed through the Canals for the same year was 18,871: the total tonnage, 1,973,841.

CANAL TOLLS.—The tolls collected on the Welland Canal during the month of July last, was £7682 3s 8d, against £5909 7s. 6d. in the same month of last year. The number of vessels passed through was 750, being an increase of 60 over July of last year, and of 262 over the same month in 1850.

NEW CHURCH.—The result of the competition by W. Thomas, Messrs. Cumberland & Storm, and J. Sheard, in preparing designs for the erection of an Irish Presbyterian Church, at the corner of Queen and Mutual Streets, in this City, has been the adoption by the committee of the design of W. Thomas, Esq., Architect. The Church is of the Norman or Lombardian style of architecture, with two staircase towers and spires on the principal front, to Queen Street, to be erected of white brick, with open timbered roof to the interior, and with circular apsis at the north end. The size of the body of the Church is 81'.0" by 55'.0", and will give an accommodation of 612 sittings on the ground floor.

We are gratified to learn that Sir Chas. Lyell, who stands at the head of modern geologists, arrived at Halifax by the last Steamer, and immediately proceeded to visit the County of Albert, in this Province, now becoming celebrated for its mineral wealth. As this Province requires only to be better known, to take a much higher rank than has hitherto been given to it, we look upon the visits, and the publicity given to the opinions of such gentlemen, as of very great importance. The opinion of Sir Charles will go far to settle the much disputed coal or asphaltum question, as if this mineral is in the place where it has been formed, it will belong to the coal family, and on the other hand, if it has been melted and ejected into its present situation, it will be entitled to the name of asphaltum.—*Nova Scotia paper.*

## FOREIGN.

### The New Crystal Palace at Sydenham.

On Thursday last the first column of the new Crystal Palace was erected, amidst the acclamations of a large and very respectable company. The scenery around the spot chosen is very beautiful, and the site presents facilities and opportunities which, it is expected, will be made good use of by those who have charge of the undertaking.

The company present included many illustrious in rank, science, literature, and commercial rank, and letters of apology, regretting their absence, were read from some of the most distinguished persons in the country.

At half-past two o'clock, the visitors, guided by a programme which had been delivered to them, assembled round the spot where the pillar of the palace was to be planted; and shortly afterwards a procession advanced, preceded and marshalled by Mr. Harker, the toastmaster. Six workmen, bearing a large and handsome banner, inscribed "Success to the Palace of the People," were followed by Mr. Laing, M.P. (the Chairman of the Crystal Palace Company), Mr. F. Fuller, and the other directors. The column was immediately raised and inserted in its socket, three young lads assisting in the operation. A bottle was deposited under the pillar, containing the coins of the realm, and a paper bearing the following inscription:—

"This Column, the first support of the Crystal Palace, a building of purely English Architecture, designed for the recreation and instruction of The Million, was erected on the 5th day of August, 1852, in the 16th year of the reign of Her Majesty Queen Victoria, by Samuel Laing, Esq., M.P., Chairman of the Crystal Palace Company. The original structure, of which this column forms a part, was built, after the design of Sir Joseph Paxton, by Messrs. Fox, Henderson, & Co., and stood in Hyde Park, where it received the contributions of all Nations, at the World's Exhibition, in the Year of our Lord 1851.

"I, your glass,
Will modestly discover to yourself
That of yourself which yet you know not of."

The new building, which is expected to be finished by the 1st of May, 1853, will differ in many important respects from the old. In consequence of the great fall in the park in which it will be situated, an additional story will be necessary in front, which will have the effect of remedying a defect in the old structure,—the want of elevation, as compared with its vast length. A slight curtailment of length will also be made, although the area of ground covered will be equal to that occupied by the Hyde-park building. The centre transept will be extended into a semi-circular roof of 120 feet diameter; and two smaller transepts will be placed towards the ends of the building. The centre transept will be nearly 200 feet in height, and 120 in width; those at the sides 150 feet high, and 72 wide. The columns and girders, instead of falling so rapidly towards the extreme end, and thereby preventing the spectator from arriving at a conception of the extent of the building, will not now keep the same line as before, but every 72 feet pairs of columns, 24 feet apart, will advance 8 feet into the nave, and from these columns will spring arched girders 8 feet deep, in lattice work of wrought iron, which support the girders of the roof. These advancing columns, tied together, will form groups of pillars like those in a gothic cathedral, and occurring at every 72 feet down the nave, will furnish to the eye a means of measuring which it had not before. The ends of the building will extend into large wings, attached to one of which will be the railway station, and these wings will terminate in lofty glass towers. The area in front will be laid out in terraces and gardens, interspersed with statues, fountains (one of which will rise to the height of upwards of 200 feet), and temples, and adorned by a choice collection of plants, shrubs, and flowers.

One of the most conspicuous and attractive sections will be that of Ethnology. No museum has yet ever attempted to show models of the different varieties of the human race, together with their national costumes, their domestic and agricultural implements, their armour, their dwellings, their modes of conveyance, and other characteristic objects appertaining to them. But, under the guiding direction and personal superintendence of such an eminent ethnologist as Dr. Latham, no fears are entertained but that all these will one day ornament the compartments of this noble building, and that a very large proportion of a complete collection will be ready by the opening.

It is intended to arrange the growing plants in such a manner as to show what are the peculiarities which mark the Flora of different parts of the world. To this end the surface of our globe will be divided into regions, or natural provinces, which are each characterized by particular races of animals and vegetables, and all the arrangements of natural objects will tend towards the due illustration of the "countries" (as it were) which nature has mapped out upon our earth, and which she has peopled with the subjects of her three kingdoms.

The ethnological specimens will, therefore, appear near the plants of the region to which they both belong. Close by them will be placed specimens of the most characteristic quadrupeds, birds, reptiles, fishes, mollusca, and insects, which are to be found in the same parts of the world. All these will be shown in the attitudes most natural to them, and best exemplifying their peculiar habits and dispositions; for which purpose the assistance of the exhibitor of the most life-like stuffed specimens in the Great Exhibition will be obtained. The fish will be preserved on a plan not hitherto tried, that of making them appear to be swimming, in very large glass vessels containing a sufficient quantity of some preservative fluid having the appearance of water. The mollusca will be represented, not by their shell only, but by shells containing models of the animals crawling or swimming in the localities peculiar to them; and in all cases the soil or situation which all these creatures inhabit will be imitated and represented as closely as possible. So that a visitor will find himself surrounded, wherever he goes, by groups of objects, taken from all the three kingdoms of nature; not placed, like museum specimens, "all in a row," but artistically arranged so as to exhibit individual habits and peculiarities to the best advantage; and so associated as to give an accurate idea of the Fauna and Flora of the region they are designed to illustrate. The selection of characteristic examples of the zoological portion has been kindly undertaken by Professor Edward Forbes, Mr. Waterhouse, and Mr. Gould, whose attainments, as naturalists, are too well known to need comment; and the whole will form an extensive series of small collections, illustrating, in a manner never hitherto attempted, the physical geography of the whole world. Such an exhibition, while it cannot fail to be amusing, will be, at the same time, replete with instruction of the soundest character, and afford a clearer insight into the subject of the distribution of plants and animals on the surface of the earth than many months of reading.

It is ultimately intended to exhibit a series of geological illustrations, corresponding to those of physical geography, on a scale which no geological museum can attempt, for want of space. Not only will the external appearances of the earth's crust at different places be shown, but also the geological strata of particular portions. Models will be prepared to illustrate mining and quarrying, to show the action and results of volcanoes and earthquakes, and to exhibit geology in its practical bearings with reference to well-sinking, the supply of water tunnelling, &c. The name of Professor Ansted will be a sufficient guarantee for the accuracy of execution of these details.

For the present, however, the principal endeavours of the Company are concentrated in bringing out as complete a collection as possible of life-sized restorations of those colossal extinct animals and birds, which we now only know of by their fossil remains. Under the direction of Dr. Mantell, it is confidently believed that a museum of such creatures will be formed which will excite the wonder of every one, and afford little opportunity for disapprobation, even amongst the most scrupulously particular anatomists.

Reference must also be made to another section of the natural history department, which is likely to prove the most useful and commercially valuable portion of the exhibition; though, perhaps, not one of the most attractive. We allude to the collection of raw produce, which is designed to show all the various articles taken from the animal, vegetable and mineral kingdoms, and applied to ornamental and useful purposes by the skill of man. With this view, the directors invite the assistance of all, in the way of contributions of raw products, either now in use or likely to be brought into use, in the arts and manufactures; and they may reasonably look forward at no distant period to being able to show such a collection of raw materials, conveniently arranged and truly labelled, as shall not only convey an immense amount of useful instruction to the mass, but give a far greater impulse to improvement amongst the manufacturers of Europe than was imparted even by the Great Exhibition of 1851.—*Illustrated London News.*

The Electric Time-Ball in the Strand.—After the satisfactory completion of the requisite arrangements which had been for some time pending between the Electric Telegraph Company and the Astronomer Royal at Greenwich, Mr. Edwin Clark, the Company's engineer, had entrusted to him the construction of the ingenious apparatus for the developement of the electric telegraph system, as applied to the regulation of time on a plan for distributing and correcting mean Greenwich time in London and at all the principal ports throughout the United Kingdom every day at one o'clock. The ball that has recently been raised on a pole upon the dome of the Electric Telegraph Company's West-end station, No. 448, Strand, opposite Hungerford-market (similar to the ball which surmounts the Royal Observatory at Greenwich,) which is a remarkable object of attraction to all persons passing to and from the west-end to the city, is now completed. It is about 6 feet high and 16 feet in circumference, made of zinc, and painted of a bright red colour, so that it may the more clearly be discerned at a distance, and can with ease accommodate three persons in the interior. It has a broad gilt belt round it, thus having the appearance of a "great globe," and at the extremity of the shaft is a cross, or bright gilded weather wand, with the four points, N. S. E. W.; and below the arms of the Electric Telegraph Company, with their initials, "E. T. C." Many difficulties have been experienced in the completion of this new idea of electricity, in consequence of numerous obstacles with regard to the correct working of the telegraph wires along the streets of London and the Greenwich Railway to the Royal Observatory. These, however, have been overcome to the great satisfaction of the directors of the Company and the Astronomer Royal, and for the last three days the experiments have been made with the most complete success, the ball or globe dropping by the electric action simultaneously with the one at the top of the Royal Observatory, precisely at one o'clock, P. M., both balls being in fact, liberated by the same hand. It is now in active operation, and will communicate the standard time of Greenwich and London, by the different lines of railway, to all the principal ports of the United Kingdom and Scotland on the same principle, as arrangements have been made to make it one of the most complete improvements of the present day, not only as regards the time for regulating chronometers on board vessels, but the chief public clocks of the metropolis, and from one end of the country to the other. An electric dial is now being completed in the midway opposite the office in the Strand which separates the crossings, and the new lamp, or light, at the top of the post has been tested as to its power of reflection, and that dial or electric apparatus will show forth the hour, minutes, &c., both day and night, to the public.—[*Ibid.*

*Submarine Rock Blasting.*—The reef rocks at Hurl Gate, New York, are in course of being blasted, and the New York *Tribune* of the 22nd ult. in describing a resumption of the process, says,—"The firing recommenced on Way's Reef. Since then thirty-eight charges have been fired on that rock, and we hope it will be reduced to fifteen feet mean low water before the close of next week. The firing on Way's Reef is from a battery of ten pairs of plates, placed on the metal float moored on that reef. As many as nine charges have been fired during a single tide. As soon as Way's Reef is broken down, 'Shell Drake Rock' will be fired upon, until it is reduced to fifteen feet below mean low water. After that, 'Frying Pan,' a very dangerous rock in mid-channel, and in rapid and deep water, will be attacked, and the firing continued on that rock until it is reduced to the same depth as Pot Rock, namely, 20½ feet below mean low water. As soon as the rocks here mentioned shall have been reduced to the depths respectively stated above, operations by Messrs. Maillefert and DeRaasloff, will be commenced on Diamond Reef, situate between Governor's Island and the Battery. This is a large rock in 16 feet water. A charge containing 500 lbs. of powder will be fired on this rock. Two blasts will be made on Hallets Point, at the Gate, in which a preparation of potash will be used for blasting. The whirlpool has been entirely filled up by the *debris* of Pot Rock, and the smallest row boat may pass over what was once Pot Rock, at any time of tide. This great and wonderful result M. Maillefert has accomplished by the firing on the surface of the rock under water without any drilling, 284 submarine charges, containing in all 34,231 lbs. of powder, and at a cost of less than 7,000 dollars. It is a work of great importance to the United States, and in fact to the whole world, and is conducted with the greatest economy. We purchase the powder, blasting-cans, and ballast-bags with ready money, and pay M. Maillefert weekly a stipulated price for each charge fired on the rock; he furnishing the labourers employed, the wires, battery and floats. The expense of removing Pot Rock, Frying Pan, and Diamond Reef, to the depth of 20½ feet, and Way's Reef and Shell Drake Rock to the depth of 15 feet below mean low water, will probably not exceed 15,000 dollars. The success that has attended M. Maillefert's new mode of submarine blasting will greatly benefit the commerce of the world, will be the means of saving thousands of lives and millions of dollars in value of property; for this system of submarine blasting will be adopted in every place where dangerous rocks obstruct navigation, inasmuch as but a small sum of money is required to pay the expense, compared with what would be required under the old system. His excellency the Portuguese minister takes great interest in these operations, and he has communicated to his government the result thus far obtained at Hurl Gate. In April last the Portuguese war steamer Porto made dreadful shipwreck on a rock in the harbour of Oporto. The most influential families in that city have now obtained one of the Francis metallic life-boats, and are in hopes to obtain the services of Messrs. Maillefert and De Raasloff to remove this dangerous rock by submarine blasting. M. Maillefert has entirely recovered from the wounds he received by the disastrous explosion of a blasting-can above water, during the operations on Frying Pan, on 26th March last."

*French Researches at Nineveh.*—The Minister of the Interior has received further accounts of the explorations, which are being carried on by M. Place, Consul of France at Mossul, in the ruins of Nineveh. In addition to large statues, bas-reliefs in marble, pottery, and articles of jewellery, which throw light on the habits and customs of the inhabitants of the ancient city, he has been able to examine the whole of the palace of Khorsabad and its dependencies, and in so doing has elucidated some doubtful points, and obtained proof that the Assyrians were not ignorant of any of the resources of architecture. He has also discovered a large gate twelve feet high, which appears to have been one of the entrances to the city, several constructions in marble, two rows of columns, apparently extending a considerable distance, the cellar of the palace still containing regular rows of jars, which had evidently been filled with wine—and at the bottom of which jars there is still a sort of deposit of a violet colour. M. Place has, moreover, discovered the storehouse of pottery, containing various articles. In addition to all this, he has caused excavations to be made in the hills of Bachiccha, Karamless, Teu Leuben, Mattai, Karakeck, Digan, &c., on the left bank of the Tigris, within ten leagues from Khorsabad. In them he has found monuments, tombs, jewellery, and some metals and stones. At Dgigiran there is a monument, which, it is supposed, may turn out to be as large as that of Khorsabad. At Mattai, and at a place called Barrican, M. Place has found bas-reliefs cut in solid rock; they consist of a number of colossal figures and of a series of full-length portraits of the Kings of Assyria. M. Place has taken copies of his discoveries by means of the photographic process; and has been authorized to make diggings near the palaces which the English are engaged in examining.

*Prizes of the Academy of Sciences of Paris.*—At the session of the 22nd of March, the prize in Astronomy, for 1852, was divided between Mr. Hind and M. de Gasparis, the former for his discovery of the new planet Irene, and the latter for that of Eunomia. The Cuvierian prize (a triennial prize and never before awarded) was given to Professor Agassiz for his Researches on Fossil Fishes.

Among the prizes offered, is one for 1854, in the department of Mathematics, as follows:—To determine the equations of the general movements of the earth's atmosphere, having in view the rotation of the earth, the calorific action of the sun, and the attraction of the sun and moon. The authors are desired to exhibit the concordance of their theory with the best observations on the atmospheric movements. Even if the whole question is not resolved, but some important steps are made towards its solution, the prize will be awarded by the academy. The prize is a gold medal of 3,000 francs.

There is also an extraordinary prize for 1853, on the application of steam to navigation. The prize was proposed first in 1836, and has been continued to 1838, 1841, 1844, 1848, and finally to 1853. It is offered "for the best work or memoir on the most advantageous employment of steam for steamships, and upon the best system of mechanism, 'installation,' stowage, and armament for such vessels." The prize is 6,000 francs. Time, December 1, 1853.

*A British Industrial University.*—In course of last month it was announced in our columns that there was reason to believe His Royal Highness the Prince Consort "contemplated the foundation of a great building and establishment in which theory would be combined with practice, in the advancement of science and art, by a concentration of talent and skill." We believe we may now state without any impropriety that in all probability the surplus of £150,000 and upwards, in the hands of the Royal Commission of the Great Industrial Exhibition of 1851, will be devoted to the foundation of an Industrial University in London, such as was long since mooted in The Builder. This central concentration of science and industry will ultimately be organized, with radii or branch institutions, throughout the whole country; but we scarcely think that the Royal Commissioners, as has been stated, have as yet formed any definite scheme for the establishment of such a university, although it is their known design to carry out the idea.—*Builder.*

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