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

APRIL, 1861.

THE PRODUCTION OF SILK FROM THE CATERPILLARS OF CANADIAN MOTHS.

For several years past the attention of naturalists and others in Europe, has been directed to the possibility of discovering some silk-producer, as a substitute for the ordinary silk-worm. Various epidemics have recently been making great havoc among the silk-worms, so much so, that during the last few years, half, or nearly two-thirds, of the crop in Europe has been lost through these causes, to the great alarm of those engaged in this branch of industry. In a late number of the "Illustrated London News," a brief account is given of the discovery of a new silk-producing moth (*Saturnia cynthia*), the caterpillar of which feeds on the leaves of the tall Ailanthus (*Ailanthus glandulosus*), a tree indigenous to China, but which has recently been introduced into and acclimatized in England. The silk obtained from this moth is described as being strong, as taking most dyes well, being cheaply produced, and as only lacking the more brilliant lustre of the best silks on which we have been so long accustomed to look. Now it is well known to naturalists that there exist in Canada several native species of this genus (*Saturnia*) of moths, some of which resemble very closely the one mentioned above. It is desired in the following paper, to draw attention to the possibility of employing the products of these moths in the manufacture of, at any rate, the coarser varieties of silk.

The subject is by no means new in Canada, the attention of naturalists having been early attracted by the splendor of the Saturniæ and the extraordinary quantity of silk they produce in forming their cocoons. Dr. Cottle, of Woodstock, read some notes on this genus of moths before the Canadian Institute in 1854,* suggesting the possibility of using their silk for textile fabrics.

All the silk and silk-stuffs of commerce are obtained at present from the common silk-worm (*Bombyx mori*); but in Bengal, and other parts of India, and to a large extent in China, valuable silk is procured from the cocoons of other species of moths, of these the most important known are the *tussah* and Arindy silk-worms. The first (*Phalæna paphia, Roxb.*) occurs in such abundance over many parts of Bengal and the adjoining provinces, as to have afforded to the natives, from time immemorial, an abundant supply of a very durable, and dark coloured silk, called *tussah*. This fabric is much worn by the Brahmins, and other sects of the Hindoos, and would no doubt, be very useful in America, as affording a cheap and at the same time very durable dress. The second, the Arindy silk-worm, is found in many parts of Bengal, where it is reared in a domestic state. Its food consists of the leaves of the common *Ricinus*, or palma-christi, called Arindy by the natives. The silk manufactured from the cocoons of this moth is of an almost incredible durability: it is said that a dress made of it lasts more than the lifetime of one person, and is frequently handed down from parent to child. The Chinese have also many wild species of silk-worm, which feed on the oak, ash, pepper-tree, and various others.

The Canadian species of the genus to which the above mentioned insects belong—the *Saturnia*, Schr., or *Attacus*, Hübner, as now constituted—are very fine insects, and spin large cocoons. This genus of large moths is, perhaps, the most handsome of all the nocturnal lepidoptera: they are beautifully covered with a soft down and are adorned with a great variety of splendid colours. The first of these is the Cecropia moth (*Saturnia cecropia*, Linn.,) the largest of the Canadian lepidoptera, not uncommon in any part of Canada. Its wings, when expanded, measure from six to seven inches in breadth; their ground colour is dusky-brown. The anterior pair are adorned near the middle, with a kidney shaped, reddish-white spot margined with black; and beyond this, nearer the edge, with a reddish-white, slightly wavy, band bordered with black; the rest of the wing is of a rather lighter colour, becoming a light brown at the edge. Near the tip there is also a black eye-like spot, and a short zig-zag line of a whitish colour, running from it to the front of the wing. The posterior wings are of the same colour, and ornamented in much the same way; the band is rather broader, and of a lighter hue, as is also the kidney-shaped disk in the middle. The head is red, with a white collar between it and the thorax, which is also red. The abdomen is of a rather darker red, and is marked with white transverse lines. The antennæ of the male are broadly pectinated, of the female much less so.

The caterpillar is almost as beautiful as the perfect insect. Its length is from three to four inches; it is of a light green colour, with a number of light red, or yellow, wart-like points, projecting from it. On each segment there are two small blue spots. It feeds on the leaves of the apple, cherry, and plum trees; the first of which appears to be its favorite

* A few rough notes on some of the Canadian Saturniæ, and suggestions on the possibility of using their silk for textile purposes.—*Canadian Journal*, Vol. II., Old Series.

food. It remains on the trees, feeding on the leaves, until August or September, when it descends, and may often be seen crawling about in search of a convenient situation in which to construct its cocoon. It spins a brownish coloured cocoon, about three inches long, and one wide, which it attaches firmly to the under side of a twig. The outer coat is coarse and very strong, and affords an excellent protection to the chrysalis from the inclemency of the weather even in our severest winters. The inside of this outer integument is lined with soft, though strong brown silk, which may be unwound and spun like that of the ordinary silk-worm. In the inside lies a large black, shining chrysalis, from which the moth issues in due time. These cocoons remain on the trees until about the end of May. When about to emerge from its shell the moth throws out a caustic liquid from its mouth, which dissolves the fibres of the silk, and enables it to escape from its prison. These insects may be very easily raised from the caterpillars by placing them in a spacious box, with a little moistened earth at the bottom, and keeping them supplied with food,—if the food is allowed to become withered or mouldy, of course the caterpillars cannot be expected to retain their health. The box should be covered with a gauze or wire frame, and there should also be fastened in it some twigs on which the insect may spin its cocoon. An excellent plan is to get a glass cylinder and sink one end of it into a flower-pot in which is some white sand, the sand is kept moist and the food is stuck into it, so as to keep it fresh for some time; the caterpillar is then placed on its food, a bit of gauze is tied over the top of the cylinder, and the flower-pot and cylinder being kept out of doors, the insect is as nearly as possible in a state of nature. That these moths may be successfully raised from the eggs also, we learn from the "Transactions of the American Philosophical Society of Philadelphia," vol. 1; where we are told that as early as the year 1767, "Moses Bartrain, of Philadelphia, raised a number of caterpillars from the eggs of the Cecropia moth, from which he also obtained cocoons." It is stated in the "Philosophical transactions of the Royal Society of London," for the year 1759, that "the Rev. Samuel Pullein was among the first to attempt to unwind the cocoons of this moth;" and that "he ascertained that twenty threads of this silk, twisted together would sustain nearly an ounce in weight more than the same number of common silk." Dr. Thaddeus Harris, in his treatise on the insects of Massachusetts injurious to vegetation, remarks on this subject:—"The following circumstances seem particularly to recommend these indigenous silk-worms to the attention of persons interested in the silk culture. Our native trees afford an abundance of food for the caterpillars: their cocoons are much heavier than those of the silk-worm, and will yield a greater quantity of silk; and as the insects remain unchanged in the chrysalis state from September to June, the cocoons may be kept for unwinding at any leisure time during the winter. Consisting, as these cocoons do, entirely of silk, the fibres of which far surpass those of the silk-worm in strength, they might be employed in the formation of fabrics similar to those manufactured in India. Experiments have been made with the silk of the Cecropia, which has been carded and spun, and woven into stockings that wash like linen."

The *Saturnia polyphemus*, Fabr. is another of these silk-producing moths. Its wings expand to five or six inches; they are of a yellowish-brown colour, clouded with black; each wing is ornamented with a transparent eye-like spot. The anterior one is marked with a waved line near the edge, two small black spots at the tip, contiguous to each other, and two curved lines of a light colour at the base, near the body of the insect. The transparent spot—near the middle—is encircled with yellow and black. The posterior wing is of much the same colour,—in the male of a darker shade,—with a continuation of the marginal band, which has on this wing, a broad border of black. The transparent spot is larger, and forms the pupil, as it were, of a large eye-like spot, the iris of which is bluish grey, gradually shading into black, the whole surrounded with a deep black border. The body is of the same colour as the wings. The female is very similar to the male, except that the colours are of a lighter shade. The caterpillar is about two inches and a half in length, and about half an inch in diameter; it is of a light green colour, nearly transparent; each segment of the body rises into two humps, terminating in a little bright yellow wart, bearing two or three short hairs. Along each side there are two rows of similar wart-like excrescences, which are joined, on each segment by an oblique yellow line. Its head and feet are dark brown. It feeds on the leaves of the choke-cherry, and other species of *prunus*, and also according to some writers, on the oak and elm. When full grown, the caterpillar draws together several leaves of the tree on which it feeds, with its silken threads, and forms within them an oblong cocoon, about two inches long, rounded at the ends, and very firm, which contains much silk, somewhat similar to that of the Cecropia moth, though not in so large a quantity. The perfect insect, after having remained in the imago state all winter, emerges from the cocoon in July or August. The other Canadian species are the *Saturnia promethea*, Drury, and the *S. luna*, Drury; both spin cocoons containing silk, though not as much as the others mentioned above. The caterpillar of the *Promethea* feeds on the sassafras, and the common wild cherry; that of the *Luna* on the walnut, and hickory trees.

Of these insects the *Cecropia* will probably be found to be the most useful, as it is easiest to raise, is the largest, and produces the most silk.

The results of all the most approved modes of rearing the silkworm and preparing the cocoons, were exhibited, and might be studied with advantage, in the Crystal Palace, during 1851.

"The *Bombyx mori*, having been bred and reared under the special care and management of man during a long succession of ages, may be regarded as a domesticated species of insect; and it has become the subject, as in the higher domesticated races, of varieties, of which those called "Sina," "Syrie," and "Novi," in France, are examples.

"The Sina" variety of the silkworm is known and esteemed for the pure whiteness of its silk, the thread of which is fine, but weak, and not very lustrous. The "Syrie" variety is of large size, produces a cocoon abundant in silk, but the thread is rather coarse, and inclines to a greenish tint. The "Novi" race is small, but the cocoons are firm and well made, and the silk has a yellowish tint.

The specimens of cocoons and raw silk exhibited in the French department were numerous, and the degrees of excellence hardly to be discriminated in the finest examples selected for the award of the prize medal. With regard to the superior quality of these raw silks and cocoons, the Jury, by their recommendation of the award of the Council medal to the "Central Society of Sericiculture of France," desired to testify their admiration of the specimens exhibited by many members of that Society, and their appreciation of the important influence which it has exercised in the improvement of this valuable product of the animal kingdom.

The Jury, however, justly gave the honour of their first notice to the beautiful specimens shown by Major Count de Bronno Bronski, exhibitor of unbleached silk and silk cocoons from the Château de St. Selves, near Bordeaux, Department de la Gironde. The cocoons were remarkable for their large size and regularity of form, and the silk for the unusual length of the thread, its natural pure white colour, its fineness and lustre. The circumstances under which this superior quality of silk were obtained are certified in a report by a Committee of the Agricultural Society of the Gironde, dated 28th April, 1847, to be as follows:—"In 1836 Major Bronski reared separately the eggs of the three varieties, 'Sina,' 'Syrie,' and 'Novi.' In 1827 he set apart the cocoons of the varieties, 'Syrie' and 'Novi;' and on the exclusion of the imago, or perfect insect, he associated the males of the 'Novi' with the females of the 'Syrie;' and the hybrid ova were hatched at the ordinary period in 1838, the operations being repeated in 1839 and 1840. With regard to the race 'Sina,' M. Bronski, in 1837, separated the white from the black worms as soon as they were hatched. He then selected the largest and best shaped cocoons, and made a special collection of the eggs from the moths excluded from those cocoons. This procedure was repeated in 1838 and 1839; but in 1840 he associated the males excluded from the large cocoons of the black worms with the females excluded from those of the white worms. In 1841, he associated the males of the 'Sina' race with the hybrid females obtained from the above-described crossings of 'Novi' and 'Syrie' breeds." By these and similar experiments M. Bronski at length appears to have succeeded in obtaining a race of silkworms not subject to disease, producing large and equal-sized cocoons of a pure white colour, the silk of which was equal in all its length, strong and lustrous, and presenting an average length of thread of 1057 métres."

A few statistics are subjoined to show the very great importance of the manufacture of silk. From official returns, it is found that there were imported into Great Britian and Ireland during the year 1858:

Raw silk.....6,277,676lbs. valued at £5,791,216
Thrown silk. 358,269lbs. " " 457,866
Manufactured silk goods, from India 207,081 pieces.
" " from Europe 827,650 lbs.

The customs duties paid on these amounted to no less than £270,536.

In the same year, there were exported from England:

Raw silk..... 2,814,519lbs.
Thrown silk (foreign)..... 364,680 "
Manufactured silk goods (European).. 18,092 "
" " (Indian)... 227,139 pieces.
" " (English) 480,709lbs valued at..... ... £603,399
Thrown silk (Eng.) 551,281lbs. valued at £562,002
Silk twist " 442,641 " " " 928,644

The average weight per annum of raw and thrown silks imported into England in the years 1856-8, was 11,266,618lbs.

The returns of the silk trade for 1859, in England, amounted to £14,000,000; France, £31,300,000; Zollverein, £4,105,000; Switzerland, £4,000,000; Austrian States, £7,200,000; Spain, Italy, &c., £5,000,000. So that the total returns of the silk-manufactures in Europe amount to the enormous sum of £65,605,000.

In the year 1855, there was imported into the United States, over twenty-five million of dollars' worth of silk, from Italy, France and China, viz:—

Of raw silk..... ..... $751,623
Of manufactured silk $24,916,356

The value of the importations of silks of all kinds into Canada in 1857 amounted to $1,025,839. In 1858 it sunk to $658,045, and in 1859 rose to $901,856. A consumption which may now be assumed as fully equal to one million dollars a year, ought to supply a stimulant, which would lead many who have time at their disposal, to direct their attention to this interesting and important subject, and by practical experiment establish the feasibility of producing Canadian silk from Canadian silk-worms. It would be a very valuable and most interesting contribution to the International Exhibition of 1862, if a specimen of Canadian manufactured silk, with moths, worms, cocoons, and leaves of the trees they usually feed on, were to be prepared for exhibition.

COTTON MANUFACTURES.

"From one of the most miserable provinces in the land, Lancashire has grown to be one of the most prosperous. Within a hundred and fifty years the population has increased tenfold, and land has risen to fifty times its value for agricultural, and seventy times for manufacturing purposes. From an insignificant country town and a little fishing village, have sprung Manchester and Liverpool; and many other towns throughout the country owe their existence to the same source. These are the great monuments to the achievements of Arkwright, Crompton, Peel, and the other captains of industry who wrought this mighty change, and the best trophies of their genius and enterprize."

Cotton was but little used in Great Britain until the middle of the eighteenth century. The history of its establishment as an industrial staple is fraught with sad and humiliating incidents, reflecting disgrace upon the authors of the ingratitude and treachery which were the rewards of some of the earlier inventors of the machinery from which it derived all its importance and power. To other well known families it has been the means of securing enormous wealth, and even exalted rank; while to the British nation, cotton has been one of the chief sources of preëminence and power. Who would have thought, when Hargreaves constructed his first spinning frame ("jenny"), in 1767, that in less than a century a single firm would be *printing* calicos at the rate of a mile an hour, or turning out ten thousand miles of the same article in a year? In 1811 there were 4,600,000 of Crompton's mule-spindles in use. At the present day there are 30,000,000 mule-spindles actively employed in Great Britain alone, and the increase goes on at the rate of 1,000,000 a-year. One English firm manufactures mules at the rate of 500,000 annually.

But it is the enormous amount of capital expended in maintaining the manufacture of cotton, and the vast number of persons to whom it gives employment, directly or indirectly, that excites the astonishment and almost terror of every one who seriously studies the subject, and contemplates the calamity which would result, if a disease like the oidium of the grape vine should strike the cotton plant.

It is estimated by very competent authorities* that the capital employed in cotton manufactures in the United Kingdom, exceeds £50,000,000; that in the machinery establishments and other work-shops supplying the machinery, £50,000,000 more is invested; making in all £100,000,000 sunk in the trade. There are not less than half a million persons employed directly in the cotton mills, and one million and a half are dependent upon these workers; making two millions immediately dependent upon this manufacture, besides an additional two millions engaged in trades which supply the cotton manufacturers with their machinery;—hence there are four millions of persons in the United Kingdom entirely dependent upon the stability and progress of the cotton trade! These estimates do not include numerous other collateral branches, which swell the number of those directly or indirectly interested—deriving an income from it, or being wholly dependent on cotton—to one-sixth of the population of Great Britain and Ireland, or considerably more than the aggregate population of British North America.

The effect of the cotton trade and manufacture on Lancashire has already been noticed; but so astonishing is the result, that a few additional statistics on this important subject may be introduced with propriety and advantage.

In 1758, the population of Manchester was only 20,000—less than half that of Toronto at the present time. In 1858 it exceeded 500,000. The inhabitants of the county (Lancashire) amounted, in 1758, to 300,000; now it embraces 2,300,000 souls. The tonnage of Liverpool, in 1758, was 100,000 tons; in 1858, or one hundred years later, it had risen to 5,000,000 tons. Cotton has been mainly instrumental in producing this extraordinary increase.

An idea of the rapid increase in the manufacture of cotton fabrics in England may be gathered from the following figures.

1857.	
Cottons, Calicoes, &c.....	1,979,000,000 yards.
Value	£28,786,000
Yarns and Laces.....	8,700,000
	£37,486,000
1858.	
Cottons, Calicoes, &c.....	2,321,000,000 yards.
Value	£32,042,000
Yarns and Laces.....	9,579,000
	£41,621,000
1869.	
Cottons, Calicoes, &c.....	2,563,000,000 yards.
Value	£37,040,000
Yarns and Laces.....	9,465,000
	£46,505,000

In two years England has added twenty-five per cent. to her exports of cotton goods, yarns, &c.

The cotton crops in the United States amounted in 1849-50 to 2,096,706 bales, with a value of $117,649,947. In 1859-60 the crop reached the enormous quantity of 4,669,770 bales, having a value of $308,865,280.

* See *Journal of the Society of Arts*, Dec. 24, 1858.

The statistics will enable any one to understand the nature and extent of the anxiety which is now being manifested in Europe, respecting the continuation of the supply of the raw material from the cotton-growing States of the new Confederacy of the South, and the reason why men are so earnestly directing their attention to Africa and India, and speculating upon the probability of obtaining a supply from those regions, in case prospective troubles on this continent should diminish the amount available for exportation, or check that annual increase which the progress of the manufacture in Europe requires for its continuance.

In all European countries where any pretensions to manufacturing industry are put forth, cotton holds a prominent place; and it is worthy of remark, especially by Canadians at the commencement as it were of a new industrial career, that an able critic upon the displays at the Palace of Industry in 1855, gave it as his deliberate opinion, that "THE DEGREE OF ADVANCEMENT OF EACH PEOPLE IN THE CAREER OF INDUSTRY MIGHT BE MEASURED BY ITS SKILL IN THE TREATMENT OF COTTON."*

The steps which are now being taken in Toronto and elsewhere throughout Canada to encourage the development of this important industry, are fraught with the greatest importance to our future interests and welfare. It is one of the more encouraging and hopeful signs of the times that, while enterprising capitalists are willing to bring their means and energies to bear upon the establishment of cotton manufactories in our midst, municipal corporations are not less willing and anxious to give every reasonable encouragement to the enterprize. Under judicious management no one can doubt that the result will be most favourable to our industrial progress; and besides giving direct employment to a portion of our population most in need of it, it will induce the immigration of skilled artizans, attract the attention of foreign capitalists, give rise to numerous collateral branches of industry which will rapidly contribute to the wealth of the country, and the development of many of the hitherto unapplied resources with which nature has so abundantly furnished us.

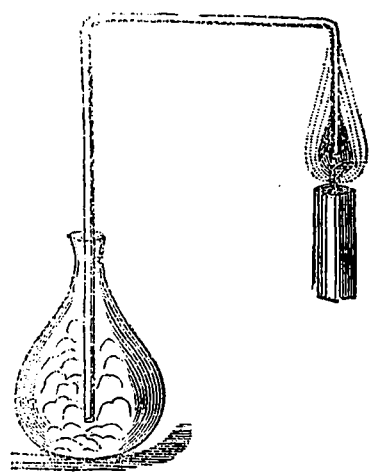
CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News Jan. 12th 1861.

LECTURE II.—A CANDLE: BRIGHTNESS OF THE FLAME—AIR NECESSARY FOR COMBUSTION—PRODUCTION OF WATER.

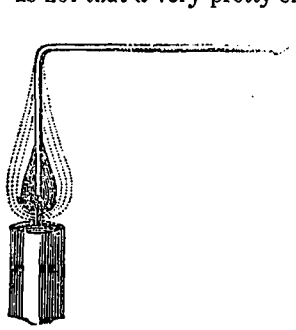
We were occupied the last time we met in considering the general character and arrangement as regards the fluid portion of a candle, and the way in which that fluid got into the place of combustion. You see, when we have a candle burning fairly in a regular steady atmosphere it will have a shape something like the one shown in the diagram, and looking pretty uniform, although very curious in its character. And, now, I have to ask your attention to the means by which we are able to ascertain what happens in any particular part of the flame; why it happens; what it does in happening; and where, after all, the whole candle goes to: because, as you know very well, a candle being brought before us and burned, disappears, if burned properly, without the least trace of dirt in the candlestick—and this is very curious circumstance. Now, in order to examine this candle carefully, I have arranged certain apparatus, the use of which you will see as I go on. Here is a candle; I am about to put the end of this glass tube into the middle of it—into that part which old Hooker has represented in the diagram as being rather dark, and which you can see at any time if you will look at a candle carefully, without blowing it about. We will examine this dark part first.



Now, I take this bent glass tube, and introduce one end into that part of the flame, and you see at once that something is coming from the flame, out at the other end of the tube; and if I put a flask there, and leave it for a little while you will gradually see that something from the middle part of the flame is drawn out and goes through the tube and into that flask, and there behaves very differently from what it does in the open air. It not only escapes from the end of the tube, but falls down to the bottom of the flask like a heavy substance, as indeed it is. We find that this is the wax of the candle made into a vaporous fluid—not a gas.—(You must learn the difference between a gas and a vapour: a gas remains permanent, a vapour is something that will condense.)—If you blow out a candle, you perceive a very nasty smell, consequent on the condension of this vapour. That is very different from what you have outside the flame; and, in order to make that more clear to you, I am about to produce and set fire to a larger portion of this vapour—for what we have in the small way in a candle, to understand thoroughly, we must, as philosophers, produce in a larger way if needful, that we may examine the different parts. And, now, Mr. Anderson will give me a source of heat; and I am about to show you what that vapour is. Now, here is a glass flask, and I am going to make it hot, as the inside of that candle-

* M. Audiganne.

flame is hot, and the matter about the wick is hot. [The Lecturer placed some pieces of wax in a glass flask, and heated them over a lamp.] Now, I dare say, that is hot enough for me. You see that the wax I put in it has now become fluid, and there is a little smoke coming from it. We shall very soon have the vapour rising up. I will make it still hotter, and now we get more of it, so that I can actually pour the vapour out of the flask into that basin, and set it on fire there. This, then, is exactly the same kind of vapour as we have in the middle of the candle; and that you may see that that is the case, let us try whether we have not got here, in this flask, a real combustible vapour out of the middle of the candle.—[Taking the flask into which the tube from the candle proceeded, and introducing a lighted taper.]—See how it burns. Now this is the very vapour from the middle of the candle, produced by its own heat; and that is one of the first things you have to consider with respect to the progress of the wax in the process of combustion, and as regards the changes it undergoes. I will arrange another tube carefully in the flame, and I should not wonder if we were able, by a little care, to get that vapour to pass through the tube to the other extremity, where we will light it, and obtain absolutely the flame of the candle at a place distant from it. Now, look at that. Is not that a very pretty experiment?



Talk about laying on gas—why, we can actually lay on a candle! And you see from this that there are clearly two different kinds of action—one the *production* of the vapour, and the other the *combustion* of it—both of which take place in particular parts of the candle.

I shall get no vapour from that part that is already burned. If I raise the tube (Fig. 1) to the upper part of the flame, so soon as the vapour has been swept out, what comes away will be no longer combustible; it is already burned. How burned? Why burned thus: in the middle of the flame where the wick is, there is this combustible vapour; on the outside of the flame is the air which we shall find necessary for the burning of the candle; between the two, intense chemical action takes place whereby the air and the fuel act upon each other, and at the very same time that we obtain light the vapour inside is destroyed. If you examine where the heat of a candle is, you will find it very curiously arranged. Suppose I take this candle and hold a piece of paper close upon the flame, where is the heat of that flame? Do you not see that it is *not* in the inside? It is in a ring, exactly in the place where I told you the chemical action was; and even in my irregular mode of making the experiment, if there is not too much disturbance, there will always be a ring. This is a good experiment for you to make at home. Take a strip of paper, have the air in the room quiet, and put the piece of paper right across the middle of the flame,—(I must not talk while I make the experiment,)—and you will find that it is burnt in two places, and that it is not burnt, or very little so, in the middle; and when you have tried the experiment once or twice, so as to make it nicely, you will be very interested to see where the heat is, and to find that it is where the air and the fuel come together.

This is most important for us as we proceed with our subject. Air is absolutely necessary for combustion; and what is more, I must have you understand that *fresh* air is necessary, or else we should be imperfect in our reasoning and our experiments. Here is a jar of air, I place it over a candle, and it burns very nicely in it at first, showing that what I have said about it is true; but there will soon be a change. See how the flame is drawing upwards, presently fading and at last going out. And going out, why? Not because it wants air merely, for the jar is as full now as it was before; but it wants pure, fresh air. The jar is full of air, partly changed, partly not changed; but it does not contain sufficient of the fresh air which is necessary for the combustion of a candle. These are all points which we as young chemists have to gather up; and if we look a little more closely into this kind of action, we shall find certain steps of reasoning extremely interesting. For instance, here is the oil-lamp I showed you,—an excellent lamp for our experiments,—the Old Argand lamp. I now make it like a candle [obstructing the passage of air into the centreof the flame]; there is the cotton; there is the oil rising up it; and there is the conical flame. It burns poorly because there is a partial restraint of air. I have allowed no air to get to it, save round the outside of the flame, and it does not burn well. I cannot admit more air from the outside, because the wick is large; but if, as Argand did so cleverly, I open a passage to the middle of the flame, and so let air come in there, you will see how much more beautifully it burns. If I shut the air off, look how it smokes; and why? We have now some very interesting points to study: we have the case of a combustion of a candle; we have the case of a candle being put out by the want of air; and we have now the case of imperfect combustion, and this is to us so interesting, that I want you to understand it as thoroughly as you do the case of a candle burning in its best possible state. I will now make a great flame, because we need the largest possible illustrations. Here is a larger wick [burning turpentine on a ball of cotton]. All these things are the same as candles, after all. If we have larger wicks we must have a larger supply of air, or we shall have less perfect combustion. Look now at this black substance going up into the atmosphere; there is a regular stream of it. I have provided means to carry off the imperfectly-burned part, lest it should annoy you. Look at the soots that fly off from the flame: see what an imperfect combustion it is because it cannot get enough air. What, then, is happening Why, certain things which are necessary to the combustion of a candle are absent, and very bad results are accordingly produced; but we see what happens to a candle when it is burnt in a pure and proper state of air. At the time when I showed you this charring by the ring of flame on the one side of the paper, I might also have shown you, by turning to the other side, that the burning of a candle produces the same kind of soot—charcoal, or carbon.

But, before I show that, let me explain to you, as it is quite necessary for our purpose, that though I take a candle and give you, as the general result, its combustion in the form of a flame, we must see whether combustion is always in this shape,—when I say "shape" I mean condition,—or whether there are other conditions of flame; and there are, and they are most important to us. I think perhaps the best illustration of such a point as that, being young ones, is to give you the result of strong contrast. Here is a little gunpowder. You know that gunpowder burns with flame; we may fairly call it flame. It contains carbon and other materials, which altogether cause it to burn with a flame. And here is some pulverised iron, or iron filings. Now, I purpose burning these two things together. I have a little mortar in which I will mix them. (Before I go into these experiments, let me hope that none of you, by trying to repeat them, for fun's sake, will do any harm. These things may all be very properly used if you take care, but, without that, much mischief will be done.) Well, then, here is a little gunpowder, which I put at the bottom of that little wooden vessel, and mix the iron fillings up with it, my object being to make the gunpowder set fire to the filings and burn them in the air, and thereby show the difference between the substances burning with flame and not with flame. Here is the mixture, and when I set fire to it you must watch the combustion and you will see that it is of two kinds. You will see the gunpowder burning with a flame and the filings thrown up. You will see them burning too, but you will see them burning otherwise than in flame. They will each burn separately. [The Lecturer then ignited the mixture.] There is the gunpowder, which burns with a flame, and there are the filings: they burn with a different kind of combustion. You see, then, these two great distinctions; and upon these differences depend all the utility and all the beauty of flame which we use for the purpose of giving out light. When we use oil, or gas, or candle, for the purpose of illumination, their fitness all depends upon these different kinds of combustion.

There are such curious conditions of flame that it requires some sharpness and some cleverness to distinguish the kinds of combustion one from another. For instance, here is a powder which is very combustible, consisting, as you see, of separate little particles. It is called *lycopodium*, and each of these particles can produce a vapour, and produce its own flame; but to see them burn you would think it was all one flame. I will now set fire to a quantity and will see the effect. We saw a cloud of flame, apparently in one body; but that rushing noise [referring to the sound produced by the burning] was a proof that the combustion was not a continuous or regular one. This is the lightning of the pantomines, and a very good one too. [The experiment was twice repeated by blowing *lycopodium* from a glass tube through a spirit flame.] That is not a combustion like that of the filings I have been speaking of, to which I must now bring you back again.

Supposing I take a candle and examine it in that part which appears brightest to our eyes. Why, there I get these black particles, which already you have seen three or four times evolved from the flame, and which I am now about to evolve in a different way. I will take this candle and clear away the gutterage which occurs by reason of the currents of air; and if I now arrange a glass tube so as just to dip into this luminous part, as in our first experiment, only higher, you see the result. In place of having the same white vapour that you had before, you will now have a black vapour. There it goes, as black as ink. It is certainly very different from the white vapour, and when we put a light to it you will find that it does not burn, but that it puts the light out. Well, these particles, as I said before, are just the smoke of the candle; and this brings to mind that old employment which Dean Swift recommended to servants for their amusement, namely, writing on the ceiling of a room with a candle. But what is that black substance? Why, it is the same carbon which exists in the candle. How comes it out of the candle? It evidently existed in the candle, or else we should not have had it here. And now I want you to follow me in this explanation. You would hardly think that all those substances which fly about London, in the form of soots and blacks, are the very beauty and life of the flame, and which are burned in it as those iron filings were burned here. Here is a piece of wire-gauze, which will not let the flame go through it, and I think you will see, almost immediately, that when I bring it low enough to touch that part of the flame which is otherwise so bright that it quells and quenches it at once, and allows a volume of smoke to rise up.

I want you now to follow me in this point,—that whenever a substance burns, as the iron filings burnt in the flame of gunpowder, without assuming the vaporous state,—they may become liquid or they may remain solid,—they become exceedingly luminous. I have here taken three or four cases away from the candle, on purpose to illustrate this point to you; because, what I have to say is applicable to all substances, whether they burn or whether they do not burn,—that they are exceedingly bright if they retain their solid state, and that it is to this presence of solid particles in the candle that it owes its brilliancy.

Here is a platinum-wire which does not change by heat. If I heat it in this flame see how exceedingly luminous it becomes. I will make the flame dim for the purpose of giving a little light only, and yet you will see that the heat which it can give to that platinum-wire, though far less than the heat it has itself is able to raise the platinum-wire to a far higher state of effulgence. This flame has carbon in it; but I will take one that has not carbon in it. There is a material, a kind of fuel—a vapour, or gas, which ever you like to call it—in that vessel, and it has no solid particles in it; so I take that because it is an example of flame itself burning without any solid matter whatever; and if I now put this solid substance in it, and you see what an intense heat it has, and how brightly it causes the solid body to glow. This is the pipe through which we convey this particular gas, which we call hydrogen, and which you shall know all about next time we meet. And here is a substance called oxygen, by means of which this hydrogen can burn; and although we produce, by their mixture, far greater heat than you can get by the candle, yet there is very little light. If, however, I take a solid substance, and put that into it, we get a great light. If I take a bit of lime, which is a thing which will not burn, and which will not vaporise by the heat, and because it does not vaporise remains solid, and remains heated, you will find what happens as to the glowing of it. I have a most intense heat here produced by the burning of the hydrogen in contact with the oxygen; but there is as yet very little light—nor for want of heat, but for want of particles which can retain their solid

state; but when I hold this piece of lime in the flame of the hydrogen as it burns in the oxygen, see how it glows! This is the glorious lime-light, which rivals the voltaic-light, and which is almost equal to the sun-light. I have here a piece of carbon or charcoal which will burn and give us light exactly in the same manner as if it were burnt as part of a candle. The heat that is in the flame of a candle decomposes the vapour of the wax and sets free the carbon particles; they rise up heated and glowing as this now glows, and then enter into the air. But the particles when burnt never pass off from a candle in the form of carbon. They go off into the air as a perfectly invisible substance, about which we shall know hereafter.

Is it not beautiful to think that such a process is going on, and that such a dirty thing as charcoal can become so incandescent? You see it comes to this—that all bright flames contain these solid particles; all things that burn and produce solid particles, either during the time they are burning, as in the candle, or immediately after being burnt, as in the case of the gunpowder and iron-filings, all these things give us this glorious and beautiful light.

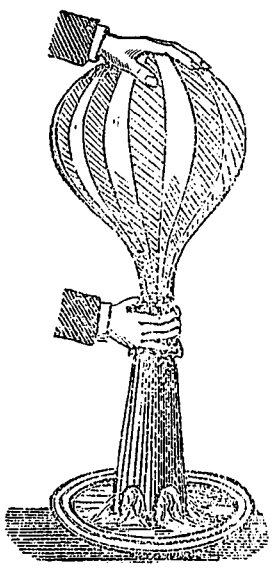
I will give you a few illustrations. Here is a piece of phosphorous, which burns with a bright flame. Very well; we may now conclude that phosphorus will produce, either at the moment that it is burning or afterwards, these solid particles. Here is the phosphorus lighted, and I cover it over with this glass for the purpose of keeping in what is produced. What is all that smoke? That smoke consists of those very particles which are produced by the combustion of the phosphorous. Here again are two substances. This is chlorate of potassa, and this is sulphuret of antimony. I shall mix these two things a little, and then they may be burnt in many ways. I shall touch them with a drop of sulphuric acid, for the purpose of giving you an illustration of chemical action, and they will instantly burn. [The Lecturer then ignited the mixture by means of sulphuric acid.] Now, from the appearance of things you can judge whether they produce solid matter in burning. I have given you the train of reasoning which will enable you to say whether they do or do not. And what is this bright flame but the solid particles passing off?

Mr. Anderson has in the furnace a pretty hot crucible,—I am about to throw into it some zinc filings, and they will burn with a flame like gunpowder. I make this experiment because you can make it well at home. Now, I want you to say what will be the result of the combustion of this zinc. Here it is burning—burning beautifully like a candle, I may say. But what is all that smoke, and what are those little clouds of wool which will come to you if you cannot come to them, and make themselves sensible to you in the form of the old philosophic wool, as it was called? We shall have left in that crucible, also a quantity of this woolly matter. But I will take a piece of this same zinc and make an experiment a little more closely at home, as it were. You will have here the same thing happening. Here is the piece of zinc; there [pointing to a jet of hydrogen] is the furnace, and we will set to work and try and burn the metal. It glows, you see; there is the combustion; and there is the white substance into which it burns. And so if I take that flame of hydrogen as the representative of a candle, and show you a substance like zinc burning in the flame, you will see that it was merely during the action of combustion that this substance glowed—while it was kept hot; and if I take a flame of hydrogen and put this white substance from the zinc into it, look how beautifully it glows, and just because it is a solid substance.

I will now take such a flame as I had just now and set free from it the particles of carbon. Here is some camphine, which will burn with a smoke; but if I send these particles of smoke through this pipe into the hydrogen flame you will see that they will burn and become luminous, because we heat them a second time. There they are. Those are the particles of carbon re-ignited a second time. They are those particles which you can easily see by holding a piece of paper behind them, and which, whilst they are in the flame, are ignited by the heat produced, and, when so ignited, produce this brightness. When the particles are not separated you get no brightness. The flame of coal-gas owes its brightness to the separation, during combustion, of these particles of carbon, which are equally in that as in a candle. I can very quickly alter that arrangement. Here, for instance, is a bright flame of gas. Supposing I add so much air to the flame as to cause it all to burn before these particles are set free, I shall not have this brightness; and I can do that in this way:—If I place over the jet this wire-gauze cap, as you see, and then light the gas over it, it burns with a non-luminous flame, owing to its having plenty of air mixed with it before it burns; and if I raise the gauze up, you see it does not burn below. There is plenty of carbon in the gas; but, because the atmosphere can get to it and mix with it before it burns, you see how pale and blue the flame is. And if I blow upon a bright gas-flame, so as to consume all this carbon before it gets heated to the glowing point, it will also burn blue. [The Lecturer illustrated his remarks by blowing on the gas-light.] The only reason why I have not the same bright light when I thus blow upon the flame is, that the carbon meets with sufficient air to burn it before it gets separated in the flame in a free state. The difference is solely due to the solid particles not being separated before the gas is burnt.

You observe that there are certain products as the result of the combustion of a candle; and that of these products one portion may be considered as charcoal, or soot; that charcoal, when afterwards burnt, produces some other product; and it concerns us very much now to ascertain what the other product is. We showed that something was going away; and I want you now to understand how much is going up into the air; and for that purpose we will have combustion on a little larger scale. From that candle ascends heated air, and two or three experiments will show you the ascending current; but, in order to give you a notion of the quantity of matter which ascends in this way, I will make an experiment by which I shall try to imprison some of the products of this combustion. For this purpose I have here what boys call a fire-balloon; I use this fire-balloon merely as a sort of measure of the result of the combustion we are considering; and I am about to make a flame in such an easy and simple manner as shall best serve my present purpose. This plate shall be the "cup," we will say, of the candle; this spirit shall be our fuel; and I am about to place this chimney over it, because it is better for me to do so than let things proceed at random. Mr. Ander-

son will now light the fuel, and here at the top we shall get the results of the combustion. What we get at the top of that tube is exactly the same, generally speaking, as you get from the combustion of a candle; but we do not get a luminous flame here, because we use a substance which is feeble in carbon. I am about to put this balloon—not into action, because that is not my object, but to show you the effect which results from the action of those products which arise from the candle, as they arise here from the furnace. [The balloon was held over the chimney, when it immediately commenced to fill.] You see how it is disposed to ascend; but we must not let it up, because it might come in contact with those upper gas-lights, and that would be very inconvenient. [The upper gas-lights were turned out at the request of the lecturer, and the balloon was allowed to ascend.] Does not that show you what a large bulk of matter is being evolved? Now, there is going through this tube [placing a large glass tube over a candle] all the products of that candle, and you will presently see that the tube will become quite opaque. Suppose I take another candle and place it under a globe, and then put a light on the other side, just to show you what is going on. You see that the sides of the jar become cloudy and the light begins to burn feebly. It is the products you see, which makes the light so dim, and this is the same thing which makes the sides of the jar so



opaque. If you go home and take a spoon that has been in the cold air and hold it over a candle—not so as to soot it—you will find that it becomes dim just as that jar is dim. If you can get a silver dish, or something of that kind, you will make the experiment still better: and now just to carry your thoughts forward to the time we shall next meet, let me tell you that it is *water* which causes the dimness, and when we shall next meet I will show you that we can make it, without difficulty, assume the form of a liquid.

Starch from Potatoes.

At Stowe, Vt., there are five factories in which starch is made from potatoes. Each consumes about 20,000 bushels per annum, and eight pounds of starch is the yield of each bushel.—*Scientific Amer.*

The Board of Arts & Manufactures
FOR UPPER CANADA.

PROCEEDINGS OF THE SUB-COMMITTEE.

Thursday, March 14th, 1861.

The Sub-Committee met at the Board-rooms, according to adjournment, at half-past 1 o'clock, p.m. Present: the President (Dr. Beatty), Vice-President (J. E. Pell, Esq.), Prof. Hind, Prof. Hincks, Dr. Craigie, W. Hay, Esq., and Mr. T. Sheldrick.

Minutes of former meeting were read and confirmed.

The Secretary read a letter from the Lower Canada Board, in relation to the *Journal*, and to the great Exhibition of 1862.

An account for books, and for printing the March number of the *Journal*, was ordered to be paid.

The Secretary reported that he had effected an insurance on the books, fixtures, and furniture of the Board, for $1000, at one per cent. premium, in the Provincial Insurance Company.

The President reported that the Board of Agriculture has appointed a special committee to cooperate with this Board in matters relating to the World's Exhibition, in 1862; and that said Board has adopted the draft of amendments to the act of incorporation, as previously agreed upon by this Board, and has appointed a special committee to cooperate with the committee appointed by this Board in procuring the passage of such amendments; and that said Board has also requested this Board to prepare the prize list for the arts and manufactures department of the next Provincial Exhibition.

The Committee appointed at the previons meeting to draft a series of suggestions in relation to the International Exhibition of 1862, presented the following

REPORT.

The Committee appointed to draft a series of suggestions relating to the steps which should be taken by the Board of Arts and Manufactures for Upper Canada to secure a comprehensive representation of Canadian industry and natural resources at the International Exhibition to be held in London during 1862, beg to report that they have endeavoured to indicate some of the objects towards which the efforts of the Board should be directed, and to suggest the manner in which they may be carried out.

It is necessary to state, at the outset, that the suggestions of this Committee are based upon the supposition, that it is the desire and intention of the government that Canada should be represented at the Exhibition of 1862, as in the former Exhibitions held in London and Paris in the years 1851 and

1855 respectively, but with such additional display as the progress of our civilization, the increased knowledge of the resources of our country, and the experience of the past, enable us to make.

The Committee do not consider it necessary to dwell upon the great advantages which the honorable position attained at former Exhibitions has been to Canada, in making the resources of the country better known in Europe, and in directing the attention of the emigrating classes to it as a desirable field for settlement or commercial enterprise. They consider themselves justified in assuming, that no one will be disposed to question the propriety of an endeavour to maintain a reputation already productive of numerous benefits, and susceptible under judicious management of directing renewed and increased attention to Canada as a field for emigration and for the employment of capital and industry.

The Committee understand it to be the desire of the Board, in thus early adopting measures to facilitate the representation of our civilization, industry and resources at the Exhibition of 1862, before the action of the government or the amount of aid available is made known, to obviate as far as possible the difficulties and disadvantages which were felt previous to former exhibitions, on account of the short notice which was given to exhibitors, that the display would partake of a provincial character, and that aid would be supplied by a public grant.

A moment's reflection will suffice to show that if an entire year is not devoted to the collection of some of our natural productions, especially those of the vegetable kingdom, the representation will be incomplete, and therefore, to a certain extent, valueless, as the season in which many necessary specimens are best developed will soon pass away. And here your Committee cannot refrain from urging on the Board the absolute necessity of a scientific arrangement of all our natural products. They are perfectly aware that very many persons do not acknowledge the necessity of this precision, but the Committee call especial attention to the fact, that the jurors of the Exhibitions of London and Paris laid the greatest stress upon scientific arrangement, and many valuable products were wholly neglected and ultimately forgotten, in consequence of the absence of this requisite. It is to be borne in mind that the jurors of the Exhibition of 1862 will be, like their predecessors in 1851 and 1855, men of the highest scientific and commercial rank, who will recognize as the basis of their awards in most displays of natural productions, scientific classification, whereby they are enabled to form a correct estimate of the value of any new material not previously known to industry or commerce, and to point out hopeful fields for speculative enterprise. The Committee might quote numerous instances of the loss which has attended an absence of this necessary guide, did they think that the subject required such amplification.*

In submitting the following outline the Committee desire it to be understood, that it is by no means to be considered as affording a complete list of Canadian natural productions or manufactures. It is intended rather to assist those whose profession or employment renders them familiar with details, in order that they may fill up the blanks; and for this purpose the Committee suggest that so much of this report as may be approved of be printed and distributed among professional men, merchants and manufacturers, with a request that they will enumerate any additional articles according to their personal knowledge, of their value or probably utility; a measure which will greatly contribute, it is thought, to the adoption of a final plan of operations, when the whole question comes before a general Committee, to be appointed in all probability by the authority and with the sanction of the government.

It is customary, in classifying the various industries of Canada, to group them under the following headings:

1. Agricultural Productions.
2. Productions of the Forest.
3. " of the Mine.
4. " of the Fisheries.
5. " of Animals.
6. Manufactures.

I.—Agricultural Productions.

Whatever relates to the agricultural productions of Canada, the Committee are persuaded will be most ably served by the Board of Agriculture, who have appointed a Committee to co-operate with this Board, and who will give especial attention to this department.

II.—Productions of the Forest.

1. Timber.
2. Gums and Resins.
3. Oils.
4. Dye Stuffs.
5. Tanning Materials.
6. Potashes.
7. Miscellaneous.

Among the most important results of the Exhibitions of 1851 and 1855, was the acquisition of correct ideas respecting the state of our knowledge of forest productions in their relation to manufacturing industry. It has been well said by one of the Jurors of the Exhibition of 1851, that, "even a slight examination of the raw produce which forms the basis of our manufactures, must lead to the conclusion that in many cases the best substances are not used, nor are the best modes of preparing them

* The Committee take occasion to refer to the articles published in the March number of the Journal of the Board, entitled, "Canada at the International Exhibition of 1862" and "European Emigration to Canada," in which some of the advantages of Scientific arrangement at the Exhibitions of 1851 and 1855 are pointed out.

followed." "A new substance, like a new process, is looked on with distrust;" "it is not in the market; the broker does not know it—and that is nearly the same as pronouncing it of no value."

I.—TIMBER.

A full representation of the woods of Canada involves the necessity of a collection, scientifically arranged, of all the most important trees of our forests, embracing a portion of the trunk, specimens of the leaves, bark, flowers, fruit, and portions of the roots of many species.

Each tree should be represented by—

1. A part of the trunk in its natural state, three feet long.
2. A block, when procurable, at least one foot cube, planed and polished on all sides.
3. Specimens properly preserved of the bark, leaves, fruit and flower.
4. Sections of the butt-end and roots of certain trees, distinguished by their *feather*, or grain.

Subjoined is a list of Canadian forest trees used in the arts and manufactures, of all of which specimens of the parts named in the foregoing paragraphs should be procured. The locality in which each species is most abundant, and the area of its distribution, should be determined and stated. It is advisable that all contributions should be sent in the rough state to one central locality, where they may be submitted to a uniform mode of preparation for Exhibition.

LIST OF THE MOST IMPORTANT CANADIAN FOREST TREES.

1. *Magnoliaceæ.*

White wood, so called in Canada (*Liriodendron tulipifera.* Linn.) Common in Western counties.

2. *Tileaceæ.*

Lime, or Bass-wood (*Tilia Americana.* Linn.)

3. *Anacardiaceæ.*

Sumach (*Rhus typhina.* Linn.)

4. *Aceraceæ.*

Maple (*Acer Saccharinum.* Linn.) Common.
Waved Maple " "
Bird's Eye Maple " "
Red Maple. (*Acer rubrum.* Linn.)
Soft Maple (*Acer Dasycarpum.* Ehrhart.)

5. *Amygdalaceæ.*

Wild Yellow Plum (*Prunus Americana.* Marshall.)
Red Cherry (*Cerasus Pennsylvanica.* Loisel.)
Black Cherry (*Cerasus serotina.* De Candolle.)
Choke Cherry (*Cerasus Virginiana.* De Candolle.)

6. *Cornaceæ.*

Cornel, flowering dogwood (*Cornus Florida.* Linn.)

7. *Pomaceæ.*

Dotted or Apple Thorn (*Cratægus punctata.* Jacquin.)
Red Thorn (*Cratægus coccinea.* Linn.)
White Thorn (*Cratægus crus Galli.* Linn.)
Mountain Ash (*Pyrus Americana.* De Candolle.)
June or Service berry (*Amelanchier Canadensis.* Torrey & Grey.)

8. *Fraxinaceæ.*

White Ash (*Fraxinus Americana.* Linn.) Common throughout Canada.
Swamp or Black Ash (*Fraxinus sambucifolia.* Lambert.) Common.
Red Ash (*Fraxinus pubescens.* Walter.) Sparsely distributed.
Rim Ash (*Fraxinus juglandifolia.* Lambert.)

9. *Lauraceæ.*

Sassafras (*Sassafras officinale.* Von Esenbeck.)

10. *Ulmaceæ.*

White or Swamp Elm (*Ulmus Americana.* Linn.) Common everywhere.
Red or Slippery Elm (*Ulmus fulva.* Michaux.)
Rock Elm (*Ulmus racemosa.* Thomas.) Rare.
Gray, or Winged Elm (*Ulmus alata.* Michaux.)

11. *Juglandaceæ.*

Butternut (*Juglans cinerea.* Linn.) Western Canada.
Black Walnut (*Juglans nigra.* Linn.) Western Counties.
Soft Walnut.
Shell bark Hickory (*Carya alba.* Nuttal.) Common west of Hamilton.
Smooth bark Hickory (*Carya tormentosa.* Nuttal.)
Pignut (*Carya glabra.* Torrey.)
Bitternut (*Carya amara.* Nuttal.)

12. *Corylaceæ.*

White Oak (*Quercus alba.* Linn.) Common in the western part of the Province.
Swamp White Oak (*Quercus bicolor.* Wild.)
Red Oak (*Quercus rubra.* Linn.) Common.
Black Oak (*Quercus nigra.* Linn.)
Chesnut (*Castanea vesca.* Linn.) Common in Western Canada.
Red Beech (*Fagus Ferruginea.* Aiton.) Abundant.
White Beech (*Fagus Sylvatica.* Willd.)
Blue Beech, Horn-Beam (*Carpinus Americana.* Michaux.)
Iron Wood (*Ostrya Virginica.* Willd.) Generally distributed.

13. *Betulaceæ.*

Paper or Canoe Birch (*Betula papyracea.* Aiton.)
Yellow Birch (*Betula excelsa.* Aiton.)
Cherry Birch (*Betula lenta.* Linn.)
Black Birch (*Betula nigra.* Linn.) Common.
Alder (*Alnus Incana.* Willd.)

14. *Saliaceæ.*

Black Willow (*Salix nigra.* Marshall.)
Aspen Poplar (*Populus tremuloides.* Michaux.)
Large-toothed Aspen (*Populus grandidendata.* Michaux.)
Balm of Gilead (*Populus balsamifera.* Linn.)
Cotton Wood, Necklace Poplar (*Populus monilifera.* Aiton.)

15. *Platanaceæ.*

Button Wood, American Sycamore (*Plantanus Occidentalis.* Linn.) Western counties.

16. *Pinaceæ.*

Pitch Pine (*Pinus rigida.* Miller.)
Red Pine (*Pinus resinosa.* Aiton.)
Yellow Pine (*Pinus mitis.* Michaux.)
White or Weymouth Pine (*Pinus strobus.* Linn.) Common in the northern part of the Province.
Balsam Fir (*Abies balsamea.* Marshall.) Common in the North.

Hemlock Spruce (*Abies Canadensis.* Michaux.) Common.
White Spruce (*Abies alba.* Michaux.) Common in Northern parts.
Black Spruce (*Abies nigra.* Poiret.) Common in Northern parts.
American Larch, Tamarack (*Larix Americana.* Michaux.) Common in swamps.
White Cedar (*Thuya Occidentalis.* Linn.) Common in swamps.
Red Cedar, Savin (*Juniperus Virginiana.* Linn.)

The following comparative table shows the value of the Exports alone of the Productions of the Canadian Forests during the years 1857, 1858 and 1859:

	1857.	1858.	1859.
Ashes—Pot	$859,863	$740,933	$769,512
Pearl	287,993	188,826	337,759
Timber—Ash	25,360	16,999	24,067
Birch	46,985	30,339	56,294
Elm	432,822	163,389	200,840
Maple	1,593	285	723
Oak	576,630	377,561	359,731
White Pine	2,821,320	1,811,340	2,249,006
Red Pine	526,458	374,079	363,567
Tamarack	28,471	5,410	11,382
Walnut	51,140	22,837	25,719
Basswood, Butternut and Hickory	15,462	20,121	14,800
Standard Staves	548,384	398,874	329,876
Other Staves	174,771	170,379	201,047
Battens	4,276	897	1,962
Knees	466	3,470	4,723
Scantling	22,168	22,922	23,760
Treenails	140	202	300
Deals	1,955,377	1,675,918	1,477,381
Deal Ends	58,852	36,115	44,526
Planks and Boards	2,573,470	2,902,267	2,690,119
Spars	84,410	32,319	25,383
Masts	135,884	69,617	92,714
Handspikes	437	713	1,569
Lath and Lathwood	60,825	34,230	37,216
Firewood	62,558	36,155	42,187
Shingles	46,257	24,314	36,157
Sleepers	1,363	.....	.....
Railroad Ties	18,025	39,524	23,861
Oars	6,582	11,405	17,188
Other Woods	35,726	25,367	75,098
Saw Logs	111,440	47,734	125,490
Total Produce of the Forest	$1,1575,508	$9,284,514	$9,663,962

REMARKS.

1. *Acer saccharinum* (Sugar Maple). This tree is common throughout Canada, and very large quantities of sugar are made from it annually. It is important to bear in mind that while the sugar maple is most recklessly destroyed in the process of clearing land in every part of Canada, the French government are fostering the cultivation of this tree in France, with a view to the production of sugar from it. The bird's-eye maple, a variety of the sugar maple, is esteemed one of the most valuable woods in Europe for cabinet work, and would always command a high price in that market.

2. *Tilia Americana* (Basswood). The inner bark of this tree is valuable for its fibre; it may be manufactured into cordage, and it is one of those numerous fibres which have been recommended and employed for the manufacture of paper.

3. *Carpinus Americana* (Blue Beech). The wood of this tree is much sought after for the manufacture of cog wheels and other parts of machinery, where great toughness is required.

4. *Juglans cinerea* (Butternut). The bark of this tree contains a dye.

5. *Abies Canadensis* (Hemlock). The bark is very extensively used in tanning.

6. *Carya alba* (Hickory). The bark contains a yellow dye.

7. *Sassafras officinale* (Sassafras). Valuable for the essential oil contained in the root.

8. *Abies balsamea.* Large quantities of Canada balsam are obtained from this tree.

9. *Rhus typhina* (Sumach). The young shoots and flowers only of this dye plant are valuable. It is stated that the reason why the American sumach does not enjoy the same reputation as the *Rhus coriaria* of Europe, arises from the fact that the old shoots are used. The shoots of the year should be taken before the leaves fall, and dried quickly in the sun.

II.—GUMS AND RESINS.

1. Canada Balsam.
2. Turpentine.
3. Pitch.
4. Spruce Gum.

III.—OILS.

Oil of Cedar.
Oil of Spruce.
Oil of Hemlock.
Oil of Birch (distilled from the bark).

[This oil is of great interest. It is used in the manufacture of Russian leather, from which that material derives its odour, and its power of resisting the attacks of insects. It is particularly desirable that this product should be represented, with specimens of leather prepared by it.]

Oil of Linseed.
Oil of Mustard.

Specimens of the Wood, Bark, Seeds, &c., from which the Oil is procured, should accompany each contribution.

IV.—DYE-STUFFS.

It should be remarked at the outset that Dye-stuffs should always be placed side by side with samples of the Colour they yield, and in every case where practicable the use of each substance should be illustrated. Professor Edward Solly, in his lectures on the result of the Exhibition of 1851, says: "When we remember how many thousand tons of dyeing-woods are annually imported, and how many thousand tons are absolutely useless woody fibre, we cannot help coming to the conclusion that here chemical science might be applied with great advantage, and that if colonists could be taught how to extract and concentrate the true colouring principles of these woods, much unprofitable labour and expense would be saved; nay, more, these concentrated dye-stuffs might be profitably imported from places from which the cost of carriage would altogether prevent the importation of the dye-stuff

in its raw state. This is a matter of great practical importance, and one which has not yet received the attention it deserves." That our woods furnish some excellent natural dyes, all will admit, who have seen the brilliant colours produced by the simple arts of the native Indians.

The following are some of the native Canadian dyes:

Alder, the bark.
Sumach, the bark and flowers.
Blood Root, the flowers and root.
Butternut, the bark.
Hickory, the bark.
Golden Rod, flowers.

V.—TANNING MATERIALS.

Hemlock, bark.
White Oak, bark.
Sumach, leaves and bark.

MISCELLANEOUS.

Labrador Tea Plant (*Ledum Latifolum*). Common in swamps on the north shores of Lakes Huron and Superior. At least two bushels of this plant should be collected.

Wild Hemp (*Canabis sativa*), in the natural state, made into cordage, and bleached.

Asclepias (Milkweed). Two or three species, with the fibre prepared and bleached, and specimens of the Silk.

A series of Specimens, illustrating the vegetables from which various pharmaceutical products are obtained, with the product as fitted for the market.

Wild Rice (*Zizania aquatica*). This is an important plant, little known in Europe. It should be represented by specimens of the entire plant, and several quarts of the ripe grain.

Slippery Elm Bark (*Ulmus Fulva*). A valuable medicinal product.

Blitum (Strawberry Blite). A red dye.

Preserved and Manufactured Articles of Food.

III.—Productions of the Mine.

The following quotation from the Reports of the Jurors is sufficient to show that the representation of the Mineral wealth of Canada cannot be placed under better management than that of the distinguished head of the Geological Survey, Sir W. E. Logan:

"Of all the British colonies, Canada is that whose exhibition is the most interesting and 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 productions to the Exhibition. This comes from the fact that the collection has been made in a systematic manner; and the result is, 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. 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 arranged them since their arrival in London."

It will probably be advantageous to describe briefly the manner in which the productions of the mine were represented in 1851. Useful hints may be gleaned from that arrangement by intending exhibitors:

The arrangement adopted was similar to that given in the Catalogue of Canadian Economic Minerals, appended to the Report of 1849-50. It was purely technical, and the collection was divided into ten classes:—

1. Metals and their ores.
2. Minerals requiring more complicated chemical treatment to fit them for use.
3. Mineral paints.
4. Materials applicable to the fine arts.
5. Materials applicable to jewellery.
6. Materials for glass-making.
7. Refractory materials.
8. Grinding and polishing materials.
9. Materials applicable to the purposes of common and decorative construction.
10. —Miscellaneous materials.

Thus classified the specimens were placed in regular sequence in the space allotted them, and each kind from each individual source was accompanied by a ticket which gave the name of the material, the quantity in which it occurred, the geological formation and the locality in which it was situated, with the facilities for working it, and the name of the exhibitor.

It is important to notice that all materials applicable to the purposes of common and decorative construction, should be represented by dressed blocks, in their application to useful or ornamental purposes.

Attention is especially called to the representation of Petroleum. The occurrence of this material in large quantities in different parts of Canada, and the advantages it promises as a new source of industry, make it very desirable to secure an ample representation in its raw and manufactured state.

IV.—Animal Productions.

1. Glue.
2. Isinglass, from the Sturgeon.
3. Neat's foot Oil.
4. Bees' Wax.
5. Lard Oil.
6. Moose, Cariboo, Bear, &c., Skin.
7. Furs.
8. Porpoise Leather.
9. Whale Leather.
10. Sealskin Leather.

V.—Productions of the Fisheries.

The fisheries of the Gulf and Lower St. Lawrence as well as of the Inland Lakes, are among the great natural resources of Canada.

The total produce of the fisheries exported during the years 1857, 1858, and 1859, were respectively, $540,113, $718,296, and $817,423, but the value of the fish taken in the Gulf and Lower St. Lawrence

in 1859 exceeded one million dollars, giving employment to about 6000 men. The annual exportation of fish oil has risen from $19,000 in 1855 to $30,000 in 1859. These figures represent the value of exports of fish oil from three ports in the Gulf and Lower St. Lawrence. As the produce of the fisheries are chiefly exported or brought into the market in their raw or unmanufactured state, it is scarcely necessary to dwell upon this branch of industry, as it does not admit of representation by specimens. Among the products which have already acquired importance or give promise of becoming so, are:

1. Seal oil.
2. Cod liver oil.
3. Porpoise oil (*Delphinus Minor.*)

[This oil is particularly valuable on account of its retaining its fluidity at extremely low temperatures.]

4. Porpoise leather.
5. Whale oil.
6. Capelin oil.
7. Shark oil.
8. Fish manure.

All of the oils should be sent in the raw state and also clarified.

VI.—Manufactures.

With reference to this important department of our national industry, this committee would urge the necessity of individual exertion on the part of those who are engaged in different branches, and the great importance of a full representation of our growing manufactures, at the International Exhibition. In view of the increasing attention which Canada is now attracting in the United Kingdom, it is essentially necessary that intending emigrants should be made fully aware that they can readily and economically obtain all the necessary and most of the more advanced manufactures for private consumption, or for their employment in different kinds of industry. The remarkable cheapness of many common articles of furniture and domestic economy, make it advisable that they should be represented, with a view to show how far the facilities enjoyed in Canada, from an abundance of raw material and admirably adapted machinery, have been taken advantage of.

The classification, in detail, of articles in the Department of Manufactures, would be premature at present, but it would undoubtedly form a prominent feature in a general scheme, if it should be thought advisable to take any additional steps before the action of the Government is made known.

Always bearing in mind that the most encouraging hopes of future success are foreshadowed by a willingness to accept the lessons taught by the Exhibitions of 1851 and 1855, we do not scruple to draw attention to the teachings of competent judges, when we quote a few opinions regarding our manufactures ten years ago.

The Jurors say that "the quality of the fibre of Canadian flax and hemp is good, but its preparation faulty and objectionable; with a little more care, the value of each would be considerably increased." Since that period several Flax Mills have been established in Upper Canada, and the staple which they have produced will no doubt show the great and rapid progress which has been made in this very important branch of industry during the past ten years. The same remark may be applied to Soaps, to which reference is made in the succeeding paragraph.

Of Canadian soaps, the Jurors say "the yellow soap from Canada possesses a most disagreeable odour; the fancy soaps are likewise badly made, giving no lather whatever."

The manufacture of stearine candles was commended, and, from what was sent to the Exhibition, the Jurors infer that the art will soon be perfected.

In flannels, it was said that Canada furnished "a few common and low flannels; but not much in this line has yet been attempted here."

In the Summary of the Jurors they say: "It is not therefore to be expected that much attention can be given to Arts and Manufactures that are yet in their infancy; still the specimens sent will convey to the English artisan an idea of the field there is for the exercise of his calling. The blankets, horse-cloths, and grey *etoffe de pays*, will bear comparison with those of any other country."

It remains now to be shown how general has been the progress throughout the country since the Jurors of 1851 were called upon to express their opinions respecting our manufactures in their infancy.

The following is a general classification of Machinery and Manufactures:—

I.—MACHINERY.

1. Machines for direct use, including Carriages, Railway and Marine Mechanism.
2. Manufacturing Machines and Tools.
3. Civil Engineering, Architectural and Building Contrivances.
4. Philosophical, Musical, Horological, and Surgical Instruments.

II.—MANUFACTURES.

1. Woollen and Worsted.
2. Flax, Hemp and Cotton.
3. Leather, Saddlery, Boots and Shoes.
4. Skins and Hair.
5. Paper, Printing and Bookbinding.
6. Woven, Felted, and Laid Fabrics.
7. Dyed and Printed Goods.
8. Carpets, Oil Cloths, &c.
9. Articles of Clothing.
10. Cutlery, Edge and Hand Tools.
11. General Hardware.
12. Gold and Silversmith's Work.
13. Furniture, Upholstery, &c.
14. Manufactures in Mineral substances, for Building or Decoration.

15. Manufactures from Animal and Vegetable substances, not woven or felted.
16. Miscellaneous Manufactures and Small Wares.

The committee do not feel themselves in a position to make any further suggestions respecting details; future steps will probably be entirely dependant upon the aid which may be available from a public grant. It is of the utmost importance that this question should be disposed of at an early date, in order that active steps may be immediately taken.

W. Hay, *Chairman.*
Henry Y. Hind,
William Hincks,
J. E. Pell.

Resolved, That the report of the Committee on International Exhibition, be received and adopted, and printed in the *Journal* of the Board; and that the Secretary be instructed to transmit copies of the Report to the Board of Arts and Manufactures for Lower Canada, and to the Board of Agriculture for Upper Canada; and that five hundred copies be printed in a supplement to the *Journal* and distributed to the various manufacturers and others throughout the Province.

Resolved, That the Committee on the International Exhibition be re-appointed, with instructions to co-operate with any committee that may be appointed by the Lower Canada Board of Arts and Manufactures, and with the committee already appointed by the Board of Agriculture for Upper Canada, in carrying out such preliminary arrangements as may be found necessary.

Resolved, That the President, Vice-President, and Secretary, be a Committee to prepare a prize list for the next Provincial Exhibition, in connection with the Committee named on behalf of the Board of Agriculture.

Resolved, That the Committee on Act of Incorporation be instructed to co-operate as far as possible with the Board of Agriculture for Upper Canada, and with the Board of Arts and Manufactures for Lower Canada, in procuring the necessary amendments thereto.

The meeting then adjourned.

W. Edwards, *Secretary.*

THE ACT RELATING TO BOARDS OF ARTS AND MANUFACTURES.

Subjoined is the portion of chapter 32 of the Consolidated Statutes of Canada, which relates to this Board, and to the Annual Exhibitions of Agricultural, Horticultural, Arts and Manufactures Products, with such amendments incorporated therein as were agreed upon during last year by the Boards of Arts and Manufactures for Upper and Lower Canada, and, with two or three trifling exceptions, by the Board of Agriculture for Upper Canada. The Board are now applying to the Government and Legislature for the adoption of these amendments.

We regret not yet having received the Minutes of Proceedings of the Board of Arts and Manufactures for Lower Canada in relation to any further amendments proposed, but we believe that amongst others it is now the intention of that Board to ask for a total separation from the Board of Agriculture, in relation to Exhibition matters. On this point the Upper Canada Board differ widely from their brethren of Lower Canada, believing it to be far more to the interest of all classes in Upper Canada that the connexion should be maintained, and they have therefore, in the amended Bill now proposed, made provision for a joint and harmonious working with the Board of Agriculture.

Members and Officers.

I.—There shall be, in and for Upper Canada, a Corporation, composed as hereinafter provided, and called "The Board of Arts and Manufactures for Upper Canada."

II.—There shall be, in and for Lower Canada, a Corporation, composed as hereinafter provided, and called "The Board of Arts and Manufactures for Lower Canada."

III.—Each of the said Corporations may acquire and hold real or immoveable property for the purposes of the Corporation, and may sell, exchange, lease, or therwise dispose of or depart with the same from time to time; but no property shall be sold or otherwise alienated unless by authority of the Board, granted for that purpose, at a meeting held after special notice shall have been given of the business to be transacted, and by a vote of at least two-thirds of the members present at such meeting.

IV.—The said Corporations shall respectively be composed of the Minister of Agriculture for the time being (who shall be *ex officio* a member of each); the Professors and Lecturers in the various branches of Physical Science in the Chartered Universities and Colleges affiliated with Universities in Upper and Lower Canada respectively; the Chief Superintendents of Education in Upper and Lower Canada respectively, for the time being, *ex officio;* the principal or staff officers of the Provincial or Geological Survey in that section of the Province in which they may be respectively residents; the Presidents for the time being of, and one delegate from each of the incorporated Boards of Trade; and the President of, and delegates from each incorporated Mechanics' Institute, or of any incorporated Arts Association, qualified as hereinafter mentioned, in Upper and Lower Canada respectively—such delegates to be chosen annually as hereinafter provided; and the Faculty of any institution of learning, of Collegiate rank, composed of at least five Professors or Lecturers—one of whom shall be a professor or lecturer upon Physical Science,—may, in the month of December in each

year, elect one of such professors or lecturers to represent such College or Faculty upon such Board, and the President or Principal of such College or Faculty shall certify to the Board the name of the Professor or Lecturer so appointed.

V.—The incorporated Boards of Trade in each City and Town in Upper and Lower Canada respectively, shall at its last meeting in each year, elect and accredit to the Board of Arts and Manufactures for Upper or Lower Canada, (according as its place of meeting is in Upper or Lower Canada) one of its body as a member thereof.

VI.—Each incorporated Mechanics' Institute in Upper or Lower Canada respectively, shall, at its last meeting in each year, elect and accredit to the Board of Arts and Manufactures in Upper or Lower Canada, one delegate for every twenty members on its roll, being actual working mechanics or manufacturers, and paying an annual subscription of at least one dollar each to its funds.

2. Each incorporated Arts Association in Upper or Lower Canada respectively, expending not less than one half of its annual income in the promotion of the Fine or Industrial Arts in Canada, shall, at its last meeting in each year, elect and accredit to the Board of Arts and Manufactures in Upper or Lower Canada, one delegate for every thirty members on its roll, who are paying an annual subscription of at least two dollars each to its funds.

3. But no Institution or Association shall be entitled to send more than fifteen delegates to either of the said Boards; and in case a vacancy occurs in the representation of any Mechanics' Institute, Board of Trade, or Arts Association, entitled to send delegates to either of the said Boards, such Institute, Board, or Association may, at its first meeting thereafter, elect a delegate or delegates to fill such vacancy.

VII.—The names of the delegates elected, together with the names of the Presidents of such Mechanics' Institutes, Boards of Trade and Arts Associations, as aforesaid, shall be forthwith transmitted by the Secretary of the Institute, Board or Association electing them to the Secretary of the Board to which they are elected, who shall thereupon inscribe their names upon the roll of the members of the said Board, for the year about to commence.

2. With the names of the delegates when transmitted by the Secretary of a Mechanics' Institute or Arts Association, there shall be transmitted a statement, under the corporate seal of such Institute or Association, and verified by the written declaration of the Secretary transmitting the same, of the names of all the members on the roll of such Mechanics' Institute who are working mechanics or manufacturers, and are paying an annual subscription of at least one dollar each to the funds of such Institute; and the names of all the members on the roll of each Arts Association, who are paying an annual subscription of at least two dollars each to the funds of such Association.

3. If it appears by the said statement that any Mechanics' Institute or Arts Association has elected too many delegates, then the Secretary of the Board shall abstain from recording any of the names of the delegates of such Institute or Association, and shall submit the matter to the Board at its first meeting; and the said Board may, if they see fit, adjudge that such Mechanics' Institute or Arts Association shall not be entitled to any delegate for the year then next ensuing, or may decide by vote or ballot which delegate or delegates shall be rejected, and in this latter case the names of the remaining delegate or delegates shall be forthwith inscribed on the roll of members.

4. The wilful making of any false statement or declaration required or authorised by this Act shall be a misdemeanor, punishable by fine, in the discretion of the Court.

Meetings and Functions of the Board.

VIII.—The said Boards of Arts and Manufactures shall meet at the Cities of Toronto and Montreal respectively, twice in every year, that is to say, on the last Tuesday in the month of January and July, if such Tuesday be not a holiday, but if it be a holiday the meeting shall take place the next day thereafter, not being a holiday.

2. And the President of either of the said Boards, and in his absence from the Province, or in the case of a vacancy in the office of President, then the Vice-President, whenever he deems it necessary or is required by any ten members thereof so to do, shall call a special meeting of the same, in the interval between any two meetings.

3. But no such special meeting shall take place until seven clear days after a written or printed notice signed by the Secretary of the Board, and specifying the day, hour and place of meeting, and the object or objects for which the same is called, has been mailed to the address of each member of the Board.

IX.—Each of the said Boards shall, at its regular meeting in January in each year, elect from among its members a President, Vice-President, and a Secretary and Treasurer, to hold office for the ensuing year, or until the election of their successors; and shall also elect a Council of not less than five nor more than nine of their number for the management during the year, of such affairs of the Board as may by any by-law be entrusted to them.

2. The President and Vice-President shall be *ex officio* members of such Council, and the Secretary and Treasurer shall be *ex-officio* a member of such Council, when elected or appointed from among the members of the Board, and not receiving any salary

for such services; and a majority of the members of such council shall be a quorum for the transaction of business.

3. But the said Boards, or either of them, may at any time they shall see fit so to do by a by-law for that purpose, appoint some fit and proper person whether a member of such Board or not, to be the Secretary of said Board, at such salary and upon such terms as to the said Boards, or either of them may seem proper, and may remove such Secretary from time to time, and may appoint another in his stead and place; and the said Boards or either of them, may in their discretion require the said Secretary, so to be appointed as aforesaid, to discharge the duties of Treasurer for the said Board, in addition to the duties pertaining to the office of Secretary.

4. In case of a vacancy occurring in any of the said offices in the course of the year, either by death, resignation or otherwise, such vacancy shall be filled up by election as aforesaid at any regular meeting of the Board, or, in the interval, by the Council at any regular meeting thereof.

X.—It shall be the duty of the said Boards of Arts and Manufactures:—

1. To take measures, with the approbation of the Minister of Agriculture, to collect and establish at Toronto and Montreal respectively, for the instruction of practical mechanics and artizans, Museums of Minerals, and Material substances, and Chemical compositions, susceptible of being used in Arts and Manufactures, with Model rooms, appropriately stocked and supplied with models of works of art, and of implements and machines other than implements of husbandry and machines adapted to facilitate agricultural operations; and also free Libraries of Referenee containing Books, Plans and Drawings, selected with a view to the imparting of useful information in connection with Arts and Manufactures.

2. To take measures to obtain from other countries new or improved implements and machines; (not being implements of husbandry or machines specially adapted to facilitate agricultural operations) to test the quality, value and usefulness of such implements and machines.

3. And generally to adopt every means in their power to promote improvement in the Arts and Manufactures of the Province.

XI.—The said Boards, with the consent and approbation of the Minister of Agriculture, may establish in connexion with their respective Museums, Model Rooms and Libraries, Schools of Design on the most approved plan, and furnished and supplied in the most complete and appropriate manner that the funds at their disposal will admit of, regard being had to the claims thereon of the other objects for which they are hereby established.

2. And the Minister of Agriculture may cause duplicates or copies of models, plans, specimens, and drawings, and specifications, deposited in the Patent office, and upon which Patents of Invention have been issued, to be made from time to time, and placed in the Model Rooms, Museums or Libraries of the said Boards ot Arts respectively.

3. The said Boards may also found Schools or Colleges for mechanics and artizans, and may employ competent persons to deliver Lectures on subjects nocnected with the Arts and Sciences, or with Manufactures, in such manner and place as the said Boards may from time to time direct.

XII.—The said Boards shall keep records of their respective transactions, and shall from time to time publish in such manner and form as to secure the widest circulation among the Mechanics' Institutes, and among mechanics, artizans, and manufacturers generally, all such Reports, Essays, Lectures and other literary compositions conveying useful information as the said Boards are respectively able to procure.

XIII.—The said Boards respectively may make and ordain such By-laws, Rules, Orders and Regulations, not being contrary to this Act or to the laws of the Province, as they may deem necessary, touching the disposition and management of their funds, property and affairs; the holding and management of exhibitions of Works of Art and Manufactures, and the execution of the duties and powers entrusted to them by this Act; and from time to time may repeal or alter the same and make others in their stead.

2. Copies of all By-laws, Rules, Orders and Regulations, and of the minutes of the proceedings of the said Boards, shall be transmitted forthwith after they are respectively made to the Bureau of Agriculture.

XIV.—All Mechanics' Institutes and Arts Associations receiving grants of money from the Government, shall be placed under the general supervision of the Boards of Arts and Manufactures for Upper and Lower Canada respectively, in like manner as the County Agricultural Societies are placed under the supervision of the Boards of Agriculture; and the said Boards shall receive from the Government, and pay over to the respective Mechanics' Institutes and Arts Associations any grant of money to which they may be entitled.

2. And it shall be lawful for each Board to retain for the use of its periodical Exhibitions, one tenth part of all such grants; and no Mechanics' Institute or Arts Association in Upper or Lower Canada shall be entitled to receive any grant of money from the Government, unless such Institute or Association has become incorporated under the general "Act respecting Library Associations and Mechanics' Institutes," chapter 72 of the Consolidated Statutes of Canada.

or by a special Act of Incorporation; nor unless such Institute or Association shall have transmitted to the respective Boards of Arts and Manufactures for Upper or Lower Canada, a properly certified copy of its Annual Report for the past year.

3. And it shall be the duty of the respective Boards of Arts and Manufactures to send Agents to visit each incorporated Mechanics' Institute and Arts Association in Upper Canada respectively, whose duty it shall be to ascertain and report on the progress each Institute or Association is making in carrying out the objects for which the grants from the Government are made; and no Association or Institute shall be called a Mechanics' Institute within the meaning and provisions of this Act, unless it shall have at least twenty members enrolled as working mechanics or manufacturers, who are paying a subscription of at least one dollar each per annum to its funds.

Provincial Exhibition Associations.

I.—The Members of the Boards of Agriculture and of the Boards of Arts and Manufactures; the Presidents and Vice Presidents of all lawfully organized County Agricultural Societies, and of all Horticultural Societies, Incorporated Mechanics' Institutes and Arts Associations, and all subscribers of one dollar annually, shall, in their respective sections of the Province, be, and constitute a "Provincial Exhibition Association" for that section.

II.—The Members of the Board of Agriculture and the Council of the Board of Arts and Manufactures, and the Presidents and Vice Presidents of County Societies, Mechanics' Institutes, Arts Associations and Horticultural Societies, (or any two members whom a County Society, Mechanics' Institute, Arts Association or Horticultural Society may appoint instead of its President and Vice President) shall be the Directors of such Provincial Exhibition Association.

III.—The Association for Upper Canada shall hold an Annual Fair or Exhibition open to competitors from any part of the Province.

2. The Association for Lower Canada shall hold a Fair or Exhibition Annually or Bi-ennially, reckoning from the date of its last Fair or Exhibition, as the Board of Directors of the Association for Lower Canada deems best.

3. The Directors shall hold a Meeting during the week of the Exhibition, and shall at such meeting elect a President and two Vice Presidents, and shall also elect a Treasurer, who shall be paid a reasonable salary for his services; and shall appoint the place for holding the next Meeting and Exhibition of the Association, and may appoint a local Committee of Management at the place where such Exhibition is appointed to be held.

4. And the said Boards of Directors respectively, may make such rules and regulations, not being contrary to the laws of the Province, as may be deemed necessary to prescribe the powers and duties of such local committees, and for the proper management of such exhibitions; and for the disposition and management of their funds, property and affairs, and the execution of the duties and powers entrusted to them by this act; and the same from time to time to repeal or alter and make others in their stead.

5. But no repeal or alteration shall be made in any rule or regulation, unless one month's notice of such proposed repeal or alteration shall have been given in any Journals that may at the time be published by the respective Boards of Agriculture, and Boards of Arts and Manufactures.

IV.—The Board of Agriculture, and the President and Vice President of the Board of Arts and Manufactures, and three other members of the Council of said Board, to be elected annually by said Council, shall be the Council of the Association, with full power to act for and on behalf of the Association between the annual meetings thereof; and all grants of money, subscriptions, or other funds made or appropriated to, or for the use of the Association, (except money collected by or granted to any local committee for the local expenses of an Exhibition,) shall be received by and expended under the direction of the said Council.

2. And the President of the Board of Agriculture, and the President of the Board of Arts and Manufactures, shall be respectively *ex-officio* President and Vice President of the Council of the Association, and the Secretary of the Board of Agriculture, together with the Secretary of the Board of Arts and Manufactures, shall be *ex-officio* joint Secretaries of the Council and of the Association.

V.—All contracts and all legal proceedings, by, with, or concerning the Association, shall be made and had with the Council of the Association in its corporate capacity, and no other contracts, agreements, actions or proceedings shall bind or affect the Association.

Members of Mechanics' Institutes, and of other public bodies, subscribing for this Journal through their respective Societies, will have their copies addressed to them direct from the office of the Board.

The Free Library of Reference, and Model Rooms, are open to the public daily, from 10 a.m. till noon, and from 1 to 4 o'clock, p.m., at the Board Room, No. 79 King Street West, Toronto.

The Secretary of the Board acknowledges the receipt by late Mails, of extensive Catalogues of Books in

every department of Literature, from the following Booksellers and Publishers, namely:—

John Weale, H. G. Bohn, Samuel Palmer and Willis & Sotheran, of London, England; and Harper and Brother, D. Appleton & Co., and Ticknor & Fields, of the United States; and of the Department of Public Institution for Upper Canada; also Catalogues of the Libraries of the Science and Art Department of the South Kensington Museum, and of the Great Seal Patent Office; also Putnam's Book-buyer's Manual, and the London Catalogue of Books from 1831 to 1855.

These Catalogues are available for reference to Mechanics' Institutes and Library Associations, and to the Public generally.

The regular meetings of the Sub-Committee of the Board are held on the last Thursday of each month.

The arrangements in contemplation at the date of our last issue, with the Board of Arts and Manufactures for Lower Canada, in regard to a joint interest in this journal, being now completed, subscriptions will hereafter be received by that Board, at the Board Room, Mechanics' Hall, Montreal.

The Board of Arts & Manufactures

FOR LOWER CANADA.

ANNUAL COURSE OF FREE LECTURES.

MR. PRINCIPAL DAWSON'S OPENING LECTURE.*

(MONTREAL, Tuesday, February 19th.)

The learned Principal opened his remarks by saying the first of the arts was the art of obtaining subsistence. Whether men were savage hunters, members of nomadic tribes or settled agriculturalists, in every case the primary object of their labour and art was to procure food. The mechanic and chemical arts followed, marking a farther stage of civilization, and the ornamental arts which came to grace and adorn our life. Of the three forms of primitive life he had enumerated the agricultural was most favorable to the development of the other arts, since it needed tools and appliances for its work, supplied a sufficiency of food for the artisan and conduced to a settled mode of life. Thus agriculture stimulated the arts and the arts reacted upon agriculture causing increased production of supplies of food. We judged of nations which had passed away by the remains handed down to us, marking their advancement in the arts. Their massive structures, their convenient implements, their tasteful designs, all showed the progress they had made, and they were given credit for the civilization these indicated. Invention springs originally from the necessities of men, for the creation of the means of procuring subsistence but improvement and progress toward perfect art depend on other causes. There was a marked resemblance between the earlier works of rudimentary art, all the world over. The pottery, weapons, &c., made in Britain before the Roman conquest and in other countries of Europe when compared with that made by the Indians of America shewed a striking resemblance. They were almost exactly alike. This spoke no doubt of a common origin, but also of common wants, and similar modes of supplying them. The nations most distinguished in initiating inventions on which the arts of life were based were not always the greatest in carrying them to perfection. Many stopped short, and others took up the ideas they had originated and carried them onward. For it required not alone mere invention and manual dexterity—the training of the handicraftsmen, but trained thought, scientific processes of investigations to secure continued progress. When art was left without the aid of science it ceased to make progress. Long before gunpowder or the art of printing was known in Europe, the Chinese were firing their squibs and fireworks, and printed after a fashion a newspaper in Pekin. But while Europe had wrought wonders by means of gunpowder and printing since they had been known to the European nations, the Chinese made very little better use of their inventions now than they did while Europe was sunk in barbarism. So a species of alphabet was known thousands of years ago in Egypt, but it was reserved for the Phœnicians, the Hebrews, the Greeks and the latter European nations to bring the use of writing to the perfection it has attained. The existence of steam and its possession of power, and the properties of electricity were known long before any practical use was found for them. This has only been evolved by means of scientific processes of thought. The Greeks and Romans advanced as far as we in the fine arts, but not in the useful. The reason was obvious; among them occupation in the useful arts was regarded as servile and degrading. Therefore cultivated minds did not apply themselves to their development. To make real progress in the arts of life then we must have scientific knowledge and mental training brought to aid the skilled hand. Men must be taught to penetrate, so far as may be, the designs of Providence as shewn in the material world, and discover and act upon the laws which govern it. This great fact required to be taught and much insisted on here. In some other parts of the world there was less need to do so. Here he regretted to say that the need was great. In the old European countries the doctrine was recognized and acted upon by the Government and people, and provision made for bringing instruction in science to the aid of the artizan. They had heard much of France and the great things it had done for popular scientific education. That had become a familiar instance. He would take one less known, but not less striking. He would call their attention to a little European state without seaports, without any remarkable internal resources, surrounded by a commercially hostile population, but which has made great progress in the arts and enjoys great prosperity. He alluded to the little kingdom of Saxony, and would quote from Barnard's journal of education to show what that little state had done to promote popular scientific education. The learned principal here read a list of the various schools. Beside the Polytechnic school at Dresden, and the Forest school

* From the *Montreal Gazette*, revised by the author.

at Tharandt, and the great University at Leipsig, with its 85 professors and 835 students, they had six Academies of Arts and Mining with 43 teachers and 1400 pupils, in addition to the great Mining Academy at Freiberg, 11 Gymnasia equal to our colleges, 6 higher Burghes and Real schools. Three special institutions for commercial and military education, with 42 teachers and 240 pupils, 17 higher schools of Industry and art with 72 teachers and 778 pupils, 69 lower technical schools with 7000 pupils, and 24 lace-making schools with 2000 pupils, together with more than 2000 common schools, and asylums, &c. All this for a population of about two millions! Was it any wonder that the arts prospered in Saxony. There science went hand in hand with art. Without this, the country could not sustain so large a population. Belgium also is celebrated for its industrial schools, yet Dr. Playfair informs us that 100 Belgian manufactures not content with their teaching had gone to Paris to finish their education in applied science there. The attention of Britain was called to these things by the great Exhibitions of 1851 and 1855, and very much had been done in Britain to further scientific education since that time. If it were urged that although continental nations had done these things and Britain had not, yet Britain maintained its ascendancy in industrial progress, it must be answered that Britain has had greater natural advantages and has benefited by the knowledge brought her by refugees from other lands. The workshops had bred thinkers who were not always content with things as they were in politics and religion; and many continental governments had expelled these people, who had sought Britain as an asylum and contributed in a very great degree to the success of British manufactures, if, indeed they had not been the principal agents in advancing them. The greater freedom enjoyed in Britain had a tending to develop thought and skill expressed elsewhere, but that was now believed to be insufficient, and government was aiding largely individual efforts to furnish the artizan with scientific education. In our own country we had as yet almost nothing but the raw material. We had land enough and water power and material for manufacture, but many of our advantages were wasted for lack of skill to use them to the best advantage. The most expensive man to maintain—the one who required the greatest area of country to maintain him was the savage, because he knew how to make the least use of the resources which nature offered. He could obtain less from her than any others. Therefore he needed more area for his maintenance than a European Prince. The agriculture in a new country was but little better. Land was cheap and labor dear, capital and skilled labor scarce, and the largest space was occupied with the least advantage through imperfect modes of industry. And so it was with manufacturing industry. We were altogether dependent upon the experience and scientific attainments of others. If we were ever to cease to be so, it must be by having our own people taught to apply scientific principles to their methods of labor. If we are to have the Arts flourish among us this must be done. Britain for years bought the applied science of the continent with her immense capital. We have not her capital; we have not the cheap labor to be obtained in European countries, and therefore there is no country in which labor-saving methods and machines are so much required as in Canada. It is only by superior knowledge that we can hope to overcome the disadvantage of dear labor. In no other way is it possible to compete with other nations. And that brought him to the consideration of the constitution and purposes of the Boards of Arts and Manufactures. The necessary efforts to promote the requisite education could not be left altogether to individuals. It was a wonder that government had not seen to it years ago. Even yet the government seemed half ashamed of acknowledging they had begun so good a work. These Boards were not yet given an independent position, but were in some measure grafted on the older Boards of Agriculture. The act provided a great deal of work for them to do. They are to take charge of and promote periodical exhibitions of the industrial products of the country, a most useful thing as shewing strangers what the country was producing, and manufacturers the improvements in manufacture which others were making. They had to provide museums of industrial products—more useful than periodical exhibitions inasmuch as they afforded permanently at all times the like information. They were to provide free libraries of reference, in which work-people and manufacturers might be able to refer to various expensive works which individuals could not afford to have in their libraries, teaching what inventions and scientific methods had been in use in other countries. They were to provide, as far as possible, or assist in providing, education for the people employed during the day in the work-shops, and unable to attend the ordinary public schools. And they were also to furnish free lectures on subjects likely to awaken an interest in practical science, if possible to classes formed for scientific study. They were to issue publications having the same end in view; and were to affiliate with them as subordinates or assistants, the various Mechanics' Institutes which gave proof of a desire and capability to do the work with advantage. Here was a great work, a magnificient function for the Boards—and yet, he hardly desired it to go abroad, the government expected it to be all done out of munificent grant of £500 per annum, a sum not more than sufficient to secure the services of an efficient secretary and editor for a journal of their transactions. By this he would not desire by any means to imply that the present secretary was not efficient, although he had done the work so long and so zealously for nothing. He only meant that was a state of things that ought not to exist—that was hardly creditable. They could not of course do what the Act indicated as their duties, but they had attempted something. He could speak more particularly of the Lower Canada Board. Some institutes had been affiliated, until the Legislature killed the majority of them by cutting off the grants, and there were few left in Lower Canada to affiliate. Schools in connection with some of these had been tried, and one—that in connection with the Montreal Institute which had last winter 200 pupils—was a model for such schools. The Board had also procured the delivery of Lectures upon scientific subjects, and had made efforts to form classes for the systematic study of chemistry. It had, with foreign aid, been enabled to gather together a small but valuable nucleus of a library of reference. It has been unable to establish a journal of its own, but the Upper Canada Board having started one, it was proposed to join them in that work.

With regard to exhibitions they had made their first great effort on the occasion of the Prince's visit. They believed and the Government believed that

nothing more important could be done to provide a fitting welcome for the Prince, or to render his visit of benefit to the Prince, than to get together a good display of the Industrial resources of the country at one central point. It had been known long ago that furs and timber could be found in the "acres of snow" which King Louis ceded to Britain, but about our agricultural resources and mineral riches almost nothing was known until the great Exhibitions of London and Paris. What advantages we had made in manufacturing industry and the arts of life was still unknown to many. It was highly desirable that an exhibition should be got up which would inform our distinguished visitors on this point. At the season of the Prince's visit much of the farming could be seen by the traveller in passing through, but the manufactures could only be adequately judged of in such an exhibition. They thought the people everywhere would see it in that light; much to their disappointment they only partially did so. The attempt made was some years in advance of the popular ideas. The Agricultural Board had little sympathy, seeing that the management was not placed in its hands. The Upper Canada Boards, actuated by that local jealousy and pride, which was everywhere unfortunately too common, devoted themselves to an Upper Canada Exhibition. The Corporation of Montreal would not give even the ordinary grant to annual exhibitions, except upon terms which the Board could not accept; and when an appeal was made to individual citizens, to aid the great national object of showing the Prince and the distinguished men he brought with him the vast resources and the industrial progress of the country—the people of this, the great centre of the industrial and commercial activity of the country thought it a matter of a subordinate interest to a grand display of one of the arts not included in the function of the Board—the art of dancing! and a larger subscription was obtained for a ball than for the great Industrial Exhibition.

Notwithstanding all its difficulties and disappointments the Board succeeded in erecting a building which is in itself a triumph of Canadian art, and in collecting the largest exhibition of the products of Canadian manufactories and workshops ever presented to the public—an exhibition which astonished every one not very familiar with the condition of the growing arts and manufactures of the country. The building we have, still incomplete, it is true, burdened with debt, but still in such a condition as to render any subsequent exhibition a comparatively simple and inexpensive matter. Had we been aided, as we should have been by this city, we should have had something more. Our building would have been complete. It would have been open throughout this winter for lectures and other means of art education—as a museum and public library—and the artizans of this city and all who visit it on business or pleasure, would have found there a nucleus at least of those means of reference and improvement which it is the duty of this Board to provide. These ends we have not yet been able to attain, but we have taken important steps toward them, and the rest must follow, unless the Government and people of Canada are blind to the great objects to be attained by the nurture of our arts and manufactures. We aim then at the establishment of a great industrial museum, representing all the natural products and manufactured articles of Canada, and including everything that we can collect from abroad likely to guide and stimulate invention and improvement here. We desire to collect a library of reference, which shall enable any one studying, and especially in art or practical science, to avail himself of all that others have known or done. We wish to establish special schools of art and practical science similar to those in the old world to which I have already referred, and and to diffuse, both by lectures and in a printed form, all the information which can be obtained on matters applicable to the present state of our industrial pursuits. These labors are not to be confined to this city. The Board must aid and stimulate the organization of Mechanics' Institutes and industrial schools throughout the Province, and must make all its institutions centres of light and information to the whole country. To effect these objects will demand a far larger amount of public aid than we have yet received; and this we must receive if Canada is to keep itself abreast of its commercial and manufacturing rivals. Let it not be said that it is too soon to attempt such institutions as those to which I have referred—that we are in advance of the time. It is lamentable to think that public attention in Canada has not been earlier aroused to such subjects. The work is all before us; the need of it appears on every hand; it is worth doing; and all that is wanted is, that active and sustained efforts should be bestowed on it. Nor must it be said that the public money is wasted in such efforts. Nothing more surely repays expenditure in any country than wise and enlightened attention to the culture of mind as the means of acting on matter. Cultivate this and all other interests will advance.—Neglect this and national interests languish and you fall perhaps irretrievably behind your more active rivals. Canada is now just in that state of progress when enlightened public effort on behalf of its agriculture, its arts and manufactures should be a first and leading object with its statesmen, and it is through this Board and similar instrumentalities that this effort must be put forth. Let me add that though this Board is for Lower Canada, yet that being placed and appropriately, in the great centre of commerce and manufactures, it must look principally to Montreal for men and means, and that this city will find by supplying these liberally it will best consult its own interests.

PROCEEDINGS OF INSTITUTIONS.

Abstract of Proceedings of the Hamilton and Gore Mechanics' Institute.

The Annual Meeting of this Institute was held in the News Room, on Friday evening, 22nd February, 1861—the Vice-President, J. F. Rastrick, Esq., in the chair.

The Report of the Board of Directors for the year past was read by the Secretary, adopted and ordered to be printed for the use of members.

The Directors, in presenting the twenty-second Annual Report, submitted a general statement of the affairs of the Institute for the past year.

I.—The Membership.

Number of members as shewn on the register, on the 1st Feb., 1860	468
Joined since that date	115
	583

Number of members or names handed in from the M. L. Association who have never come forward	60	
Number resigned or left the city, chiefly the latter	127	
		187
		396
Decrease since last Annual Report 72.		

The Members are classified as follows:—

Honorary members	13
Ordinary do	359
Junior do	24
Total	396

II.—The Finances.

Dr.

Balance from last year	$295 35
Subscriptions till 1st Feb., 1861	939 05
Hall rent	1149 38
Sale of papers	105 12
Lecture account	145 85
Sundries	213 52½
Total	$2,848 27½

Cr.

Outstanding debts 1st February, 1860, but since settled	$522 04
Whitewashing, cleaning hall, &c.	105 55½
Postage	65 09
Salaries account	450 16
Insurance	40 00
Interest	595 68
Gas	465 95
Wood and coal account	61 62½
Sundries	293 15
Balance on hand	70 50
Total	$2848 27

FINAL BALANCE OF THE BOOKS 31ST JAN., 1861.

Dr.

Cash	$70 50
Library	2,650 00
Furniture	2,612 00
Building account	20,824 31
Total	$26,156 81

Cr.

Mortgages	$11,897 44
Interest due on the same	160 00
Outstanding debts	1,979 52
Original contributions	12,119 85
Total	$26,156 81

The Board adds "in connection with this financial statement the Board are happy to inform you that the usual annual and very liberal donation of $400 from the Directors of the Great Western Railroad has been received. Such acts of generosity, are duly appreciated by all the members, and will, we doubt not, be gratefully acknowledged by this Institution, in whose welfare the donors have manifested so much interest."

III.—The Library.

The Board have much pleasure in acknowledging the following donations of books:—

By Adam Brown, Esq.	18	vols.
" Rev. H. Hansel	1	"
" James Byrne, Esq	1	"
" C. O. Counsell, Esq	2	"
" J. W. Murton, Esq	1	"
" Wm. Haskins, Esq	2	"
In all	25	

IV.—The News Room.

The cordial thanks of the Institute were tendered to the proprietors of 36 Canadian papers, for the continued liberality in supplying the Reading Room with their publications free of charge.

Fifty-eight British, American and Canadian publications are also reported as being subscribed for and regularly received.

The Directors remark that

"The News-room still continues to be regarded the best in our country, and is daily resorted to by many of the members and not a few visitors who find in it at all times the latest news from every quarter of the globe, as well as an excellent selection of the best Magazines and periodicals of the latest dates, containing information on popular and scientific subjects, from the pens of the most eminent writers of the day. The News-room may well be regarded with honest pride and enjoyed with great advantage by every public-spirited citizen of our 'Ambitious City.'"

V.—The Lectures.

In this department the Board reports that

"Despite the sparing support given to Lectures in this city, and the financial embarrassment of the Institute, your Directors, believing the Lecture to be an educational means, which it is the duty of Institutions like yours to encourage and—also to gratify, unfortunately only a minority of the members—arranged a course of Lectures during the past winter months. The Lecturers were all men of ability—two of brilliant reputation—the services of men capable to please and instruct, resident amongst us, were secured, and every effort was put forth, still the attendance, with one exception, was far from satisfactory. Your Board sincerely regret that such should be the case, but they ardently hope the members will see the necessity of seconding the efforts hereafter exerted in this direction. They trust their successors will be much more successful than themselves in this respect, and that we may yet enjoy all the advantages arising from Lectures given by gentlemen of the highest order of intellectual attainments."

One of the concluding paragraphs of the report refers to the origin, objects and tendency of Mechanics' Institutes, in the following language:—

"Glasgow had the honour of being the first place in which there existed a Mechanics' Institute. The Institution took its rise during the last year of last century, sixty-one years ago.—What Robert Raikes did for Sunday Schools, and good John Pounds did for the useful ragged schools of Great Britain, Dr. Birkbeck accomplished for Mechanics' Institutes. As its founder he merits a high place among the benefactors of our race. His name, in connection with these Institutions, will doubtless long survive the attritions of time. The professed object, as the name implies, is the improvement of our artizans and working classes of every

grade; but there is reason to fear this design has in many instances been lost sight of, or perhaps we should say, the original idea has been considerably amplified, as other classes of the community rather than operatives constitute not unfrequently the majority of subscribers and attendants."

(Signed) ADAM BROWN, *President.*
ARCH. MACALLUM, *Secretary.*

Moved by Dr. W. L. Billings, seconded by Dr. Craigie,

Resolved, that this meeting gratefully acknowledges the liberal annual donation of $400 towards the funds of this Institution, from the President and Directors of the G. W. R. Company, and that this be duly communicated by the Secretary.

The following gentlemen were duly elected Office-bearers for the ensuing year, namely:

President—F. J. Rastrick, Esq.
Vice-President—W. H. Park, Esq.

Board of Directors:

Messrs. C. Murray, D. McCullough, R. Bull, A. Stuart, A. Macallum, T. McIlwraith, G. Murison, J. F. Kidner, Wm. Michael.

CANADIAN PATENTS.

PATENTS OF INVENTION,

As issued by the Bureau of Agriculture and Statistics, Quebec, 2nd March, 1861.

William Sudworth of the Town of Woodstock, County of Oxford, Shoemaker, for "An improved process of bailing and tanning hides and skins."—(Dated 2nd November, 1860.)

Thomas Grange, of the Township of Richmond, County of Lennox and Addington, Yeoman, for "An improved Harrow Tooth."—(Dated 2nd November, 1860.)

George Kirk, of the Town of Chatham, County of Kent, Civil Engineer, for "A new and improved method of Indexing Books."—(Dated 6th November. 1860.)

James Hamilton, of the Town of Peterborough, County of Peterborough, Manufacturer of Agricultural Implements, for "An improved Grain Sower and Cultivator combined."—(Dated 21st December, 1860.)

Elijah Leonard, of the Town of London, County of Middlesex, Engineer, for "A Sawing Machine for cross-cutting timber."—(Dated 21st December, 1860.)

John D. Lawlor, of Fort Erie, County of Welland, Machinist, for "An improved Sawing Machine."—(Dated 21st December, 1860.)

Joseph Marks, of the City of Hamilton, County of Wentworth, Mechanical Engineer, for "A new system of lubricating valves, pistons, cylinders, piston rods and valve spindles of locomotives and other engines."—(Dated 21st December, 1860.)

George H. Meakings, of the City of Hamilton, Sewing Machine maker, and Isaac Mills, of the township of Flamboro' West, County of Wentworth, Yeoman, for "An article for counting and testing the quality of eggs."—(Dated 21st December, 1860.)

Thomas H. Taylor, of the Town of Chatham, county of Kent, Manufacturer, for "A self-acting cleaner for a plough."—(Dated 21st December, 1860.)

Thomas Murphy, of the village of Clifton, County of Welland, carpenter, for "A new and improved lamp for burning coal oil and other hydrocarbon liquids without a glass chimney."—(Dated 21st December, 1860.)

Peter B. B. Stiles, of the village of Beaverton, County of Ontario, Blacksmith, for "A Lifting Gate."—(Dated 21st December, 1860.)

William Gill, of the City of Toronto, County of York, Engineer, for "Certain improvements in the Flues of Steam Boilers."—(Dated 21st December, 1860.)

William Bright and James Collins, both of the Town of Guelph, County of Wellington, Machinists, for "A Clothes Airer."—(Dated 24th December, 1860.)

Nelson Kimball, of the Township of London, County of Middlesex, Mechanic, for "An improved Cultivator."—(Dated 31st December, 1860.)

Selected Articles.

ON THE ELECTRIC SILK LOOM,

BY PROFESSOR FARADAY, D.C.L. F.R.S.

"Illustrans Commoda Vitæ,"* the motto of the Royal Institution, was made the ruling principle on this the last evening of the season; an account being given of the application by M. Bonelli of electricity to the service of the figure weaving-loom. The astonishing condition of perfection to which M. Jacquard had brought the silk loom, so that artists of the highest rank could not, without minute inspection, distinguish its results from the most perfect engraving, and the manner in which he taught the weaver to construct a series of cards, and then to use them automatically, so as to produce as often as he pleased the design which they represented, are well known. Any effect of pattern, either simple or complicated, which is produced in the woven fabric depends upon the manner in which the threads of the warp are separated before the weft is thrown, and the successive re-arrangements of the warp threads which are brought about each time the shuttle is passed; a single thread of the weft therefore represents an element of the design; and in the Jacquard loom each of these requires a card pierced in a certain order, which, being brought against the ends of a set of horizontol rods, allowed some to remain undisturbed, whilst others were pushed on one side. By the action of the pedal the warp threads associated with the undisturbed rods were raised, and those belonging to the displaced rods were left unmoved; and to do this rightly, a separate pierced card was required for every thread that crossed the warp within the extent of the pattern. Frequently some thousands of cards are needed, and for the production of a woven portrait of M. Jacquard, in black and white silk, as many as 24,000 were employed.

After a design has been decided upon, it has to be converted into these cards, one for each thread of the weft included in the design; the preparation and piercing of them requires much care and time, after which they have to be linked together as an endless chain in their proper order. It is to replace this part of the weaving arrangements that M. Bonelli has applied his attention, and the peculiar power of electricity. Instead of the many pierced cards, he has but one card, or rather its equivalent, a convertible plate of brass; which, being pierced with the full number of holes required (which in the loom in action was 400), can have these holes either stopped or left open, so as to represent by its successive changes of condition the successive cards of the Jacquard series. To obtain this effect, tin-foil is attached strongly to paper, so as to form a compound sheet. The design is then drawn upon the metallic surface

* Lucretius, iii. 2.

with black bituminous varnish, and the sheet is made into an endless band, which being placed upon a roller, and kept in its position by stops, moves as the roller moves, being carried forward by its motion. A set of teeth rests on the top of this roller, touching the pattern in a line; they are made of thin brass plate, so thin that 400 of them do not occupy more than 16 or 17 inches, *i. e.* the width of the design on the roller; yet so separate that each is insulated from its neighbour by little interposed teeth of ivory; and so large and therefore weighty as to fall and rest upon the pattern, making good electrical contact where the tin-foil is exposed, but being insulated where the bituminous pattern intervenes.

Behind these teeth are 400 small electro-magnets fixed in a framework, parallel to each other, and insulated. The fine covered wires which constitute their helices are connected at one set of ends with the teeth just described, each with a tooth; whilst the other ends are brought together and made fast to one metallic plate and wire. Tracing this wire onwards, it comes to an interruptor or contact-maker from whence the metallic communication proceeds to a screw appointed to communicate with one end of a five-celled Bunsen battery, the other end of which communicates with a screw near the former. This screw has a wire proceeding from it to two insulated teeth, like the teeth bearing upon the pattern, but heavier; and these rest upon the uncovered edges of the tin-foil at the sides of the pattern, so as to keep up a constant communication with it. By simple, but perfect and secure mechanical arrangements, the following movements and results take place in this part of the apparatus. As the pedal descends under the weaver's foot at a certain time, the 400 teeth descend upon the pattern; then the circuit is completed at the interruptor in the single wire; the electric current passing through that wire, is divided into as many portions as there are teeth touching the metal in the line of pattern under realisation; it makes all the electro-magnets surrounded by these wires active, leaving the others non-magnetic; and then, as the foot is raised and the movements return in their course, the interruptor is first separated, which causing all current to cease, the magnets lose their power, the teeth are raised from the pattern; and then the cylinder carrying it moves forward just so much as to give the new line of pattern for the teeth to search out electrically (the next time they descend) which corresponds to the next cast of the weft thread. Because the pattern never moves whilst it is in contact with the teeth, it is not cut or worn by them; because the current is made by the interruptor after the teeth are in contact, and before they are separated, no fusion or burning of the metal occurs at the teeth; and because there is a tongue-wiper or brush, which, at the right time, passes under the teeth, sustains them and from off which they rub on to the pattern, there is never any want of cleanliness or of contact there.

Associated with these 400 magnets, and in the same line with them, are 400 cylinders of soft iron, called pistons; they are carried in a frame which moves to and fro horizontally between the magnets and the horizontal rods belonging to the suspensions of the wrap threads; and they move towards the magnets at a time so adjusted as to coincide with the passage of the electricity round its circuit; they find therefore some of the magnets excited, because their teeth touch the metal of the pattern: and as the box of pistons begins to return before the current is interrupted, such of the pistons as have touched excited magnets are retained or held back, whilst the others have returned in their course; the pistons therefore are divided into two intermixed groups of which the one group is perhaps half an inch behind the other. Now comes in the action of the perforated brass plate, which is to be converted for the time into the equivalent of the particular Jacquard card required, It is a vertical plate associated with the extremities of the pistons farthest from the electro-magnets: it can move up and down to a small extent: it is pierced by 400 circular holes. The 400 pistons have each a head or button, which can pass freely each through its correspondent hole when the plate is up, but is stopped at the hole when the plate is down, and then eventually closes it. Now the time is so adjusted that when the box of pistons has moved so far forward as to cause separation of the two groups, the plate descends, and by locking such of the heads as belong to the unretained group, being correspondent holes, whilst the heads of the retained group, being already behind their holes, have left them open; and so the Jacquard plate is formed, and, moving a little further, it acts on the horizontal rods before mentioned, and having by that arranged the suspenders of the wrap threads, it then goes back, or towards the electro-magnets, to take up, under the influence of the currents of electricity through the selecting teeth, the new arrangement of apertures required for the next cast of the weft thread.

The use of electricity, for the purpose of reading off the design and conveying it into the loom, involved many peculiarities, conditions, and difficulties. These were considered; and the manner in which they were either turned to advantage or overcome was illustrated by large and separate experiments.

ON THE ANTIQUITY OF THE HUMAN RACE.

BY PROFESSOR D. T. ANSTED, M.A., F.R.S.

(*Continued from page* 81.)

It only remains now to consider whether by any chance these materials have been conveyed into the places where they are found, either by some natural operations much more recent than the formation of the deposits themselves, or by some human agency of late date; in other words, whether they have drifted accidentally into holes at the surface, or whether they have been buried in graves or the foundations of buildings of a comparatively recent time. This is a question that deserves careful consideration. I have no time to dwell on the various points of evidence; but when I tell you that a dozen of the most intelligent geologists, English and foreign, most of them commencing with a decided feeling that man was far too recently introduced to admit of his manufactures being buried with gravel of any date, having examined carefully the principal localities, taken the implements themselves out of the quarry, and examined most minutely the circumstances under which they occur:—I say that when, after such investigation, a conclusion is unanimously arrived at,—namely, that these materials are contemporaneous with the gravel,—we are bound to accept that conclusion. You must, therefore take, for granted that sculptured flints of human manufacture, such as I have shown you, are found in certain beds of gravel, mixed up and of contemporaneous origin with certain bones of animals found with and near them. No one is, I think, at present at liberty to throw any doubt on this conclusion, because the investigation has been made by competent observers with perfect honesty of purpose, and by per-

sons whose integrity and knowledge of the subject is beyond any question.

I trust I have satisfied you now that flints, specimens of which are before you, and which have been found in marvellous abundance in some few localities—though hitherto only in a few—are beyond a doubt so constructed as to have required the hand of some intelligent being totally unlike in his intelligence any animal inferior to man: and also that these remains of man were found, really forming part, and often occurring in the lower part, of a great formation of gravels, and sands, and clays, or else in cavern deposits that must have taken a very long time to elaborate, and a still longer time to bring into their present position, and during the accumulation of which there lived in our latitudes large groups of quadrupeds that have long since become extinct.

Resembling in a general way the roughly-hewn implements and weapons belonging to other savage tribes, those from the gravel and caverns of England and Western Europe are yet different from them, and even of rougher make. In deposits of gravel above those which contain them are found, however, more modern specimens, similar in form, but more neatly cut, and even sometimes polished. Above these latter or amongst them, are tools manufactured of copper and iron, evidently the work of a more cultivated race. Then come the remains of the Roman conquerors of Great Britain.

At some point in the history, but probably at a comparatively recent period, lived the race to whose labours we owe the wonderful group of stones at Stonehenge, and whose cromlechs and altars are dispersed over the westernmost extremity of European land. Were these the last remains of the ancient races driven towards the sea by advancing tribes of somewhat superior cultivation and higher organization? This is a question that still remains to be answered. All we know is that the preservation of such monuments where we find them, seems to point to this conclusion, which is rendered more probable by what we see of the aboriginal inhabitants of America and Australia, who are becoming gradually lost races, owing to a similar advance of other and more civilized races.

There seems, indeed, to be a step, arrived at in the gradual modifications that take place in the human family, beyond which there is no tendency, or even power, to go back, and no power to advance, by mixture with more civilized men. When civilised men occupy a savage country we generally obtain mixed breeds, but they only last for a few generations, rapidly degenerating both physically and intellectually from the higher type without improving the lower. If this be the law of Nature, it would help to explain much that is obscure in the history of man as well of domesticated animals.

Let me now sum up what appear to be reasonable inferences from the facts we have been considering.

On land, near England, then slowly emerging out of a sea traversed by icebergs, having a climate greatly varied, but on the whole warm, there roamed, at a very distant period, elephants and rhinoceroses, large deer and musk oxen, gigantic bears, tigers and hyænas, and nnmerous smaller animals, many of which are still common. In the rivers of this land, or in pools and lakes there, were many species of hippopotamus, and we may safely conclude that there was a corresponding vegetation. It could hardly have been a small tract to support these gigantic quadrupeds; it is more likely to have been a fragment of one much larger which had been partly submerged.

The hyænas and the bears then occupied caves in the limestone rocks as dens, and carried thither their prey. The British Islands formed no separate group, and the whole Continent of Europe was probably but an archipelago. But at this time, when land was so differently distributed, when the animals, especially the larger ones, were so different, there existed tribes of savages—troglodytes, perhaps,—sheltering in holes in the ground, or sharing caverns with the wild beasts, but not without the will and the power to manufacture flint arrows and hatchets, and spear-heads, that could be fixed in simple handles with throngs, and form implements for use, or weapons for defence or offence. These early inhabitants of the western lands may not, however, have been the first, although at present no appearances of human ingenuity have been seen among the remains of the earlier and warmer land, peopled by different species of elephant and rhinoceros, and apparently by many other animals equally characteristic. The beds above the glacial drifts of the boulder clay, or the beds of boulder clay itself, contain the first yet found of those rude implements attributable to human agency.

Perhaps at this same time there existed a similarly imperfectly developed family of the human race in America; and it may be that their representatives in Africa, on the banks and at the mouth of the Nile, were then, as they certainly were afterwards, a dominant, because a more educated race.

The earliest human inhabitants of Western Europe must, however, have lived together,—they must have had a common policy,—for their weapons are all constructed according to one idea, though all are simply and roughly made, and meant for use rather than ornament. There is little symmetry of form, and often extreme carelessness of execution. So marked is this want of finish, that many of the specimens, although their character is seen which they form parts of a series, are hardly artificial enough to decide their human origin. Thousands of them are found near together; they have been shaped merely by striking one flint against another, and it seems like that for one perfect instrument made and used there were hundreds chipped off and thrown away during the progress of manufacture. This would account for the vast number of small arrow-heads or chips in comparison with the larger and more completely finished specimens.

Our early ancestors, if the tribes who constructed the flint weapons must so be regarded, may have continued with similar habits for an indefinite time. By degrees the manufacture of flint weapons probably improved, and we find in the newer gravels, in the surface deposits, and in the mouths of caverns, clear proofs of more perfect chiselling, and an approach to polish. But consider the number of years during which this change must have been going on. The climate and vegetation once permitting elephants, rhinoceroses, and hyppotamuses to flourish, must have been altered by a new distribution of land. These animals, however, spread widely, reaching even the Artic Circle; whole species were introduced, became abundant, became scarce, and entirely disappeared; while man, though adapting himself to changes that they could not endure, hardly seems to have developed sensibly in instinct or intellect. Whole tribes of human beings, the early inhabitants of unknown lands, have doubtless been replaced by other families of the great human race. Generations after generations have been born—have lived, and died—tribes have succeeded tribes, families have driven out families, and scarce anything is left behind but a few spear-heads and flint hatchets buried in caves with the bones of the bears and hyænas, or mixed with ancient gravels collected when the elephant was perhaps as common as the man. But the stamp of time is indelibly impressed on these rude flints, not less clearly than the marks of their human origin; one has a coating of white decay on the surface; another, little crystals of maganese; almost all have something to substantiate the inference that they are of equal antiquity with the stones and the bones with which they are found.

Not the less certain is it that man is a creature of yesterday. For every year that has elapsed since he appeared, centuries have passed away in the elaborate preparation for his presence. The ocean had covered the depressions of the land, and had helped to produce the successive deposits; the depths of the ocean had received film after film of fine mud, the remains of animalcules; the iceberg had carried and accumulated numerous deposits; the shores and shallow depths of the ocean had been peopled from time immemorial with animal and vegetable forms of life long before even the commencement of the last great period. There were then, however, other continents, and the groups of islands of that time were the summits of our mountains. Central Africa and Central Australia were then vast lagoons, having an outer wall of low islets. Earthquakes, however, then disturbed and elevated the lands, and there were eruptions from volcanoes which differed perhaps but little in intensity from those recently described, though the rents were not where they now are seen. Then, as ever, water circulated through the earth, and rocks were in the course of formation, governed by the same laws as those we still trace, and which are concerned in reconstructing the ever shifting framework of the earth.

With these few general and connecting remaks, I now bring to a conclusion my somewhat disconnected discourse. It occurred to me—and I believe I may venture to hope that I was not mistaken—that a sketch of the present condition of some questions in geology and physical geography would afford matter for useful and interesting illustrations; and now, in taking leave of you, let me very briefly show you how living and present is the interest in most of the subjects I have put before you.

Within the brief weeks that have passed since my first Lecture, an unusual condition of the Atlantic Ocean has been more than once the cause of some of those fearful and destructive cyclones, or spiral storms, that desolate the earth and sweep along our shores. One of these we have experienced since we last met. Before long we shall probably learn that the icebergs coming down from the Polar Seas are of unusual dimensions, and reach to latitudes seldom visited by such phenomena.

Within a few days it has been determined to send out an expedition to sound the depths of the Atlantic in a new direction, with a view to repeat under more favourable circumstances the experiment of connecting America with Europe by a telegraphic cable. I am happy to know that on this occasion there will be a naturalist on board, as capable as he is willing to clear up all the doubtful points with regard to the mud of the ocean floor and its contents, living or dead.

At the present moment I trust our brave countrymen are busy exploring still further Central Africa and Central Australasia. Captain Speke is on his way to trace the waters of Lake Nyanza, north of the equator hoping thence to reach and descend the Nile; and Dr. Livingstone, from the mouth of the Zambesi, is filling up the gaps that still remain in our maps of the east coast of Africa.

Since I spoke of earthquakes, we have been told in the public newspapers of feartul and destructive shocks destroying one of the chief cities of Peru; and it is not improbable that these may have terminated with a violent volcanic outburst. Vesuvius seems to be symbolising at the present moment the political uneasiness of Italy.

In all these, and indeed in all departments of science and natural history, knowledge is increasing; and the discoveries of one department are every day more clearly seen to bear on every other. If then, we pause for a time from other avocations for the purpose of acquiring general information and learning what is most recently discovered in science, we find that before we have even completed our inquiries, new discoveries, new methods, new views are thrusting themselves forward, threatening to displace the very novelties we have hardly prepared ourselves to admit. It is only thus that we can learn the enormous difficulties that lie in the way of successful generalisations, and excuse the shortcomings incident to attempts like that which I have undertaken, and which I now terminate.

EXTRACTS FROM THE REPORTS OF H. B. M. CONSULS.

Beet-root Sugar.—The cultivation of the beet-root for the manufacture of sugar has of late years received an immense development in the kingdom of Poland and in the adjoining provinces of Russia. The first factory was established in 1831, and the first refiners in 1839. The manufacture had increased to such an extent that in 1856 there were 52 factories in the kingdom; thirty-five were to be found in the government of Warsaw alone. The conversion of beet-root into sugar is entirely performed between the end of September and the commencement of April in each year, beyond which time the beet-root if kept becomes deteriorated. The total quantity of loaf sugar and sugar of a coarser character made in the season 1856–57 amounted to 29,013,000 lbs.

Latakia Tobacco.—The best exported from Latakia is that produced in the district of Gebel. When this has been hung up in the rooms of the peasants, and there allowed to absorb the smoke of the dwarf oak, it gives a delicious perfume in smoking. It is then called Albu Richa (Father of Scent). It is worthy of observation that the Albu Richa improves a great deal after having been some days on board ship. In Egypt it is in great demand. The peculiar property which this tobacco derives from being exposed to the smoke was accidently discovered as follows:—One year there being no demand for tobacco, the leaves were hung up for the winter in the peasants' huts, exposed to the continual smoke of their fires, and the succeeding year it was sent to Egypt, where it was considered so good that a large order was sent to Latakia for more of the same quality, which was then called Albu Richa.

Oil from Vancouver's Island.—The oil exported from this colony is procured from the native tribes inhabiting the west coast of Vancouver's Island, and is manufactured by them from the whale and dog-fish; it is of excellent quality, and has a high character in California, where it brings from two or three dollars a gallon, in consequence of its retaining its fluidity freely in the coldest weather.

It is estimated that a quantity equal to 10,000 gallons was purchased from the natives of the west coast in 1854; and considering the imperfect means they possess for taking the fish, and frying out the oil, it is not unreasonable to suppose that with the use of proper means, the returns of oil would be very greatly increased.

The oil trade is carried on by a few enterprising individuals who live among the Indians, and collect the article as it is manufactured by the natives.

Ship Spars.—A source of wealth and enterprise may be found in the magnificent ship spars produced in Vancouver's Island, which, in point of size and comparative strength, are probably the most valuable in the world, and may be procured in any number, even were the demand to include the supply of spars for the whole British navy. A company was formed in this country for the exportation of ships' masts and spars to England; but the parties finding that they had not a sufficient command of capital for the undertaking, discontinued the business, after preparing two cargoes of excellent masts, from 75 to 120 feet in length, which still remain on hand.

NEAT'S FOOT OIL.—Quantities of neat's foot oil, obtained from the wild animals of Abyssinia, are sent to America.

WINE AND SILK.—In Ancona the vine disease has continued for six years, and the good wine which formerly cost three-halfpence per bottle is now fourpence-halfpenny per bottle, which is considered excessive. The mulberry plantation is yearly increasing throughout the country to augment the production of silk.

COCHINEAL.—In consequence of the continuation of the vine disease in the island of Maderia, since the commencement of 1852, the cultivation of the cactus for the propagation of cochineal has increased, and is likely to become a source of considerable profit to the island.

The production of cochineal in Teneriffe has made immense strides during the last ten years.

RAW SUGAR FROM BEETROOT, is manufactured at Dunkirk, is imported into England, where, after being refined, it can be sold for 5½d. per lb.; if refined at Dunkirk, and sold there, the same sugar costs 8d. per lb.

LEATHER.—At Leipzig leather becomes every year a more important branch of German industry. Above a million of hides are annually prepared for sole-leather alone within the Customs' Union, and the whole quantity of leather produced is estimated at 140,000,000 lbs. annually, of which tanned leather forms 80 per cent.

INDIA RUBBER AND GUTTA PERCHA.—A tree yielding india-rubber and the gutta-percha tree are both found in large numbers on the banks of the Zambesi river, and the Governor-General of Mozambique has been requested to issue an order forbidding any gutta-percha tree being cut down, and pointing out that they should be tapped longitudinally for the extraction of the juice.

INDIA RUBBER.—The demand for india-rubber, the principal and staple product of Para (Brazil) has diminished, and is diminishing, in consequence, in a great measure, of the quantity produced on the west coast of Africa and our East India possessions, and in some degree from its having for many purposes been superseded by gutta-percha, and its application to other purposes relinquished. It is now at least 120 per cent. cheaper than it was in 1854.

COAL.—It is now evident that a grand coal-field exists at St. Catharines, (Brazil), of sixty leagues, in an east and west direction, that is, from the sea-coast of the Atlantic Ocean to St. Gabriel, and perhaps much further; and along the coast, probably 140 or more leagues, beginning from Laguna, in the province of St. Catharine, and continuing south almost to Monte Video. These mines of the Erral, so called, are not of the best quality, but they have not been explored beyond thirty yards in depth, because coal has been found at Arrico dos Katos, much more convenient to the village of Sao Jeronymo, situated on the margin of the river Jaculay, and the nearest place for embarkation being only two leagues, whilst the mines of Erral are ten leagues off. Sao Jeronymo is twelve leagues from Porto Alegre, situated on the left-hand side of the river, but opposite Triumfo, called in most of the maps Villa Nova. At Arroio dos Katos, the first seam of coal was found by boring-rods, at forty-five yards deep, and the seam is five feet in thickness. It is steam coal of very good quality; some hundred yards of galleries have been worked, which have supplied the steamers of the province. Forty yards below this seam another four-feet seam has been discovered, of even better quality than the five-fee seam. There are many leagues of these two seams. Coals have also been found in many other parts.

SPIRIT FROM CURRANTS.—At Patras (Greece) a Joint-Stock Company is being formed, under the auspices of the Government, for distilling wine and spirits from the inferior descriptions of currants, and it is proposed to bring clever workpeople and manufacturers of wine and spirits from France and Sicily.

MULES.—Naturalists may be interested in knowing that in Aleppo a mule between a donkey and a cow, is now and then met with. Its appearance is very striking—in shape like its mother, but with solid hoofs, and without horns.

SILK is the richest production of the Austrian Empire, in which the total mean annual quantity of six cocoons produced reaches 27½ millions of kilogrammes, about 60,630,000 lbs. avoirdupois, which, at Austrian livres, is equal to about £4,230,600.

The production is divided as follows:—

	KILOGRAMS.	LBS.
Lombardy	15,000,000	33,075,000
Venice	10,200,000	22,491,000
Tyrol	1,568,000	8,447,440
Other Provinces	672,000	1,481,760
Total	27,440,006	60,505,200

COWRIE SHELLS.—One Hamburgh house sends annually fourteen vessels to Zanzibar for cargoes of cowries, with which they proceed to the rivers on the west coast of Africa, and purchase cargoes of palm oil.

GOLD.—Solfala is situated at the mouth of a river of the same name, in latitude 21 deg. 11 min. south, and longitude 34 deg. 45 min. east. The Solfala river leads to the auiferous portion of Eastern Africa. Solfala is considered the ancient Ophir of Solomon, in whose days ships were sent from Tarshish to obtain gold from mines which are even now as productive as ever, but entirely neglected. The only gold at present sent from Solfala is a small quantity occasionally picked up on the surface of the earth after heavy rains. On both banks of the river Solfala, and from that river northwards to the southern bank of the Zambesi, the country is one mass of mineral wealth—gold, silver, copper, and toward Tete even iron and coal being found in abundance. Ruins of cities, once the dwelling place of nations mighty in their industry, are to be seen in this region—perhaps telling the history of those who provided gold for the Temple of Solomon.

GOLD, SILVER, AND MALACHITE.—The natives from the interior being down to Messourie, on the mainland opposite the city of Mozambique, every year gold, silver, ivory, wax, skins, and malachite, the latter in considerable quantities, showing that there are mines of copper in the Monomoises country. When Mozambique was in the hands of the Arabs an important trade was carried between Arabia and India, but for the last 200 years, under its present rulers, the trade, principally carried on by Banyans to Cutch and Goa, has been gradually decreasing. At present it exports of ivory annually 250,000 lbs., beeswax, sesame seed, archilla, rhinoceros horns, cocoa nut oil, castor oil, ground nut oil, cork, arrowroot, sago, coffee, tortoiseshell, indigo of an inferior quality, from ignorance in manufacturing it, and a spirit made from the cachu.

NUT-GALLS.—At Eatakia, in Turkey, nut-galls, and wax, can be had for the gathering; also cochineal, but they are not now collected. Ibrahim Pacha forced the peasants to gather all three.

LEATHER.—A considerable quantity of skins of the wild boar are sent from Latakia to Mount Lebanon, where they are tanned, and sent back to Latakia. The leather is used for the soles of shoes. Abundance might be had for export. Saddlers there do not make use of them.

Ancient Vases and Gold Ornaments are often picked up by the inhabitants of the Island of Astropalia or Stampalia, in the Ottoman Archipelago. It is a singular fact that no serpents or reptiles exist on the island, and although they are sometimes found among the firewood which is imported, they do not live.

Flavour of Mutton.—The flesh of the sheep of the island of Halki is highly esteemed, it having a delicious taste, in consequence, it is said, of the animals drinking only salt water. This fact is said to be well attested.

Gum Mastic is obtained from a tree of the same name. The tree rarely exceeds 8 feet in height; its leaves are evergreen, and resemble those of the turpentine tree. Mastic is one of the principal resources of the Island of Scio. To extract the gum, incisions are made on the main trunk of the tree, and from them the gum issues. Previous to 1850, the trees produced from 45,000 to 50,000 okes; but in consequence of their being killed by the frost in that year, the quantity was greatly reduced, but, In 1858, 20,000 okes were collected. The mastic tree cannot be cultivated except in the north part of the island, and all attempts to propagate this tree, whether in other parts of the island, or in other countries, have totally failed.

Brandy.—The brandy of the island of Scio is considered the best in Turkey, chiefly on account of the mastic put with it, which gives it a peculiar flavour. It is sent to Constantinople to the value of nearly one million piastres yearly.

Saw-Mills.—The number of saw-mills in the State of California, U.S., is 388, of which 178 are propelled by steam and 210 by water; and their aggregate capacity is 500 millions of feet (board measure) per year.

The Climate of South Carolina.—The climate of this region is healthy during the winter months, but deadly to whites from May to October, a single night passed on a rice plantation being sufficient to induce an attack of the so-called "country fever," a billious fever of the most malignant type, more dangerous even than the yellow fever.

NOTICES OF BOOKS.

Turning and Mechanical Manipulation. By Charles Holtzapffel, Associate of the Institution of Civil Engineers, London, &c., &c. London: Holtzapffel & Co.

Though chiefly intended for general reference and practical instruction for amateurs, this comprehensive work will be found to contain a great deal of valuable information for the practical mechanic, and ought to have a place in the library of every Mechanics' Institute. It was originally designed to extend to six volumes, but the death of the author just before the publication of the third, prevented its accomplishment, and we have only the three first volumes of the work, each of which is, however, complete in itself.

The first volume, besides containing a descriptive catalogue of the characters and uses of the various woods generally employed in the mechanical and ornamental arts, treats of materials, their structural differences and physical characteristics, and their uses in the mechanical arts. The various modes of preparing, working and joining the materials, with the practical description of a variety of processes which do not generally require the use of cutting tools. The second volume is devoted to the principles of construction, action, and application of cutting tools used by hand, viz.: chisels and planes, turning, boring and screw-cutting tools, saws, files, shears and punches; together with a description of various machines in which the hand processes are more or less closely followed.

Vol. III. describes various abrasive and miscellaneous processes which cannot be accomplished with cutting tools. And besides containing a descriptive catalogue of the apparatus, materials and processes for grinding, and polishing, commonly employed in the mechanical and useful arts; full instructions are given for the figuration of materials by abrasion, such as glass-cutting, the grinding and polishing of lenses and specula, both by hand and with machinery; the various descriptions of lapidary work, together with a chapter on seal, gem, and glass engraving, and cameo cutting; and full directions for the preparation and application of varnishes and lackers.

We cannot too highly commend this book to the attention of Mechanics. It is well written, and the various processes of which it treats are so clearly described, that they can readily be worked by persons previously unacquainted with them. It is to be hoped that the original design of the author may yet be carried out, and the work completed by the publication of the remaining three volumes, as there is at present no general treatise in the English language on these subjects.

TO INVENTORS AND PATENTEES IN CANADA.

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

TO CORRESPONDENTS.

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

TO MANUFACTURERS & MECHANICS IN CANADA.

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

TO PUBLISHERS AND AUTHORS.

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

SUPPLEMENT TO THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

VOL. I. APRIL, 1861. No. 4.

The Board of Arts & Manufactures

FOR LOWER CANADA.

PROCEEDINGS OF THE BOARD.

The following Report of the Special Committee of the Board of Arts and Manufactures for Lower Canada arrived after the April number of the Journal had gone to press. The Sub-Committee of the Upper Canada Board, at their meeting on the 2nd April, considering the importance of the suggestions offered by the Committee of the Lower Canada Board, decided to issue a Supplement, embracing the Report and Classification of the Products of Canada recommended by the Lower Canada Board.

The whole question of the selection and arrangement of materials for the International Exhibition will be re-considered by a general Committee, which will no doubt be appointed by the Government. Any difference in details which might be supposed to exist between the views entertained by the Committees for either Board can then be discussed, and a general plan of operations adopted, based upon their suggestions and others which may be advanced by different bodies or private individuals.

Report of the Special Committee.

The Committee of the Board of Arts and Manufactures for Lower Canada respectfully submit, that having fully considered the report on the coming Exhibition, prepared by the Committee of the Board for Upper Canada, and referred to them; they are of opinion that the introductory remarks, explanations and suggestions of that Committee are excellent and appropriate to the occasion, therefore they have much pleasure in recommending them for adoption by the Board for Lower Canada.

With reference to the classification of the products of Canada, the Committee is of opinion it is best at once to prepare and publish a list regularly arranged as nearly as possible in strictly scientific and practical order, without going too far into details which must necessarily be entered into hereafter. In accomplishing this, they have availed themselves of the information and experience of gentlemen, members of the Board, who have had opportunities to acquire scientific as well as practical knowledge in the various departments referred to. Therefore, the accompanying "Proposed Classification of Canadian Products" is respectfully submitted for the adoption of the Board for Lower Canada, in connection with the remarks and suggestions of the Committee of the Board for Upper Canada, and they would recommend that copies be forthwith forwarded to Toronto, hoping that that Board will not object to the adoption of the whole as being the result of the joint deliberations of the Boards of Arts and Manufactures for Upper and Lower Canada.

The Committee desire further to remark that in making arrangements for the ensuing Exhibition, it is desirable the Boards should be so intimately identified with it, as to be enabled to secure permanent advantages for the trade of the country, and its Arts and Manufactures.

Submitted on behalf of the Committee,

WILLIAM RODDEN,

Vice-President.

Board Rooms, Mechanics' Hall,
Montreal, 25th March, 1861.

Proposed Classification of Canadian Products.

It is proposed in classifying the various Natural and Industrial products of Canada to group them under the following heads:

Department I. Natural Products.

Class 1. Mineral.
" 2. Vegetable.
" 3. Animal.

Department II. Agricultural Products.

Class 1. Field.
" 2. Dairy.
" 3. Domestic.

Further details to be left to the Boards of Agriculture, who, no doubt, will ably discharge such duties as properly belong to their Department.

Department III.—Manufactures.

Class 1. Chemical.
" 2. Wood, and wood with other material.
" 3. Musical Instruments.
" 4. Agricultural, Horticultural, Dairy and Domestic Implements.
" 5. Metals prepared for manufacturing purposes.
" 6. Manufactures of the various metals and Minerals.
" 7. Machinery and Implements.
" 8. Textile.
" 9. Leather.

Department IV.—Fine Arts.

Class 1. Statuary.
" 2. Painting and Drawing.
" 3. Photography.
" 4. Engraving.
" 5. Modelling and Ornamental Design.

Department V.—Ladies' Work.

Class 1. Painting and Drawing.
" 2. Millinery, Apparel and Needlework.
" 3. Ornaments and Preparations.

Department VI.—Miscellaneous.

Productions not provided for in foregoing Departments.
Indian Work.
Antiquities and Curiosities.

It is proposed to make the following subdivision of Departments and Classes.

Department I.—Natural Products.

CLASS 1.—MINERAL.

Metals and their ores.
Minerals applicable to Chemical Manufactures.
Mineral Paints.
Materials applicable to the fine arts.
Materials applicable to Jewellery.
Materials for Glass-making.
Refractory Materials.
Grinding and Polishing Materials.
Materials applicable to the purposes of common and decorative construction.
Miscellaneous Materials.

CLASS 2.—VEGETABLE.

Woods in the natural or roughly prepared state.
Plants, Leaves, Barks and Gums of Canadian Forests.

CLASS 3.—ANIMAL.

Skins of Animals of Canada.
Animal substances used in Manufactures.
Preserved specimens of Canadian Animals.
Zoological specimens.
Products of the Fisheries and the Chase in their natural state.

Department II.—Natural Products.

Class 1. Field.
" 2. Dairy.
" 3. Domestic.

Further details to be left to the Boards of Agriculture, who, no doubt will ably discharge such duties as properly belong to their department.

Department III.—Manufactures.

CLASS 1.—CHEMICAL.

Chemical Products and Preparations.
Sugars, Syrups, Cordials, Sauces and Pickles.
Vinegars and Wines.
Confectionery, plain and ornamental.
Preserved Fruits and Vegetables.
Tobacco, Manufactured and Unmanufactured.
Soaps and Candles, plain and fancy.
Paints, Colours, and Varnishes.
Oils, Mineral, Vegetable, and Animal.

CLASS 2.—WOOD AND WOOD WITH OTHER MATERIAL.

Specimens of Wood, cleaned and prepared.
Building Materials and Trimmings in Wood.
Carpenters, Joiners, and Turners work.
Cabinet Wares and Furniture.
Articles of Domestic utility.
Carriages or Sleighs, or parts thereof.
Wooden Models of Inventions, Designs or Improvements.

CLASS 3.—MUSICAL INSTRUMENTS.

Organs, Harmoneons, and Melodeons.
Pianofortes, Violins, &c., &c., &c.

CLASS 4—AGRICULTURAL, HORTICULTURAL, DAIRY AND DOMESTIC IMPLEMENTS.

Field Implements and Machines.
Labour Saving Implements and Machines.
Dairy Implements and Machines.
Domestic implements and Machines.

CLASS 5—METALS PREPARED FOR MANUFACTURING PURPOSES.

Pig, Bar, Sheet and Hoop Iron.
Pig, Bar and Sheet Lead.
Pig, Bar and Sheet Copper and Brass.

CLASS 6—MANUFACTURES OF THE VARIOUS METALS AND MINERALS.

Manufactures in Cast Iron, plain and ornamental generally, including Stoves, Grates, Furniture and hardware.
Manufactures in wrought iron, light and heavy, plain and ornamental, and wire work.
Nails, Spikes, Brads, Tacks.
Manufactures in Brass, Copper, Zinc, Tin, Lead, and composition of Metals.
Lamps, Chandeliers and Gas Fixtures.
Castings of Iron, Brass and composition of metals.

CLASS 7—MACHINERY AND IMPLEMENTS.

Mill work and Engine work.
Railway, Hydraulic, and other Machinery.
Models of Machines and Implements, useful or Instructive.
Machines in operation, shewing any new means or process of manufacture.
Machines in use, new manner of labour-saving.

CLASS 8—TEXILE FABRICS.

Straw, Flax, and Hemp, and the manufactures thereof.
Cotton and the manufactures thereof.
Wool and the manufactures thereof.
Cloths, Satinets, Flannels, Shawls, Blanket and Carpeting.
Articles manufactured of Linen and Silk, or mixtures thereof with other materials.
Wearing Apparel, Civilian and Military.
Hats, Caps, and Head Dresses.
Cordage, Lines, and Twines.

CLASS 9.—LEATHER AND LEATHER MANUFACTURES.

Morocco, Enamelled, Porpoise and Patent Leather, Sole, Upper, Skirting, Binding, Harness, Hose, Belt, Lace, Carriage top, and other Leathers.
Harness and Saddlery.
Trunks, Bellows, Belting and Hose.
Boots, Shoes, Moccasins, Mits and Gloves.
Military fittings.

Department IV.—Fine Arts.

CLASS 1.—STATUARY.

Sculpture and Statuary in Marble or Stone.
Statuary, in Bronze, composition or other material.

CLASS 2.—PAINTING AND DRAWING.

Paintings in oil.
Drawings in Water Colours.
Crayon Drawing.
Pencil Drawing.
Pen and Ink Sketches.
Lithography.

CLASS 3.—PHOTOGRAPHY.

Photographs.
Ambrotypes.
Daguereotypes.

CLASS 4.—ENGRAVING.

Engraving on steel.
" on copper.
" on wood and other metals. } with proof in print.

CLASS 5.—MODELLING AND ORNAMENTAL DESIGN.

Mechanical, Architectural and ornamental Drawing, designing and mapping.
Models in paper, card, wood, or other material.
Ornamental work of any or various material.

Department V.—Ladies' Work.

CLASS 1.—PAINTINGS AND DRAWINGS.

Paintings, in Oil or Water colors.
Sketching, Drawing and Mapping.
Crayon and Pencil work and Penmanship.

CLASS 2.—MILLINERY, APPAREL, AND NEEDLE WORK.

Millinery and Decorations.
Lace, Fringes, Trimmings, in any material.
Knitting, Netting and Crotchet Work.
Worsted Work and Embroidery.
Quilts, Counterpanes, Curtains and Covers.
Needle Work in any material.
Ladies' and Children's Clothing.

CLASS 3.—ORNAMENTS AND PREPARATIONS.

Preserved Dried Leaves and Flowers of Canada.
Articles (useful and ornamental) made of Straw, Hair, Feathers, Paper, Wax, Shell or Composition.
Written Composition, Words with Music.

Department VI.—Miscellaneous.

Penmanship and Printing.
Painters' Work generally, on any material.
Bookbinder's and Stationer's Work.
Paper and Stationery, plain and ornamental.
Carving, and Carving and Gilding.
Gilding, Silvering and Bronzing.
Gold, Silver and Plated Work.
Dental and Surgical Instruments.
Philosophical and Mathematical Apparatus.
Clocks, Watches and Jewellery.
Work on Marble and Stone, for building and ornamental purposes.
Bricks and Tiles, for building and other purposes.
Glass and Earthenware.
Brushmaker's and Combmaker's Work.
Furrier's Work, and Material manufactured and prepared for manufacturing.
India Rubber goods.
Indian Work, in Bark, Hair, Skins, &c., &c.
Bark Canoes, Paddles, Bows and Arrows, Snow Shoes, and Basket Work.
Canadian Antiquities and Curiosities.
Meat, Fowl, Fish, and other Products put up for keeping or exportation.

In arranging the foregoing Classification, your Committee have endeavoured to be guided by the Natural, Scientific, and Mechanical order of things, their past experience having convinced them of the great importance of a careful arrangement. There are, however, many details which it is not now necessary to mention.

Copy of the Memorial

Proposed to be submitted by the Board of Arts and Manufactures for Upper Canada on the subject of the International Exhibition, to be held in London in 1862.

"Your memorialists respectfully beg leave to address your Honourable House on the subject of the International Exhibition to be held in London in 1862.

"Your memorialists have the best grounds for the expectation that the proposed Exhibition will exceed in importance and grandeur those illustrations of progressive Industry and Art which elicited the astonishment and admiration of the civilized world, at London in 1851, and at Paris in 1855.

"Your memorialists consider that the honourable position acquired by Canada at those Exhibitions greatly contributed to diffuse information throughout Europe respecting the resources of the Province, to draw the attention of emigrants to it as a field for industry and settlement, as well as to induce numbers of commercial men and capitalists to make it their home or the scene of their enterprise.

"Your memorialists believe that the progress which has been made in our knowledge of the resources of Canada since the year 1855 might greatly enhance the value of any display that could be made in 1862. They believe that the advance in our civilization during the past six years will, if properly represented, exercise a proportionately greater effect upon those who may have the opportunity of comparing 'CANADA IN 1862' with 'CANADA IN 1855' or 'CANADA IN 1851.'

"But while your memorialists are firmly persuaded of the great benefits which might accrue to the country from a proper representation next year at London, of its resources and the civilization of its people, they also believe that without ample pecuniary assistance from Your Honourable House that great object can not be attained.

"With a view to enable our countrymen to exhibit the Progress of their Industry, the increased Extent and Value of the Resources at their command, their Growing Power as an Industrial People, your memorialists humbly pray that Your Honourable House will be pleased to grant that a sum not less than $60,000 of public money may be expended, under proper supervision and control, in assisting to secure a fit representation of the Resources and Civilization of Canada at the International Exhibition of 1862.

"And your petitioners will ever pray, &c."

ASSOCIATION OF ARCHITECTS, CIVIL ENGINEERS, AND PROVINCIAL LAND SURVEYORS OF CANADA.

At a meeting of this Association held in Toronto on the 6th February last, George Brown, Esq., of Montreal, 1st Vice-President, in the chair, the question of an uniform system of measurement of Artificers work was brought up on a report from the Special Committee. The subject was very fully discussed, there being a very large number of members present, who took great interest in the matter. The report recommended the application of a decimal system similar to that in general use on the Continent of Europe, but the majority considered that such a mode, however convenient, would be next to impracticable in this Province. It was therefore resolved to refer back the report, with instructions to adapt, as far as possible, the system set forth in Laxton's *Price Book*, which contains the rules regulating the general measurement of work in England. A Paper was received from Mr. Hanvey, of St. Thomas, "On the Allowance to be made for the Curvature of the Earth in Surveying," which was appointed to be read at the next meeting. A resolution was passed sympathising with the family of the late lamented President of the Association, Wm. Thomas, Esq. The 1st Vice-President, Mr. Brown, having vacated the chair, a vote of thanks was accorded him for his zeal in making a journey from Montreal at so inclement a season of the year to attend the meeting, and for his able conduct in the chair. The meeting then adjourned.

The Association met again at Toronto for the nomination of officers, on the 6th March last, Wm. Hay, Esq., Architect, Toronto, in the chair. After the nomination, which was the chief business of the meeting, an interesting discussion ensued on Mr. Hanvey's paper, presented at the previous meeting, in which Mr. J. O. Browne, of Toronto, Mr. Peters, of London, and others, took part. The question greatly affects the practice of surveying in this Province, where frequently the first line of a survey is run on a true meridian, and the others parallel or rectangular to it. It was generally admitted that the polar lines should be true local meridians, and that some alteration in the Statute directing the mode of surveying for the Province is required. Mr. Peters having been called to the chair, a vote of thanks was given to Mr. Hay for the able manner in which he presided at the meeting.