THE JOURNAL

OF THE

BOARD OF ARTS AND MANUFACTURES

FOR

UPPER CANADA.

EDITED BY HENRY YOULE HIND, ESQ., M.A., F.R.G.S.

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BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA,

FOR THE YEAR 1861.

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

JANUARY, 1861.

INTRODUCTION.

It is presumed to be unnecessary to discuss in the pages of this journal, the importance of affording encouragement and aid to manufacturing Industry throughout the Province. Government has recognized the principle involved in the support of Home Industry by establishing Boards of Arts and Manufactures, and defining their duties. One comprehensive paragraph in the Act, "*To make better provision for the* ENCOURAGEMENT *of* AGRICULTURE, *and to* PROVIDE *for the* PROMOTION *of* MECHANICAL SCIENCE," instructs them to "adopt every means in their power to promote improvement in the mechanical arts and in manufactures in the Province." The first efforts of the Board for Upper Canada are necessarily limited by its pecuniary position, and while it must for some years be dependent upon public aid, yet its organization is so framed that means and opportunities to fulfil the duties imposed by law, will expand and gain strength with the objects of its care.

The establishment of a Museum embracing raw and manufactured materials, models of works of art, implements and machines employed in manufacturing processes, the formation of a Free Library of Reference and the introduction of new and improved implements and machines from other countries, are in themselves important and extensive duties; but, in addition to these the Board is empowered to establish in connection with the Museum, a Model room, a School of Design for Females, and a School for Mechanics, and to employ competent persons to deliver lectures connected with the Mechanical Arts and Sciences, or with manufactures.

While thus defining the duties of the Boards of Upper and Lower Canada in the exercise of a beneficial, and probably also a highly important and powerful influence upon the progress of Industry in the Province, the originators of this project have had in view the steps which were taken in Europe some years ago, to further the same object there. Next to the absence of capital, a want of skilled artizans and intelligent manufacturers, educated in the details of their special branches of Industry, has always proved the greatest drawback to steady progressive advancement.

In the mother country, the Committee of Council on Education has a Science and Art Department, whose members report annually on their proceedings. The last report of the Department (1860) relates to:—

I.—Aid afforded to the Industrial classes in obtaining Instruction in those branches of Science and Art *which have a direct bearing on their occupations.*

II.—The administration of the South Kensington Museum as the Central repository for examples in different branches of Science and Art, which as far as may be practicable are made available for the benefit of the United Kingdom and are circulated to provincial schools.

III.—Institutions for the promotion of Science and Art, subject to the superintendence of the department.

It will not escape notice that this report touches upon the most important of those objects which it is the duty of the Boards of Arts and Manufactures in Canada, to promote "by every means in their power." So encouraging are the results obtained in the United Kingdom, that an enumeration of some of them which approximate closely to what it is desirable to secure in Canada, will be both instructive and appropriate.

In 1852-3, twenty-three Schools of Design, with 6,997 students, now re-formed into Schools of Art, cost an average of £2 11s. for each student; in 1858, seventy-eight Schools of Art, completely organized and containing 80,000 students, were sustained at an average cost of 9s. 3d. per student, or about one-seventh of the cost in 1851.

Great success has attended the circulation of objects of Art among the Art Schools of the United Kingdom. A travelling collection during the last three years has been sent to 26 places and visited by 306,907 persons, realizing to the funds of the Art Schools, £6,011. Although the most fragile articles, such as Sèvres procelain, and glass, were transmitted at least 3,690 miles by railway, and were packed and unpacked 56 times, no specimens were broken or damaged. The Committee on Education consider that this experiment has shown that the use of national property in works of Art may be extended to all parts of the United Kingdom, and that the system should be revised, enlarged, and made as self-supporting as possible.

The South Kensington Museum, built upon the estate purchased with the surplus funds derived from the great Exhibition of 1851, is a splendid illustration of British energy, talent, and skill, exerted in favour of manufacturing industry. The collections consist of objects of ornamental art, an Architectural Museum, a Trade Museum, a court of Modern Sculpture, a Government Educational Collection, a gallery of British Art, &c., &c., &c. A novel feature in this Museum is the System of Loans, whereby the public taste is greatly encouraged and promoted. Public institutions and private individuals *loan* their collections to be exhibited in this Museum, and permit the different objects to be photographed and copies sold at cost price. The number of persons visiting the South Kensington Museum in 1859 amounted to 475,365. Among its most interesting and important collections are the Animal Products, Food Collections, and the Building Materials. The appeal made to the public by the Superintendent of the Food and Animal Collections, may be appropriately introduced here. "To this department of our Museum I would especially invite the attention of that great class of manufacturers in our country, who are engaged in the production of the commodities of life from animal substances, requesting for *their own sakes* and for the sake of the advancement of the industrial interests of the country, that they will assist in carrying out the great objects of this collection, by contributing specimens of the processes and goods which they manufacture. There is no more worthy object of national pride and ambition than the scientific exhibition of the materials and products of that industry on which the physical greatness of our nation depends."

The Museum of the Board for Upper Canada is at present limited to Models of Patents. The organization of a department is in contemplation, designed to exhibit improved manufacturing processes throughout their different stages, from the crude or raw material to the highest attainable result in all its various details. The other departments of a general Museum of Art and Industry have been already organized by the Chief Superintendent of Schools, with a view to a School of Art, for which the preparations are now completed in the Normal School Buildings at Toronto. These adjuncts to our educational system will relieve the Board of an expensive and difficult undertaking, and will be no doubt efficiently carried out under the able direction of the Chief Superintendent. The steps which have been taken in furtherance of this project are given below.*

A Free Library of Reference, devoted exclusively to works relating to Manufacturing Industry in all its branches and details, is being gradually formed, and a programme is given on a subsequent page of the periodical examinations of members of Mechanics' Institutes and others who may become candidates for the certificates of the Board. Finally the Board has commenced the issue of this Journal, the object and plan of which are so fully given in the Prospectus that no further allusion to it is necessary.

France, Germany, and Belgium have been long distinguished for the care and activity displayed by their respective governments in providing schools for special branches of industry, and for placing the means of acquiring a knowledge of all kinds of handicraft or improved manufacturing processes within reach of every one. The utmost solicitude and attention have been devoted in times of peace, during late years, to the industrial training schools, and every encouragement has been given to the introduction of improved processes or the discovery of more economical methods of arriving at a given result.

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* *Annual Report of the Normal, Model, Grammar and Common Schools in Upper Canada, for the year* 1859—*by the Chief Superintendent of Schools.*

THE EDUCATIONAL MUSEUM.

This Educational Museum is founded after the example of what is being done by the Imperial Government as part of the system of popular education—regarding the indirect as scarcely secondary to the direct means of training the minds and forming the taste and character of the people.† It consists of a collection of school apparatus for Common and Grammar Schools, of models of agricultural and other implements, of specimens of the natural history of the country, casts of antique and modern statues and busts, &c., selected from the principal museums of Europe, including busts of some of the most celebrated characters in English and French history; also copies of some of the works of the great masters of the Dutch, Flemish, Spanish, and especially of the Italian schools of painting. These objects of art are labeled, for the information of those who are not familiar with the originals, but a descriptive historical catalogue of them is in course of preparation. In the evidence given before the Select Committee of the British House of Commons, it is justly stated, "that the object of a National Gallery is to improve the public taste, and afford a more refined description of enjoyment to the mass of the people; and the opinion is, at the same time, strongly expressed, that as "people of taste going to Italy constantly bring home beautiful modern copies of beautiful originals," it is desirable even in England, that those who have not the opportunity or means of travelling abroad, should be enabled to see, in the form of an accurate copy, some of the celebrated works of Raffaelle and other great masters; an object no less desirable in Canada than in England. What has been thus far done in this branch of public instruction, is in part the result of a small annual sum, which, by the liberality of the Legislature, has been placed at the disposal of the Chief Superintendent of Education, out of the Upper Canada share of school grants, for the purpose of improving school architecture and appliances, and to promote arts, science and literature by means of models, objects and publications, collected in a Museum, in connection with this department.

The more extensive Educational Museum at South Kensington, London, established at great expense by the Committee of Her Majesty's Privy Council of Education, appears, from successive Reports, to be exerting a very salutary influence, while the School of Art connected with it is imparting instruction to hundreds, in drawing, painting, modeling, &c. A large portion of the contents of our Museum has been procured with a view to the School of Art, which has not yet been established, though the preparations for it are completed. But the Museum has been found a valuable auxillary to the Schools; the number of visitors from all parts of the country, as well as from abroad, has greatly increased during the year, though considerable before; many have repeated their visits again and again; and I believe the influence of the Museum quite corresponds with what is said of that of the Educational Museum in London.

† See my Annual Report for 1857, in which there is a full detail of what is done in England in this respect.

The effect of this solicitude has been very marked in elevating the condition of the artizan, enriching the manufacturer, and swelling the coffers of the State. But most striking does the result appear to be when comparisons are instituted between the condition of those countries in which Industry is encouraged and educated, and those where it is left unaided, or neglected altogether. No doubt the natural resources of a country play a very important part in its progress in the industrial arts. The United Kingdom would occupy a far different position in the scale of nations if coal and iron had not been abundant and easily accessible, for it is only of late years that the powerful influence of government has been directed to the special education of the industrial classes. The people have elevated themselves by their innate genius and enterprise without external aid, yet while they stand preëminent in mechanical contrivances and in the more useful products of industry, yet, in the arts generally, they are outstripped by the specially educated continental manufacturer and artizan.

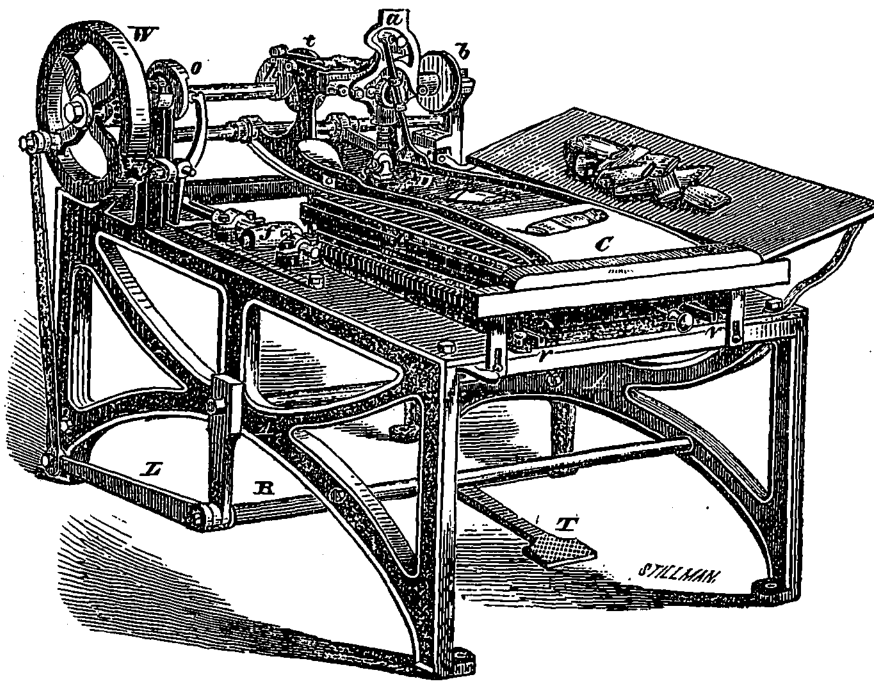
In future articles the condition of Industry in Europe will be described, and the beneficial influences made manifest which have arisen from a knowledge of the practice and progress of other countries being brought within the reach of the Industrial classes, whether by Training Schools, Industrial Schools, Model rooms, Museums, Journals or lectures. The genius and circumstances of a people determine which of the preceding aids to improvement are best adapted to their wants.

Canada is a producing and consuming, but comparatively not yet a manufacturing country. The exports in 1857 amounted to twenty-seven million dollars, and of these the value of manufactures did not reach $400,000. In 1859 the exports amounted to $24,766,981, among which were manufactures to the value of $487,231, showing a large relative increase. The importations of 1857 amounted to twenty-nine million dollars in round numbers, and among the items are numerous articles which every one may wonder are not manufactured to a larger extent in this province. Woolens to the value of $3,900,000 were imported in 1857. Leather manufactures to the extent of $514,493; Refined sugar, $171,270; Ale and Beer, $100,000; Carpets, $132,000; Candles, $72,000; Cotton manufactures to the extent of nearly five million dollars, and a vast number of other articles for which there is a rapidly growing market. The field for manufacturing enterprise is ample, but means, namely CAPITAL and SKILL, are either too limited or at present inaccessible.

The census tables for 1851 convey a fair idea of the then condition of manufacturing industry in the Province as far as it goes, and from it, it may be inferred that all the elements of this important interest exist in abundance, with the exception of those mentioned in the preceding paragraph. The census about to be taken will supply the basis of future action, and show in what direction the influence of the Boards of Arts and Manufactures may be most advantageously exerted. Information on all topics bearing upon the objects for which they were incorporated is much needed, and until this hiatus be supplied it is impossible that they can adequately fulfil the duties belonging to them.

Since 1851 great strides have undoubtedly been made in various kinds of industry, particularly in Upper Canada, and numerous establishments on an extensive scale are now in active and successful operation; but in order to form an adequate conception of what may be accomplished, it is desirable to know with accuracy and detail what has been already done.

The immense importance of the lumber trade is patent to all. An industry which absorbs twenty five thousand able bodied men is necessarily an interest of the greatest magnitude, although only a part of it can be included under the heading of Arts and Manufactures. Not so, however, with Pot and Pearl Ashes. The production of the raw material is a rude process, capable of considerable improvement, but the production of numerous articles of great commercial value from the crude materials might be very advantageously pursued in Canada, where the raw material is cheap and abundant. The value of exported pot and pearl ashes amounted in 1857 to $1,145,452, one fourth of this product being shipped to the United States, the other three fourths to the United Kingdom. Leather including manufactured articles, and the preparation of the raw material is one of the most important branches of industry in the Province, and its annual value exceeds $10,000,000. The Hardware industry may be symbolized by $1,200,000 per annum, it is steadily increasing and promises to become a valuable source of national wealth. Manufactures in Wood, Wool, Cotton, and Paper may reach $1,800,000 and are yet in their infancy; Whiskey, Soap, and Candles, and other minor branches of industry, represent a combined annual product of not less than $1,200,000. In the aggregate the annual value of the Manufactures of Canada exceed $15,000,000, or three-fourths of the total amount imported in 1857. On another page an abstract is given in tabular form of the statistics of manufactures in Canada as far as ascertained. With a rapidly increasing population, an extensive country, in which exist most of the materials forming the basis of modern industry, the field for action, co-operation, mutual encouragement and assistance is large and promising, and as far as this journal is concerned, it is occupied with confidence and a firm belief in a successful issue.



SPENCER'S ADDRESSING PRESS,

Patented in Canada, Great Britain. and the United States

The above cut represents the largest size of these machines. *A* is the frame, upon the top of which are the grooved rails *r r*, on which the carriage *B* runs in a longitudinal direction. The bed rests on the top of the carriage, and is provided with a grooved track, so as to be moved laterally, in order to bring the several columns in the form successively under the aperture *S* in the tympan or shield. The carriage is moved by the pawl *f*, which works with the toothed rack on the side of the carriage.

The names of subscribers to periodicals are set up in narrow columns and separated by quads, so as to allow only one to be printed at each impression, and the columns, when the form consists of more than one, are also separated by riglets. The form thus made up and inked, is placed upon the bed of the machine; the first name in the column at the left hand is brought under the aperture in the tympan, and the machine is set in motion by the power applied to the fly-wheel by means of the foot-treadle *T R L*, which, operating upon the pawl *f* by means of a cam and lever, causes the carriage to move at each revolution of the shaft the distance required to bring each name under the aperture in the shield; and the matter to be printed is placed over the aperture, and is pressed upon the type by the small platen or stamp through the aperture—all other parts of the form being protected from contact with the paper—and thus the desired impression is made. As soon as the platen rises, the paper is thrown off by the fly upon a moving apron.

When the carriage has run the whole length of the first column, its motion is reversed, and at the same time the bed moves from right to left, so as to bring the next column in the line of the aperture in the tympan, and so traversing each column alternately down and up, until all the names in the form have been printed; which is to be removed, and another placed upon the bed, and the operation repeated. An expert hand can print addresses with one of these machines at the rate of from three to four thousand per hour, without any liability to errors or omissions.

A simpler kind of these machines is made, on the same principle, in which the carriage runs only one way, and is drawn back by hand, and the bed moved laterally by the same means. These vary in price according to size and quality, from fifty to one hundred and fifty dollars, which are capable of printing addresses at the rate of from one to two thousand per hour.

As the type used in these machines are arranged in ordinary forms, all difficulty is obviated in changing addresses of subscribers, and inserting names or dropping them; and types that are too much worn for ordinary printing may be used for this purpose.

Several of these machines are in operation both in Canada and the United States and Nova Scotia, and the labor-saving value of the invention is now fully tested. The cost of addressing periodicals by this machine is only about one-fourth that of writing them. The address can be printed either on the wrapper or on the margin of the paper.

COTTON MANUFACTURES IN CANADA.

No branch of manufacturing industry is so much needed in Canada as that of Cotton. In a future number an enumeration of what is now doing will be given. Subjoined is a table showing the imports of Cotton manufactured and unmanufactured, into this Province, from 1853 to 1858.

Table showing the value of Importation of Cotton Manufactures into Canada, during the years 1853 *to* 1859, *inclusive.*

YEAR.	VALUE.	DUTY.
1853	$5,262,743	$657,843.
1854	5,076,349	634,543.
1855	3,307,894	425,496.
1856	5,028,935	678,894.
1857	4,796,046	719,413.
1858	3,315,119	497,234.
1859	4,863,444	902,150.

Table showing the value of Cotton Wool imported into Canada, during the years, 1853 *to* 1859 *inclusive.*

YEAR.	VALUE.
1853	$17,907
1854	15,256
1855	14,831
1856	19,040
1857	3,557
1858	11,238
1859	17,882

Table showing the value of Cotton Yarn and Warp imported into Canada during the years 1853 *to* 1859, *inclusive.*

YEAR.	VALUE.
1853	$140,034
1854	112,323
1855	119,056
1856	116,516
1857	151,308
1858	149,595
1859	204,672

COMMERCE OF CANADA IN 1859.

Value of Imports in 1859	$33,555,161 00
Value of Exports in 1859	24,766,981 00
Amount of duty collected	4,437,846 12

Trade with the United States.

Value of Imports	$17,592,916
Value of Exports	13,922,314

Comparative Statement of Value of Imports and Exports of Canada for years 1858 *and* 1859.

Imports, 1858	$29,078,527
" 1859	33,555,161
Exports, 1858	23,472,609
" 1859	24,766,981
Total Imports and Exports, 1858	52,551,136
" " " 1859	58,322,141

Increase in 1859, $5,771,006, or 11 per cent.

Comparative Statement, showing the Gross Values of Articles of Canadian Produce and Manufacture, exported during 1857, 1858 *and* 1859.

ARTICLES.	1857.	1858.	1859.
Produce of the Mines	286,469	314,823	468,512
" " Fisheries	540,113	718,296	817,423
" " Forest	11,575,508	9,284,514	9,663,962
Animals and their Products	2,262,119	2,625,978	3,789,502
Agricultural Products	8,882,825	7,904,400	7,339,798
Manufactures	398,821	325,376	487,231
Coin and Bullion	....	....	3,652
Other Articles	121,120	112,538	110,732
Value of Ships built at Quebec	1,383,444	743,640	421,566
Estimated Exports short returned	1,556,205	1,443,044	1,664,603
Total value of Exports......$	27,006,624	23,472,609	24,766,981

Statistical View of the Commerce of Canada, exhibiting the Value of Exports to and Imports from Great Britain, her Colonies, and Foreign Countries, during the year 1859.

COUNTRIES.	VALUE OF EXPORTS.	VALUE OF IMPORTS.
Great Britain	7,976,758	14,786,084
North American Colonies	840,475	381,755
British West Indies	7,025	533
United States of America	13,922,314	17,592,916
Other Foreign Countries	355,806	793,873
Total ....$	23,102,378	33,555,161

Comparative Statement of the Quantity and Value of the principal articles of Canadian Manufactures, exported during the years 1857, 1858 *and* 1859.

	1857.		1858.		1859.	
	QUAN.	VALUE.	QUAN.	VALUE.	QUAN.	VALUE.
Books	....	....	....	4,505	....	3,866
Cotton	....	$2,162	....	276	....	325
Candles..........Lbs.	6,676	1,138	8,427	1,246	8,218	1,040
Furs	....	6,258	....	1,130	....	9,440
Glass	....	122	....	286	....	924
Hardware	....	18,290	....	13,218	....	14,621
India Rubber	....	163,699	....	80,067	....	261,815
Indian Barkwork	....	409	....	351	....	581
Leather	....	4,044	....	4,664	....	8,584
Linen	....	....	....	436	....	87
Machinery	....	9,075	....	12,053	....	13,063
Musical Instruments	....	730	....	1,350	....	996
Carriages ......Number	105	7,033	219	10,693	835	12,946
Starch ....Lbs.	....	70	1,484	148	69	7
Straw	....	8,039	....	14,358	....	9,433
Rags	....	15,641	....	12,401	....	22,701
Soap ....Lbs.	....	2.281	16,824	1,321	86,752	6,092
Sugar Boxes...Number	....	40.358	111,671	45,298	56,900	18,502
Oil Cake	....	16,169	....	15,693	....	22,945
Biscuit ....Cwt.	....	11,714	1,126	5,600	1,780	9,325
Wood	....	33,049	....	50.126	....	41,470
Woolens	....	1,377	....	1,861	....	864
Ground Plaster & Lime	....	9,578	....	6,655	....	4.235
Liquors—						
Ale, Beer & Cider.Galls.	14,890	3,728	35,351	7,422	25,947	6,290
Whiskey .... do.	2,424	1,937	1,879	977	12.972	7,465
Other Spirits ... do.	14,626	41,620	18,297	33,056	8,754	9,113
Vinegar.......... do.	613	280	1,302	285	2,247	501
Total Manufactures...	....	398,821	....	325370	....	487,231

Manufacture of Malt Liquor in Canada.

The number of gallons brewed in the province in 1858, was 1,247,803; of this quantity Canada East produced, 397,428 gallons, and Canada West, 850,375 gallons. The duty amounted to $14,107. The number of gallons brewed in 1859, reached 3,566.854, being 1,365,597 for Canada East, and 2,201,257 gallons for Canada West. The total duty including licenses, amounted to $37,318 54.

Manufacture of Proof Spirit in Canada.

In 1858, the number of stills for the manufacture of proof spirit was 120, being ten in Canada East, and 110 in Canada West. The amount of spirit produced was, 864,696 gallons in the eastern part of the Province, and 2,543,701 gallons in the western. The total amount was 3,408,397 gallons, or about one gallon and a half for every man, woman, and child in the province. The duty collected on spirits amounted to $126,942. In 1859 the number of stills was 109, and of gallons of proof spirit manufactured, 3,308,098; the duty amounted to $198, 485.87.

The Acton Mines.

The quantity of copper ore exported from Acton, in Lower Canada, during the present year by the Grand Trunk Railroad, was 1,825 tons, between the months of February and November, and the declared value of this export amounted to $120,502.

EDUCATIONAL SUMMARY FOR THE YEAR 1859.*

The total number of educational institutions of every description in Upper Canada reported, was 4,372—increase, 114; the total amount expended in support of these institutions, was $1,389,582; adding balance on hand, the total amount available was $1,594, 807—being an increase of $83,791. But the total number of pupils returned as attending the Common and Grammar Schools, was 305,973—increase 7,831; and a small decrease of 152 students and pupils attending other institutions, exclusive of the Normal and Model Schools. The aggregate amount available for the support of the Common, Grammar, and Normal Schools, Superannuated Teachers, &c,, (not including other educational institutions), during the year, was $1,430,304—being an increase of $36,013; thus showing a decrease of $2,222, in the amount expended in the support of other institutions.

General Statistical Abstract of the Progress of Education in Upper Canada, from 1850 *to* 1859 *inclusive.*

1. Grammar Schools.—The number of *Grammar-Schools* in 1850, was 57; in 1859 it was 81. The number of pupils attending the Grammar Schools in 1850, was 2,070; in 1859, it was 4,381, though many hundreds were excluded from the Grammar Schools in 1854 by the Regulations which required an entrance examination—increased attendance in 1859 over 1850, 2,311. As the present Grammar School Law did not go into operation until 1854, no returns of the amount provided for the salaries of Grammar School Masters exists earlier than 1855. The amount provided for the salaries of Masters in 1855, was $46,255; the amount provided for the same purpose in 1859, was $61,564.

2. Common Schools.—The number of Common Schools in 1850, was 3,059; the number in 1859, was 3,953—total increase, 894. The number of *Free* Schools in 1850, was 252; the number in 1859, was 2,315—total increase in the ten years, 2,063.

3. The whole number of pupils attending the Common Schools in 1850, was 151,891; the number of pupils attending them in 1859, was 301,592—increase of 1859 over 1850, 149,701.

4. The total amount paid for salaries of Common School Teachers in 1850, was $353,716; the amount paid for the same purpose in 1859, was $859,325—increase of 1859 over 1850, $505,609.

* Annual Report of the Normal, Model, Grammar and Common Schools in Upper Canada for the year 1859, by the Chief Superintendent of Schools.

5. The amount expended for the building and furnishing of school-houses, libraries, apparatus, &c., in 1850, was $56,756; the amount expended for these purposes in 1859, was $250,721—increase of 1859 over 1850, $193,965.

6. The total amount expended for all common School purposes in 1850, was $410,472; the total amount expended for these purposes in 1859, was $1,110,046—the increase of 1859 over 1850, $699,574.

Two remarks may be made in reference to the foregoing statistics and others contained in the table referred to. The first remark is, that little more than one-tenth of the sums of money mentioned have been provided by the Legislature from endowments and grants. The Legislature imposes no tax for any educational purpose. All the rest of the large sums mentioned are provided by voluntary local taxation and other exertions in each municipality.

The second remark is, that the above statements refer entirely to amounts of money provided and expended for School purposes, and the number of pupils attending the Schools, not taking into account at all the improvements which have been affected in the school-houses and their furniture, in the character and qualifications of School Teachers, in the text-books, apparatus, discipline, and teaching of the schools, the establishment of school libraries and other agencies and facilities for the diffusion of useful knowledge.

The Board of Arts & Manufactures

FOR UPPER CANADA.

PROCEEDINGS OF THE BOARD.

PRIZE ESSAY.

The Board of Arts and Manufactures for Upper Canada, in order to attract and direct the employment of European and other capital towards Upper Canadian Manufactures, hereby offers a first prize of One Hundred and Fifty Dollars, and a second prize of Seventy-five Dollars, for the first and second best Essays on "The Manufactures which are most suited to the circumstances and capabilities of Upper Canada," taking into account:

1st. The raw materials produced in the Province, as well as those most easily obtained from other countries.

2nd. The natural facilities, as well as the mechanical capabilities of the Province.

3rd. The populations of the cities and country, male and female, not required in the ordinary domestic employments.

4th. Articles that can be advantageously manufactured in Upper Canada, with the difference in the prices here, and at the places from which they are usually imported; showing the margin of profit to cover the additional cost of labour.

5th. The articles of Upper Canada manufacture for which there is, at the present time, a greater demand than can be supplied.

Each Essay must be sent under cover to the Secretary of the Board, on or before the 1st day of

July, 1861; and be accompanied by an enclosure containing the author's name and address, and having a mark or seal on the outside corresponding with a mark or seal on the Essay.

The Judges will be appointed by the Executive Committee of the Board, and their award, as soon as made, will be published in the Journal of the Board.

No prizes will be awarded unless the Essays are considered worthy by the Judges.

W. Edwards,
Secretary.

MODEL ROOMS AND LIBRARY.

The Model Rooms, and the free Library of Reference, illustrative of the Industrial and Decorative Arts and Manufactures, now in course of formation, are open to the Public, daily, at the Board Rooms, 79 King Street West, Toronto, from 10 A.M. till noon, and from 1 to 4 o'clock, P.M.

In the Model Rooms are deposited about 500 Models of Canadian Patented Inventions.

The Library contains upwards of 400 folio and octavo volumes of Specifications, Plates, Indices, &c., &c., of British Patented Inventions; 95 volumes of Cyclopœdias, Dictionaries, and Works on Arts, Manufactures and Decoration; 100 volumes of Statutes, Journals, &c., of the Legislature of Canada; and a large number of Pamphlets containing Parliamentary and other Reports. There are also 17 of the leading British and American Mechanical and Scientific Journals regularly received at the Rooms.

A large number of valuable English works have recently been ordered by the Executive Committee.

The publication of a catalogue of the above-mentioned works, and of such others as it is intended to add to the Library from time to time, will be commenced in the next number of the Journal.

NOTICE OF MEETING OF THE BOARD OF ARTS, &c.

In accordance with the requirements of the Act constituting this Board, the Annual Meeting will be held on Wednesday, the 2nd January, instant, at 1 o'clock, p.m., at the Board Rooms, 79 King Street West, Toronto. Owing to the time named following so close on New Year's day, a quorum may not be obtained; and in the event of this being the case, an adjournment will have to be made to some future day, of which due notice will be given.

For the information of the members of the Board, and the officers and members of Mechanics' Institutes and Boards of Trade, sections 22, 23, 25 & 27, chap. xxxii. of the Consolidated Statutes of Canada: and also By-law No. X. of this Board, are appended:—

Sec. 22.—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 of and Lecturers on the various branches of physical science in all the Chartered Universities and Colleges in Upper and Lower Canada respectively—the Chief Superintendents of Education in Upper and in Lower Canada respectively for the time being, *ex officio*—the Presidents for the time being of and one Delegate from each of the Boards of Trade—and the Presidents of and Delegates from each of the incorporated Mechanics' Institutes, or of any incorporated Arts Associations qualified as hereinafter mentioned, in Upper and Lower Canada respectively—such Delegates to be chosen annually as hereinafter is provided.

Sec. 23.—The Board of Trade in each City and Town in Upper Canada, shall, at its first meeting in the month of January, in each and every year, elect and accredit to the Board of Arts and Manufactures for Upper Canada, one of its body as a member thereof.

Sec. 25.—Each incorporated Mechanics' Institute in Upper and Lower Canada respectively, shall, at its first meeting, in the month of January, in every year, elect and accredit to the Board of Arts and Manufactures in Upper or Lower Canada respectively, (according as its place of meeting is in Upper or Lower Canada,) one delegate for every twenty members on its roll, being actual working mechanics or manufacturers, and having paid a subscription of at least one dollar each, to its funds for the year then last past.

Sec. 27.—The names of the Delegates so elected shall be forthwith transmitted by the Secretary of the Board or Institute 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 then about to commence; with the names of the Delegates when transmitted by the Secretary of a Mechanics' Institute, there shall be transmitted a statement verified by the oath of the Secretary transmitting the same, to be taken before a Justice of the Peace, of the names of all the members on the roll of such Mechanics' Institute, being actual working mechanics or manufacturers, and having paid subscriptions of at least one dollar each to its funds, for the year then last past.

By-Law X.—The Delegates from each Mechanics' Institute shall, before taking their seats as members of the Board, present to the Secretary a certificate, under the Corporate Seal of the Institute from which they come, signed by the President or Vice-President, and countersigned by the Secretary thereof, stating their appointments as such Delegates; and the Delegates from each Board of Trade, before taking their seats, shall present a certificate of their election, signed by the President, and countersigned by the Secretary of such Board.

The Delegates for the past year, from such Mechanics' Institutes and Boards of Trade as shall not have had a new election prior to the Annual Meeting of the Board, will be entitled to take their seats at such meeting.

W. Edwards,
Secretary.

EXAMINATION OF CANDIDATES FOR CERTIFICATES.

The following programme of a scheme for holding Periodical Examinations has been sent to the Presidents of the several Mechanics' Institutes in Upper Canada:—

SIR,—This Board has determined upon holding periodical examinations of such members of the various Mechanics' Institutes in Upper Canada as may choose to avail themselves of them, under the rules and restrictions hereafter laid down; the object of such examinations being to encourage, test, attest and reward efforts made by the industrial classes for self-improvement.

These examinations will be open to all members of incorporated Mechanics' Institutes or Library Associations in Upper Canada, who are over 16 years of age, and are not students of any college, graduates or under-graduates of any University, or certified school teachers; or who are not following any of the learned professions.

The Board earnestly invites the co-operation of the managers of the respective Institutions, in carrying out the following scheme of

Previous and Final } Examinations by { Local Committees. The Board of Arts and Manufactures.

LOCAL COMMITTEES.

1.—The Managers of Mechanics' Institutes and Library Associations desirous of co-operating with this Board, in promoting the education of such of their members as have not been able to avail themselves of the benefits of academical instruction and distinction, but who are now willing to engage in classes or evening schools, or other means of self-improvement, are invited to form local committees for the purpose of organising and superintending classes; for the holding of the necessary preliminary examinations; and to assist and co-operate with the examiners appointed by the Board. Each local committee must consist of at least three members, and should be composed of such persons as would command the respect and confidence of the community.

2.—Each local committee should submit to the Secretary of this Board, on or before the first of January, 1861, a list of the names of the Chairman and Secretary, and other members of the local committee.

PREVIOUS EXAMINATIONS BY THE LOCAL COMMITTEES.

3.—The local committees will conduct the previous examinations of their own candidates, and also supervise the working of papers which the examiners appointed by the Board will set for the final examinations.

4.—No candidate will be admitted to the final examination without a certificate (see Form No. 4 in Appendix) from his local committee, that he has satisfactorily passed its previous examination; especially in the subjects in which he wishes to be examined by the Board.

5.—The previous examinations by the local committees may be either wholly written, or partly oral and partly written, as each local committee may think best; and must be held sufficiently early in the year to allow the results to be communicated to the Secretary of this Board, on or before the first day of May, 1861.

6.—The local committee may, with advantage, admit to the previous examinations, and grant suitable certificates and rewards to persons of very humble attainments; but the "pass" to the final examinations should not be given to any candidates, however meritorious, whom the local committees consider to have no chance of obtaining certificates from the Board.

FINAL EXAMINATION BY THE EXAMINERS APPOINTED BY THE BOARD.

7.—Forms containing the names of the candidates passed by the local committees, and the subjects in which they wish to be examined, must be returned to the Secretary of the Board not later than the first day of May, 1861, (see Form No. 4 in the Appendix.)

8.—The Examiners appointed by the Board will then set the requisite papers for the final examination, and these will be forwarded to the local committees. The local committees will see, and certify to the Board, in the form which the Board will furnish, (see Appendix, Form No. 7), that the papers are fairly worked by each candidate, without copying from any other, and without books or other assistance; and will return the worked papers to the Board.

9.—The final examinations will be conducted by printed papers.

10.—The examiners will award certificates of three grades, but certificates of the first grade will be awarded only to a high degree of excellence.

11.—The final examinations will be held simultaneously on the days, and at the hours specified in the time-table for 1861, (Appendix, Form No. 6) at those institutions where local committees are established.

12.—Judgment will then be passed by the examiners appointed by the Board, and the awards of certificates will be communicated to the respective local committees.

13.—The following are the subjects appointed for the final examinations in May, 1861:—

I. Arithmetic.
II. Book-keeping.
III. Algebra.
IV. Geometry.
V. Mensuration.
VI. Trigonometry.
VII. Conic Sections.
VIII. Principles of Mechanics.
IX. Practical Mechanics.
X. Magnetism, Electricity and Heat.
XI. Astronomy.
XII. Chemistry.
XIII. Animal Physiology.
XIV. Botany.
XV. Geology and Mineralogy.
XVI. Agriculture and Horticulture.
XVII. Geography.
XVIII. Political and Social Economy.

XIX. History.
XX. English Grammar and Composition.
XXI. English Literature.
XXII. French.
XXIII. German.
XXIV. Music.
XXV. Drawing and Modelling.
XXVI. Penmanship.

14.—To indicate the portions of the subjects that will be taken in the examinations, certain text-books have been set down for the several departments; but it is distinctly to be understood, that in so doing no opinion is pronounced as to the comparative merits of the works named. The books selected are, generally, those in common use. Real knowledge, however or wherever acquired, will be accepted, and the exposition of a subject in the candidate's own words will be preferred by the examiners.

I. Arithmetic.

15.—Fundamental rules of Arithmetic; Proportion, Simple and Compound; Practice; Interest, Simple and Compound; Fractions, Vulgar and Decimal; Extraction of Square and Cube Roots.

16.—The Examiners will take into account not only the correctness of the answers, but the excellence of the method by which they are worked out, and the clearness and neatness of the working (which must always be shown).

17.—Text Books; any of the modern treatises on Arithmetic.

II. Book-Keeping.

18.—Book-keeping by Single and Double Entry; Drafts of the various forms of Bills of Exchange, Promissory Notes, Invoices, &c.; and an accurate knowledge of the various books used in the counting house.

19.—Text Books:—Principles of Book-keeping, by W. Scott Burn (*Rowsell*, Toronto); Kelly's Elements of Book-keeping (*Simpkins & Co.*).

III. Algebra.

20.—Algebraical Fractions, Square and Cube Root, Greatest Common Measure, Least Common Multiple, Simple and Quadratic Equations single and simultaneous, Ratio and Variation. Candidates should be prepared to give explanations of Elementary Principles and proofs of Fundamental Propositions.

21.—Text Books:—Colenso's Algebra (*Longmans'*) or Barnard Smith's Algebra (*Bell and Daldy*).

IV. Geometry.

22.—A facility in solving geometrical theorems and problems, deducible from the first six books of Euclid, will be expected on the part of those who desire to obtain certificates of the first or second class.

23.—Text Books:—Euclid, Books I., II., III., IV., VI., XI., and XII. Potts' smaller edition (*Parker*), or Colenso's Edition of Simpson's.

V. Mensuration.

24.—The calculation in numbers of the areas and circumferences of plane figures bounded by arcs of circles or right lines. The superficial and solid contents of cones, cylinders, spheres, &c.

25.—Measuring and estimating artificer's work.

26.—Text Books:—Tate's Mensuration. Young's Treatise on Mensuration (*Simms and M'Intyre*).

VI. Trigonometry.

27.—In Plane Trigonometry, the formulæ for the trigonometrical functions of the sum of two angles, the numerical solution of plane triangles, and the use of logarithmic tables, &c.

28.—Spherical Trigonometry, Napier's Rules, Solution of Spherical Triangles.

29.—Text Books:—Colenso's Trigonometry (*Longman*). Snowball's Trigonometry (*Macmillan*, Cambridge). Hall's Trigonometry for Schools (*Christian Knowledge Society*), or any of the modern treatises on Algebraical Trigonometry. Mathematical Tables (*Chambers' Series*).

VII. Conic Sections.

30.—The properties of the three curves treated geometrically; also as deduced from the cone. The principles of projection, orthogonal and central, applied to derive the properties of the Conic Sections from those of the circle.

31.—Analytical Conics, including the equations of the straight line, the circle, the three conic sections, and the general equation of the second degree.

32.—Text Books:—Puckle's Conic Sections (*Macmillan*). Todhunter's Conic Sections (*Macmillan*). Salmon's Conic Sections (*Longmans'*). Drew's Conic Sections (*Macmillan*). Whewell's Conic Sections (*Parker*).

VIII. Principles of Mechanics.

33.—The properties of matter, solid, fluid, and gaseous.

Statics: The composition, resolution, and equilibrium of pressures acting on a material particle; constrained particles; machines; attractions.

Dynamics: Gravitation; collision; constrained motions; projectiles; oscillations.

Rigid Dynamics: Motion of a rigid body about a point;—of a free rigid body;—of a system of rigid bodies.

Hydrostatics: Pressures of fluids; equilibrium of floating bodies; specific gravity; elastic fluids; machines; temperature and heat; steam; evaporation.

Hydrodynamics: Motion and resistance of fluids in tubes, &c.; waves and tides.

Pneumatics: Mechanical properties of the air; the barometer.

34. Text Books:

Wood's or Todhunter's Mechanics.
Goodwin's Mathematics.
Miller's, Phear's, or Webster's Hydrostatics.
Webster's Theory of Fluids.
Orr's Circle of the Sciences.
Cherriman's Statics and Dynamics (*Maclear & Co.*).
Olmsted's Natural Philosophy (College Edition.)
Golding Bird's Elements of Natural Philosophy by C. Brooke (*Churchill*).
Lardner's Handbooks on Natural Philosophy.

IX. Practical Mechanics.

35.—The Application of the Principles of Mechanism to Simple Machines. The Steam Engine.

36.—Text Books:—Lardner on the Steam Engine. Nasmyth's Elements of Mechanism, with Remarks on Tools and Machinery (*Weale*).

X. Magnetism, Electricity, and Heat.

37.—The Properties of Magnets; Terrestrial Magnetism; Diamagnetism. Statical or Franklinic Electricity; Voltaic Electricity; Electrodynamics; Thermo-Electricity; the Electric Telegraph.

Conduction, Convection, and Radiation of Heat; Instruments for Measuring Heat; Specific and Latent Heat; Diathermancy.

38.—Text Books:—Lardner's Handbooks of Natural Philosophy (*Walton and Maberly*).

Golding Bird's Elements of Natural Philosophy, by C. Brooke (*Churchill*).

XI. Astronomy.

39.—The Principles of Plane Astronomy.

40.—Text Books:—Herschel's Astronomy. (*Longmans'*). First chapters.

Airy's Lectures on Astronomy.

XII.—Chemistry.

41. Physical. Elementary laws of heat, light and electricity, in connection with chemical action.

Inorganic. Chemistry of the metalloids and metals, laws of combining proportions, volumes of gases, vapours, &c.

Organic. Composition, properties and decompositions of alcohols, acids, &c.

42. Candidates are expected to be able to explain decompositions by the use of symbols. Questions illustrative of general principles will be selected from the following amongst other trades and manufactures: Metallurgy of Lead, Iron and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal-Gas, Sulphuric Acid, &c.

43. Text Books:—Fownes' Manual of Elementary Chemistry. Miller's Elements of Chemistry. Croft's Chemistry (*Maclear & Co.*); Elements of Chemistry (*Chambers' Educational Course*).

XIII.—Animal Physiology.

44. The general principles of Animal Physiology. Practical application of them to health and the wants of daily life.

45. Text Books:—Carpenter's Animal Physiology 1859 (*Bohn*).

Lardner's Animal Physics (*Walton and Maberly*).

Translation of Milne-Edward's Manual of Zoology (*Renshaw*).

XIV.—Botany.

46. Vegetable Physiology. Classification of Plants. Leading principles of Morphology. Scientific and applied Botany.

47. Text Books:—Gray's Botanical Text Book; Lindley's School Botany; Henfrey's Rudiments of Botany, and Henfrey's Rudimentary Course of Botany.

XV.—Geology and Mineralogy.

48. The properties and distinctive characters of the commonly occurring Minerals and Metallic Ores; the structural characters, conditions of occurrence, and classification of Rocks generally.

49. Geological Phenomena now in action, with Theory of Springs, Currents, Tides, Winds, &c.

50. Text Books:—Dana's Manual of Mineralogy; Lyell's Elementary Geology; and Buff's Physics of the Earth.

XVI.—Agriculture and Horticulture.

51. Theory and Practice of Agriculture and Horticulture. Results of Tillage operations; Effects of particular Manures, Draining, &c.; Management of Stock, and general Economy of the Farm.

52. Knowledge and Management of the Orchard and Garden. Pruning, Grafting, &c.

53. Text Books:—Johnston's Elements of Agricultural Chemistry and Geology; Johnston's Lectures on do.; Youatt's Treatises on the Horse, Cattle, Sheep and the Pig; Low's Principles of Practical Agriculture.

XVII.—Political and Social Economy.

54. Text Books:—Elements of Political Economy, by James Mill. Principles of Political Economy, by John Stuart Mill.

The Phenomena of Industrial Life. Edited by the Dean of Hereford (*Groombridge*).

Whately's Lectures on Political Economy (*Parker*).

55. Some knowledge of the Commercial, Financial and Statistical History of the United Kingdom and of Canada, will be required.

N.B.—The Principles of Political Economy, by John Stuart Mill, need be studied only by those who aspire to a first-class Certificate.

XVIII.—Geography.

56. Political Geography. General Questions in Ancient and Modern Geography; Maps drawn from memory; Explanation of Geographical Definitions.

57. Mathematical Geography.

58. Physical Geography. Outlines of Physical Geography.

59. Text Books:—Stewart's Modern Geography; Anderson's Modern Geography; Pillan's Ancient Geography; Mrs. Somerville's Physical Geography; Chambers' Atlas. For reference, Blackie and Son's Imperial Gazeteer.

XIX.—History.

60. Outlines of Greek and Roman History; English History from the Norman Conquest; Canadian History.

61. Text Books:—Schmitz's Manual of Ancient History; White's Great Britain and Ireland; Hamilton's Outlines of English History; Hallam's Middle Ages, ch. viii. (*Murray*); Student's Hume; Roy's History of Canada; Boyd's History of Canada (*J. Campbell*).

XX.—English Literature.

62. Shakspeare's "Hamlet."
Milton's "Paradise Lost," Books I. and II.
Spenser's "Faerie Queen," Book I.
Cowper's "Task."
Pope's "Essay on Man."
Wordsworth's "Excursion," Books I. and II.
Bacon's "Essays."
Bacon's "Advancement of Learning," Book I.
Addison's "Spectator."
Johnson's "Rambler."
Craik's "History of the English Language."
Trench on the "Study of Words."

N.B. Candidates may select any two of the authors in the above list.

63. Candidates are recommended to make a very careful study of the text of the authors they may select The questions on each author will be divided into two sections, the first intended to test the candidate's acquaintance with the text, the second his knowledge of the subject matter, and his critical and literary information. Full marks will not be given for answers to the second section, if those to the first section do not prove satisfactory.

XXI.—English Grammar and Composition.

64. Grammatical Analysis of Sentences in Prose and Poetry; Composition on a given subject.

65. Text Books:—Dr. Connon's System of English Grammar; Parker's English Composition; Dr. Reid's English Composition.

XXII.—French.

66. The Examination paper will be divided into three parts.

The first will comprise questions on any portion of the French Grammar (To be answered in French, if possible), and an extract from a contemporary French writer to be translated into English. Candidates, in order to obtain a 3rd class certificate, should do full justice to this first part.

The second part will comprise an English extract to be translated into French, and a list of idiomatic expressions to be rendered from French into English or *vice versa.* This should be done satisfactorily by the candidate who aims at a 2nd class certificate.

In the third part, candidates for the 1st class certificate will have, in addition to the above, to answer properly some *elementary* questions on the three following subjects:

1. French literature from 1830 to 1848.
2. French Weights and Measures as compared with the English.
3. The Religious Wars in France in the 16th century.

67. Text Book:—Michelet's *Réforme* (volume viii. of his *Histoire de France.*)

XXIII.—German.

68. Schiller's "Wilhelm Tell." Grammatical and Critical Analysis of.

Goethe's "Iphigenie Auf Tauris."

Goethe's "Egmont."

Composition on a given subject.

Pieces from each of the above works will be given for translation. Every candidate must translate one piece. First-class certificates will be given to those only who translate well from English, and write in German a good Essay relating to German History since the Reformation.

XXIV.—Music.

69. Theory of Music. Notation, the modern modes, intervals, time signatures, the stave, transposition, modulation, terms and characters in common use.

70. Elements of Harmony.

71. Arrangements must be made in the previous examinations by the local committees, to test candidates by oral examination, in their knowledge or appreciation of the sound of musical successions and combinations. A form of the test to be used for this purpose by the local committees, at the previous examinations, will be sent by this Board to such local committees as may apply for it, in due time before the examination.

XXV.—Drawing and Modelling.

72. Orthographical Projection, or Geometrical Drawing, of Architectural or Engineering subjects, Machinery, &c.

Linear Perspective.

Ornamental Drawing of Natural or Conventional objects.

Original Designs.

Landscape Drawing in pencil, crayon, water colours, or in oil.

73. Models of figures, groups, foliage, &c., connected with the Fine or Decorative Arts.

74. The local committees will select, and forward to the Board, such specimens of Drawing and Modelling as they may deem worthy, and which they shall certify to be the work, solely, of the candidate named, who may not be an artist by profession.

XXVI.—Penmanship.

75. Business Hand. An even round hand, without flourishes, will be preferred.

76. Ornamental Penmanship.

77. Specimens to be selected by the local committees, and forwarded to the Board, on the same conditions as specimens in department XXV.

TERMS OF ADMISSION TO THE EXAMINATIONS.

78. Every candidate for examination must be passed by a local committee, and must be a member of, or student of a class in, an Incorporated Mechanics' Institute or Library Association in Upper Canada.

APPENDIX.

The following forms, that will be forwarded at the proper time to the local committees, are here published, in order that the committees may know before hand what arrangements they will have to carry out in co-operation with this Board.

Form No. 1.

Board of Arts and Manufactures, Toronto.

Sir,—I forward to you a return, (No. 2,) which I shall be obliged by your filling up and re-posting to me, as soon as possible, in order that the necessary Forms (No. 4) may be forwarded to you.

I am, Sir, your obedient servant,

————, Secretary.

To the Secretary, Local Com. of————

Form No. 2.—Return of Candidates who have attended the previous Examinations.

———— Local Committee,
————, 1861.

Sir,—I beg to inform you that, on the*———— of ———— Candidates underwent the previous Examination; that † ———— of these Candidates passed the Examination satisfactorily; and that † ———— of them desire to present

* Insert date. † Insert number.

themselves at the Final Examinations. I have, therefore, to beg that you will furnish me with the requisite number of the Forms (No. 4).

(Signed)———————
Secretary, Local Com.

To ————————, Secretary of the Board of Arts and Manufactures.

FORM No. 3.—Circular taking out supply of Forms No. 4 to Local Committees.

Board of Arts and Manufactures, Toronto.

SIR,—I am directed by the Board of Arts and Manufactures to forward the accompanying ——— Forms (No. 4) for the Candidates who are reported by your Local Committee qualified for the Final Examination.

I am to request that these forms may be filled up, signed, and returned to me as soon as possible, not later than the 1st of May, as the number of papers to be prepared, and other important details of the Final Examination, cannot be settled until the returns from all the Local Committees are complete.

One of the forms now sent to you is to be filled up, partly, as you will perceive, by, and partly on behalf of, each candidate. Every such candidate must carefully remember the number entered, in red ink, at the head of the form which is given to him, as this number (and not his name) will have to be entered on each of his papers at the Final Examination, and by it alone will his work be known to the Examiners, or re-arranged in the event of any accidental mixture or displacement of the papers. Cards bearing numbers corresponding with those at the head of the forms, will be sent from this office to you for distribution to the respective candidates.

You will have the goodness to keep a list of the Candidates, *with the number of each opposite his name*, for reference in case of difficulty. A copy of the list should also be hung up, in some conspicuous place, in the Examination Room, which may be specially consulted by the Candidates on the days of the Final Examination.

Detailed instructions (Form No. 5) as to the regulations adopted by the Board to secure uniformity and fair dealing in the arrangements for the Final Examination, will be hereafter forwarded to you.

I am, Sir, your obedient servant,
————————, Secretary.

FORM No. 4.—Candidate's Return.

1. Candidate's name, in full________________
2. Age last birthday________________
3. Residence________________
4. Occupation (present or proposed)________
5. Member of________________Institution.
or
6. Student of a Class in__________Institution.
7. Number of years at School____________
8. Number of years since leaving School______
9. Father's name________________
10. " occupation________________

I, the above-named________________ declare that the above returns are correct, and that I desire to present myself as a Candidate at the ensuing Examination, to be held by the Board of Arts and Manufactures at________________.

N.B.—The above return must be entered by the Candidate in his own handwriting.

I HEREBY CERTIFY that the above-named ________________has passed a satisfactory previous Examination in the special subjects, opposite to which, in the margin, I have placed my initials.

Signed________________

On behalf and by authority of the Local Com. of——— } ________________
Dated this ——— day of 1860.
To ————————

FORM No. 5.—Letter of Instructions.

Board of Arts and Manufactures, Toronto.

SIR,—I am directed by the Board to inform you that the papers for the ensuing Final Examination of Candidates, for the Board's Certificates, will be forwarded by post, on ——— the ——— day of ———, in a parcel addressed to you at ———.

You will have the goodness to let me know, on ————, the ——— of ————, in time for the despatch of duplicate papers, if the parcel is not duly delivered to you by the morning of that day.

The outer wrapper of this parcel should be opened as soon as received, when you will find the papers for each evening enclosed in a separate envelope, with the number of papers in each subject endorsed upon it. *The seal of each separate envelope is to be broken in the presence of the assembled candidates, at the commencement of the time appointed* in the Time-table. This direction, as well as the *order* and *hours* of Examination laid down in the Time-table, must be *strictly* observed. It is absolutely necessary, for the proper working and ultimate success of these Examinations, that there should not be the least suspicion as to the perfect fairness and equality with which they are conducted by the different Local Committees; and such suspicions can only be obviated by the *simultaneous* opening of the separate envelopes, and by the *simultaneous* working of the *same* set of papers before each Local Committee. On this, and on the firmness and fidelity with which the members of the Local Committees discharge the simple, though somewhat onerous, duties required of them to prevent the possibility of any dishonest dealing on the part of any candidate while under examination, the success of the present system depends.

I am, therefore, to invite your most careful attention to the "Advice to Candidates" which you will find printed at the foot of the enclosed copies of the Time-table, and to the terms of the accompanying Forms of Declaration, one of which Forms will have to be filled up and returned to me, after it has been signed by at least two members of the Local Committee, at the end of each meeting of the candidates. To provide for this it will be necessary that you should immediately make arrangements with your colleagues on the Local Committee, to secure the attendance of a sufficient number of them in rotation at the different periods of the examination. The attention of your Candidates should be drawn to the Time-table now sent to you, and copies of it should be suspended in the Examination Room.

It will further be necessary that the Local Committee should provide writing paper, of foolscap size, scribbling-paper for rough drafts, and blotting paper, for the use of the candidates at the Final Examination, who should be desired to bring their own pens and a small inkstand to the examination room, but nothing else. They must be required, on entering the examination room, to give up all books, papers, memoranda, writing books, or loose blotting paper which they may have brought with them, under the penalty of immediate exclusion from the examination if any such articles should thereafter be found in their possession. After such notice the plea of accident or forgetfulness cannot be admitted.

The Time-table has been drawn up to meet the general convenience of the whole number of Candidates who will assemble at the different Local Committees; and no *variation* of the Time-table can possibly be allowed.

The Candidates should sit in the order of their numbers, as far apart from each other as the space at your command will allow. If you cannot spread them out so as to prevent the *possibility* of communications passing between them, it will be well to disregard the numerical order, and arrange alternately the candidates who take different subjects.

Three hours only are allowed for each paper.

All writing must cease at the end of the three hours, *to a moment;* and, if there is no clock in the room, notice should be given to the candidates when one and two hours have elapsed, and again when they are within ten minutes of the end of each sitting.

The candidates should leave their answers at their seats, after having carefully fastened them together, in order, through the upper left-hand corner. A supply of twine and some large needles should be provided for this purpose.

The papers should then be collected—those on each subject separately—and arranged in the order of the Candidates' numbers. After a *separate* Declaration has been filled up and signed, in reference to the papers on *each subject*, it should be tied up with them; the whole set, or sets, worked each evening should be forwarded either by letter or parcel post, in *one* parcel addressed to me at this office.

The Board regrets to have to trouble you with the observance of so many minute directions, but trust you will see the necessity of faithfully carrying them out, in order to avoid the occurrence of any mistakes.

I am, Sir, your obedient servant,

————————, Secretary.

FORM No. 6—Time-table.

EXAMINATIONS OF THE BOARD OF ARTS AND MANUFACTURES FOR U. C., 1861.

The Examinations will be held on the evenings of the 28th, 29th, 30th, and 31st May, 1861.

The hours of Examination will be from 7 o'clock to 10, and they must be strictly adhered to.

No Candidate will be admitted after the Examination shall have commenced.

TIME TABLE FOR 1861.

No Candidate may work more than one paper in each evening.

TUESDAY, the 28th May, from 7 to 10 p.m.	WEDNESDAY, the 29th May, from 7 to 10 p.m.	THURSDAY, the 30th May, from 7 to 10 p.m.	FRIDAY, the 31st May, from 7 to 10 p.m.
Arithmetic. Trigonometry Magnetism, Electricity and Heat. Agriculture and Horticulture. History. English Grammar and Composition. Penmanship.	Book-keeping. Conic Sections. Chemistry. *English Literature. Music. Geology and Mineralogy.	Algebra. Practical Mechanics. Astronomy. Animal Physiology. Political and Social Econo'y French. Drawing and Modelling.	Geometry. Mensuration. Principles of Mechanics. Botany. Geography. German.

* Two Papers of one hour and a half each in this subject are considered as one.

ADVICE TO CANDIDATES.

Read over the Time-table carefully, and note the hours appointed for the subjects in which you wish to be examined. Be at your seat in the Examination Room *five minutes before the hour appointed* for each Paper which you are to work.

When the Paper is given to you, *first* look to the instructions printed at the head of it, and *then* read the questions carefully over, marking those which you think you can answer best. Do them first, and if any time remains, you may try some of the others, but do not exceed the number of questions appointed to be answered. Remember, that a few accurate and sensible answers will gain a higher number of marks than a great number of indifferent attempts.

As soon as notice is given (10 minutes before the end of the time) finish your Papers, see that they are numbered rightly, and in their proper order, fasten them with twine at the upper left hand corner, and leave them UNFOLDED at your seat.

CAUTION.

No Candidate may speak to another Candidate, on any pretence whatever, under pain of immediate expulsion.

If a Candidate has any question to ask, or wants anything in the course of the Examination, he should not leave his place; but *should stand up and call out his number*, when some one will attend to him.

No Candidate will be allowed to resume the working of a Paper after he has once left the room in the course of the time appointed for that Paper.

Any Candidate detected in taking unfair advantages, such as referring to any Book, or Written Paper, or in seeking or receiving assistance from another, will be immediately expelled.

Whoever gives assistance will be treated in the same manner as he who receives or asks for it.

Stationery, including blotting-paper, will be furnished by the Local Committee, for the use of the Candidates. No one can be permitted to bring any book, paper, or other thing into the Room with him, except an inkstand and a supply of pens.

The Papers should be carefully and neatly written.

Ill-spelt Papers will be rejected by the Examiners.

FORM No. 7.—(Declaration.)

DECLARATION.

Local Committee of____________

We, the undersigned, hereby declare that the (a)______papers on________________(b)____which are forwarded herewith, were worked in our presence by the Candidates whose numbers they respectively bear, without any assistance whatever, from books, notes, or memoranda, from each other, from ourselves, or from any other person. We declare that not more than three hours were occupied in working these papers; that they were worked at the time appointed for them in the Time-table issued by the Board, and that no Candidate was allowed to resume or complete a paper after having left the Examination room in the course of the time assigned to that paper; we further declare that the paper of questions given to each Candidate was taken from the envelope in which it was transmitted from the Board of Arts and Manufactures, the seal of this envelope being broken in our presence, and in that of the assembled Candidates, at the commencement of the time appointed for the paper in the Time-table issued by the Board; and, finally, we declare that not fewer than*______of our number were present during the whole time that the Candidates were engaged on these papers.

Name, designation and address of members of Local Committee who were present during the working of the papers referred to in the above declaration.† ____________ ____________ ____________ ____________ ____________

N.B.—The members of the Local Committee will appreciate the importance of this Declaration. To sign it without a certainty of its truth, would be to attempt a fraud on the Board, on the Examiners, on the Candidates, and on the public at large. The Board is confident that the Local Committees will not only act with perfect good faith, but will use such scrupulous care and caution, that errors in their "Declarations" will be impossible.

By order of the Board,

W. EDWARDS, *Secretary*.

Toronto, Nov. 1860.

ASSOCIATION OF ARCHITECTS, CIVIL ENGINEERS AND P. L. SURVEYORS OF THE PROVINCE OF CANADA.

This Association was established in March, 1859. It has for its objects, as stated in the preamble of its published rules, "the establishment of a tariff of charges for reference in cases of disputed claims, the collection and exhibition of Works of Art, Models and Drawings, articles of practical utility in the several professions, and also the meeting together at stated times for the consideration and discussion of subjects that might be of interest to the Association."

Its officers for the years 1860–'61, are:

W. THOMAS, Toronto, *President*.
GEO. BROWN, Montreal, *1st Vice-President*.
F. J. RASTRICK, Hamilton, *2nd* do.
S. DENNIS, Toronto, *3rd* do.
WILLIAM HAY, Toronto, *Treasurer*.
JOHN TULLY, Toronto, *Secretary*.

Committee:

J. O. BROWNE, Toronto,	W. T. THOMAS, Toronto.
H. McLEOD, London,	S. PETERS, London,
A. H. HORSEY, Kingston.	J. H. SPRINGLE, Montreal,
W. KAUFFMAN, Toronto,	THOMAS GUNDRY, Toronto,
F. F. PASSMORE, Toronto.	JOSEPH SHEARD, Toronto.

Its meetings are held on the first Wednesday of each month from October to May, inclusive, at three in the afternoon, in the Rooms of the Board of Arts and Manufactures, King Street, Toronto.

CANADIAN PATENTS,

As issued by the BUREAU OF AGRICULTURE AND STATISTICS, from 1st. July, to 6th. October, 1860:—

James Alexander Campbell, of Georgetown, county of Halton, Printer, for "A Card Press and Mailing Machine.—(Dated 4th July, 1860.)

William Bowman, of the city of London, county of Middlesex, Engineer, for "An iron surface bearing fish or joint plate for Railways.—(Dated 4th July, 1860.)

Samuel Morse, of the town of Milton, county of Halton, Machinist, for "An improved combined Reaping and Mowing Machine.—(Dated 4th July, 1860.)

Charles Carlton, Waggon Maker, and Joshua Carlton, Blacksmith, both of the township of York, county of York, for "An improved Seaming Cultivator.—(Dated 4th July, 1860)

John Worthington, Builder, and John Brown, Modeller, both of the city of Toronto, county of York, for "The discovery of a 'Composition' for the manufacture of Fire Bricks."—(Dated 4th July, 1860.)

The Reverend James Spencer, of the city of Toronto, county of York, Wesleyan Minister, for "A machine for printing words, names, numbers, dates or addresses upon papers, pages, books, tickets, periodicals and other articles requiring to be marked, printed or addressed."—(Date of *re-issued* Patent 6th July, 1860.)

Charles Meadows, of the township of East Zorra, County Oxford, Yeoman, for "An improved machine for sawing firewood from the log."—(Dated 6th July, 1860.)

Phillip D. Eckardt, of Unionville, in the Township of Markham, County York, Carriage maker, for "A Root Slicer."—(Dated 9th July, 1860.)

Henry P. Griggs, of the Town of Port Hope, County Durham, Physician and Surgeon, for "An Empire Thermometer Churn."—(Dated 9th July, 1860.)

Charles B. Brown, of the Town of St. Thomas, County Elgin, Machinist for "A plaster, Dry Manure and Grain Sower."—(Dated 23rd July, 1860.)

Edward John Maxwell, of the City of Montreal, Carpenter, for a "Double Action Flush Window Bolt."—(Date of *re-issued* Patent 25th July, 1860.)

Samuel John Kelso, of Chicoutimi, County Chicoutimi, Agent for an "Aqua-Gravitation Engine."—(Dated 26th July 1860.)

(*a*) Insert Number, (*b*) Insert subject.
* State the number, which in no case must be less than *two*.

† This declaration must be signed, in every case, by, at least, *two* of the members of the Local Board; and, when more than twenty Candidates are examined at any one sitting, by, at least, *three* such members. It must not, in any case, be signed by a member of the Board from whom any of the Candidates have received instruction in the subject of the paper to which it refers.

Joseph B. Palser, of the city of Montreal, Paper Manufacturer, for an improved and useful article of manufacture, termed and denominated by him, "Staple Fibre."—(Dated 26th July, 1860.)

Lewis House, of the village of Beamsville, County Lincoln, Machinist, for a "Corn Sheller."—(Dated 2nd August, 1860.)

Henry Yates, of the Town of Brantford, County Brant, Mechanical Engineer, for an "Improved perforated Fire Grate, Feed Water Heater and Damper Combined," for Steam Engines.—Date of *re-issued* Patent 2nd August, 1860.)

Andrew Bridge, of West Brook, in the Township of Kingston, County Frontenac, Cooper, for a "Self-acting Churn."—(Dated 2nd August, 1860.)

Hiram Broadbent, of the city of Hamilton, County Wentworth, Brass and Iron Founder, for "Improved Stop-Cocks, Plugs and Valves," for the passage of Water and other Fluids.—(Dated 2nd August, 1860.)

William Welch, of the city of Hamilton, County Wentworth, Engine Driver. for a "Spark Annihilator."—(Dated 2nd August, 1860.)

George White, of the village of Newmarket, County of York, Blacksmith, for "An improved Straw Cutting Box."—Dated 7th August, 1860.)

Joseph B. Palser, of the city of Montreal, Paper Manufacturer, for "An improved apparatus" to be used in the manufacture of Paper Pulp from straw and other fibrous materials.—(Dated 8th August, 1860.)

Cornelius James Scott and Samuel Dustin, Lockwood, both of the township of Camden, County of Addington, Farmers, for "An improved Harvesting Fork,"—(Dated 25th September, 1860)

Hiram Marlatt, of the village of Thorold, County of Welland, Gentleman, for "A Fruit Picker."—(Dated 25th September, 1860.)

Isaiah Tyson Smith, of the Town of Belleville, County of Hastings, Miller, for "Smith's perfect system of Mill Stone Dressing by a Diamond."—(Dated 25th September, 1860.)

Horace Brown, of the Township of Bastard, County of Leeds, Miller, for "A new method of balancing Mill Stones,"—(Dated 25th September, 1860.)

Charles Wilson, of the Village of St. Mary's, County of Perth, Trader, for "A Grain Separator."—(Dated 25th September, 1860.)

John Davis, of the Town of Chatham, County of Kent, Machinist, for "An Hydraulic Bellows, "—(Dated 25th September, 1860.)

James Paton Clarke, of the City of Hamilton, County of Wentworth, Professor of Music, for "A Reaping and Mowing Machine, termed the Scythe Reaper and Mower."—(Dated 25th September, 1860.)

James Findlay, of the City of Toronto, County of York, Engineer, for "A Branch Rail, termed, Findlay's Branch Rail,"—(Dated 25th September, 1860.)

John William Henry Schneider, of the Township of Barton, County of Wentworth, for a "Safety Check," for the more effectual management of kicking, run-away and otherwise unruly horses.—(Dated 25th September, 1860.)

John Langstaff, Junior, of the Township of Markham, County of York, Machinist, for "Wooden Eave Trough, or Water Conductor,"—(Dated 25th September, 1860.)

Charles Horatio Waterous, of the Town of Brantford, County of Brant, Machinist, for "A new mode of packing and preserving Hops."—(Dated 25th September, 1860)

Robert Might, of the Village of New Hamburg, County of Waterloo, Machinist, for "An improved mode of constructing Threshing Machines."—(Dated 25th September, 1860.)

Thomas Towell, of the Township of Seneca, County of Haldimand, and William Gunson, of the Township of Glandford, County of Wentworth, Machinists, for "An improved Cultivator and Thistle Cutter."—(Dated 25th September, 1860.)

George McKenzie, of the Town of Goderich, County of Huron, Carriage and Waggon Maker, for "An improved Pipe Bush."—(Dated 25th September, 1860.)

John Yerks, of Charlotteville, County of Norfolk, Mechinist, for "An improved Root Cutter."—(Dated 25th September, 1860.)

Samuel Morse, of the Town of Milton, County of Halton, Machinist, for "An improved Threshing Machine."—(Dated 25th September, 1860.)

William James, of Mariposa, County of Victoria, Farmer, for "A Double action Dash Churn."—Dated 25th September, 1860.)

William Weir, of the City of Montreal, Publisher, for "Improvement in the manufacture of Paper Pulp from straw or other vegetable substances."—(Dated 2nd October, 1860.)

Norman L. Webster, of Richmond, County of Richmond, Blacksmith, for a new and improved Furnace, to be called "Webster's Furnace."—(Dated 2nd October, 1860.)

Joseph Paradis, of the Parish of St. Judes, Machinist, for "An improved Water Wheel."—(Dated 3rd October, 1860.)

Joseph B. Palser, of the City of Montreal, Paper Manufacturer, for certain new and useful "Improvements in the manufacture of Paper Pulp from straw and other fibrous materials."—(Dated 3rd October, 1860."

Matthew Moody, of the Parish of Terrebonne, Machinist, for "An Accommodating Joint," working on two centre bearings, applied to Mowing and Reaping Machines."—(Dated 4th October, 1860.)

Charles Brooks, of the Township of Ascot, Merchant, for a Self-acting Carriage Brake."—(Dated 4th October, 1860.

Frederick Lane, of the City of Montreal, Gentleman, for "A new and improved Galvanic Battery and Electric Helix."—(Dated 6th October, 1860.)

Selected Articles.

STARCH.

Every Farmer in Canada should understand the process of manufacturing Starch from potatoes. It frequently happens that large quantities of spoiled potatoes accumulate during unfavourable seasons, and in remote districts where the market price is not remunerative. If they were converted into starch, a market would be found at once, and the product is so portable that its conveyance would be a trifle compared with its value, which in England is $100 a ton. The following article is deserving of general attention.

ON STARCHES, THE PURPOSES TO WHICH THEY ARE APPLIED, AND IMPROVEMENTS IN THEIR MANUFACTURE. *

At the beginning of this century, starch was used only in the laundry, for the toilet, and, to a limited extent, as diet, whilst now a great variety of starches have been introduced into commerce, and, by certain

* By Dr. F. Grace Calvert, F.R.S., "Journal of the Society of Arts

processes, which I shall hereafter describe, converted into gum or sugar, and thus have become used in manufactures; and to give an idea of the immense quantities used in Lancashire, especially at print and bleach works, I may mention that at one single print works, in Manchester, above 300 tons of these products are used annually. One of the great chemists of the day has made the curious remark that this most important diet of man is often associated in plants with acrid or poisonous substances; thus, for example, in the wild chesnut, the starch is mixed with an acrid substance. In the roots of the *arum*, starch exists conjointly with an acrid and venomous substance; and in the root of the manioc it is mixed with prussic acid. But the Deity has given to man an intuition which enables him to separate the starch with facility from its poisonous accompaniments. Thus the natives of Guiana and of the West Indies have found out that by heating the roots of the manioc, the prussic acid was dissipated and the tapioca obtained.

A most interesting fact is, that although the globules of these starches vary in size from the thousandth of an inch to the three-hundreth, as in the case of potato starch, and the other part or shell has a different molecular arrangement from the internal part, still they have been proved by analysis to have all the same ultimate composition when pure and dried at 220° Fahr., viz., C_{12} H_9 O_9 or 72 parts of carbon, and 81 of water. All starches except Inuline give a blue color when iodine, and if the compound be mixed with water and heated, the color disappears, though, strange to say, it returns when the solution cools. M. Payen has recently discovered a method of rendering this splendid color comparatively permanent, and, as this discovery may result in some useful applications, I think it right to state that the best way to produce it is to leave some potato starch in contact with ammonio-oxide of copper for several hours, washing the excess of the latter away, boiling the green precipitate which remains, and adding to it a solution of iodine, when a splendid purple precipitate will be formed. *

The globules of starch when heated in water, swell, burst, and are then found to be composed of successive concentric layers, but the outer layer has a different molecular arrangement from the internal ones; for M. Payen has found that these parts have different degrees of solubility in ammonio-oxide of copper, and has further observed that the outer envelope will swell to 1,000 times its original size when placed in contact with the above fluid. Starches are highly hygrometic; thus ordinary potato starch can combine with 3, 5, 11, and 16 equivalents of water. The starch, as extracted from the potato, contains 45 per cent., 25 per cent, when kept in a damp atmosphere, and 18 per cent. when stored in a dry place; and it is easy to distinguish starch which contains (say) 18 per cent. from that which contains 35 per cent., by placing a small piece on a metallic plate heated to 212 degrees, when the starch with 18 per cent. will fly about, whilst that with 35 will agglomerate and form hard lumps; in fact it is by means of this property of potato starch that large quantities of artificial tapioca are made on the continent.

Although I shall refer, further on, to the curious transformation of starch into sugar by the action of acids, I may here state that M. Fremy has demonstrated that the sweetening of fruits is due to the action of the acids converting the starch existing in them into sugar, and that N. Niépce de St. Victor has recently made the curious observation that when paper is impregnated with starch, and exposed to the rays of the sun, the starch is slowly converted into sugar. Diastase, or an albuminous ferment, which exists in all grains, but especially in malt, possesses also the same property to a high degree, more particularly at a temperature of 150° Fahr., as proved in the mash-tub of the brewer; and I am gratified to find that the suggestion which I made thirteen years ago, viz., that this temperature should not be exceeded, is now generally acted upon by brewers, who find that a higher temperature annihilates the converting power of diastase and thereby causes serious loss.

One of the greatest triumphs of chemistry applied to physiology has been the discovery of diastase in the saliva and pancreatic juice in the human system, by which the starch taken as food is converted into an isomeric substance called glycogene, stored by the liver and there converted, according to the requirements of vitality, into sugar, and carried by the circulation of the blood into the capillaries, where it is converted into water and carbonic acid, producing the heat necessary for the maintenance of life. Chemists have also discovered the presence of starch or a substance isomeric to it in the skeletons of many of the invertebrata, such, for example, as the crustacea, arachnida, and insects, and the envelope of certain tunicate molusca; and Messrs. Berthelot and Piligot have recently placed this interesting fact beyond doubt.

Starch presents not only a great similiarity of composition to the fibres of plants, such as flax and cotton, but, when treated with concentrated nitric acid, it is also transformed into fulminating substance, called Xyloidine, similiar to gun cotton.

Although time will not allow me to enumerate all the various starches known, I think it advisable to mention the principal kinds used in commerce. They are:—

Arrowroot, obtained from the roots of the *Maranta arundinacea*, in the East and West Indies, by pounding in mortars, and elutriation through sieves.

Sago, obtained from the pith of the sago palm, which grows in the Molucca and Phillipine Islands.

Tapioca, obtained as above stated from the manioc root (*Jatropha Manihot*).

Inuline, or starch obtained from the dahlia root.

Millet starch, obtained from the *Paniacum Miliaceum*.

Rice starch.

Wheaten starch.

Fecula, or potato starch.

Wheaten Starch.—The starch in wheat is associated with a most curious elastic and azotised substance, called gluten, the quantity and quality of which in the wheat determine the nutritive and commercial value of its flour, and it is only very recently that this substance, which has generally been considered as a waste product, has received a valuable application in calico printing. An eminent chemist and calico printer of Glasgow, Mr. Walter Crum, has discovered that under certain circumstances, gluten is soluble in weak alkali, and thus has applied it as a substitute for albumen for fixing on muslins a beautiful purple mauve color, called French purple.

* See comptes Rendus de l'Académie des Sciences, 1859.

Thus the two principal ingredients of wheat, gluten and starch, are used in calico printing, the gluten for some colors, and the starch for others.

The usual mode of obtaining starch from wheaten flour is to place some flour or crushed wheat, with water, in large tubs or vats, allowing it to enter into fermentation, and to continue fermenting for several weeks, according to temperature. In well-conducted establishments this operation is carried on in rooms heated in winter, so as to allow the fermentation to proceed without interruption. The fermentation of the grain produces a foul acid water called *sour water*, and the putrefaction of the azotised substance of the grain gives rise to a very offensive odor. The sour water contains alcohol, acetate of ammonia, acetic and lactic acids, biphosphate of lime, and decomposed gluten. The fermentation which first occurs is the vinous, at the expense of the sugar and a certain portion of the starch; carbonic acid and alcohol are thus formed. The former is evolved, and the latter remains in the liquor. The alcohol is rapidly transformed, under the influence of the oxygen of the air and the gluten, into acetic acid, and it is by this acid thus formed, conjointly with lactic acid, that the complete separation of the starch and gluten is effected. The ammonia comes from the decomposition of the gluten, and the lactic acid is a secondary product arising from that of the starch. But still the fermentation and the acids are not sufficient to remove or destroy the whole of the gluten, which forms a layer on the top of the starch; this mass, called *slimes* or *flummery*, was formerly used for feeding pigs, but is now employed by calico printers in their *resist pastes*, and by the patent gum manufacturers in the preparation of certain of their products. The slimes and the other results of decomposition above enumerated are removed by washing and by sieves from the starch, when this is allowed to settle in clear water for several days so as to acquire a sufficient consistency. If the starch is to have a blue tint, called Poland, fine ultramarine must be mixed in the liquor of the last sieve, in the proportion of about 2 per cent. It is then either placed on cloths to drain, or put in wooden chests, the bottoms of which are lined with cloth; this operation is called *boxing*. When sufficiently drained it is dryed by various means, and then the masses are broken into lumps of about six cubic inches, wrapped in paper, and placed in carefully heated stoves, when, strange to say, these masses split up into thousands of irregular pieces, well known to consumers. Potato starch and all those similiar to it cannot assume this peculiar form.

The above fermentation process is not only objectionable from the length of time it requires, and the noxious products which arise from it, but also from its serious destruction of valuable materials, which amounts to between 30 and 40 per cent. Mr. Martin, of Paris, succeeded some twenty years ago in doing away with the above inconveniences, by kneading the floor into dough, and introducing it into a wooden cylinder, working on its axes and armed with cutters, and having its openings covered with a fine copper gauze. By this means Mr. Martin obtained a larger yield of starch, and saved the valuable substance called gluten, which he turned to good account by drying it, pulverising it, and selling it as granulated gluten; it is now sold in London under the fictitious name of *semolina*. He also, by adding gluten to flour, brought the latter into a state to be easily manufactured into macaroni and similar pastes. To separate the small amount of gluten which the starch still contains, Mr. Martin allows it to ferment for several days, or treats it with chemical agents, which separate the gluten from the starch. Wheaten starch is not only employed for domestic purposes, but is also used extensively by calico printers, especially for thickening colours into the composition of which free acids enter. A similar supply of starch can be obtained from rye, barley, oats, buckwheat, millet, and maize.

To obtain their starch, potatoes are washed in a suitable machine, to remove all dirt; they are then reduced to pulp by rasping, and the pulp is elutriated upon a fine wire sieve, and, by successive similar operations, the starch is separated from the pulp. After having been drained in boxes, lined with felt, it is then placed on dried floors, made of plaster of Paris, which absorbs the greatest part of the water, and, to complete its desiccation, it is further dried in the air and in stoves. The farina so prepared, although suitable for manufacturing purposes, has still a peculiar rank taste, which renders it disagreeable as food. To remove this nauseous odour and taste which it possesses, Mr. Martin washes the starch with a weak solution of carbonate of soda, which renders it perfectly sweet.

Besides its application as above in the manufacture of artificial tapioca, and as a substitute for arrowroot, it is also used in large quantities in print works for thickening colours, and finishing goods, and also as a substitute for wheaten flour in laundry purposes. The Glenfield Company, as I believe, were the first to introduce a preparation of farina which has the advantage, when boiled with water, of forming a clear fluid, which gives to net and other fine fabrics a transparent appearance, instead of an opaque one. This the company effects by mixing with the starch a trace of sulphuric acid, which still is sufficient to convert the insoluble starch into a soluble substance, called *dextrine*. A process has lately been patented to effect the same change by means of oxalic acid.

Recently Mr. Sorel has published a most interesting application of starch, which consists in producing an artificial substance, capable of replacing in many instances, ivory, horn, gutta percha, &c. He obtains his new plastic and translucent matter by adding farina to a solution of chloride of zinc, of such a strength as to swell it out without dissolving it. This mass becomes hard and tenacious, and to modify these properties various substances, such as oxide of zinc and sulphate of baryta, are added in a powdered state; and what is curious is that, whilst oxide of zinc renders the mass opaque, sulphate of baryta does not affect its translucent appearance.

The extension which took place in calico printing, some 20 or 30 years ago, called into consumption such large quantities of gum arabic, that farina heated to a temperature of 250 to 300 degrees, and thus rendered soluble as a gum, became extensively employed as a substitute, and of late years it has assumed an important place in the list of materials used by calico printers. To effect this curious change at the present day, farina is heated to the above temperature, either in a revolving cylinder or in iron troughs placed in a stove for several hours, when it acquires an umber colour and becomes soluble in water. This change is entirely a molecular one, as the raw and calcined farina have the same composition, notwithstanding which farina gives a blue colour with iodine, and when calcined a purple. As the colour of calcined farina is an objection to its employment in many instances, it was a great desideratum to find a process for its conversion, at such a low temperature, as to leave the converted farina nearly colourless. This was first effected in 1838, by M. Payen, who found that if to 400 parts of dry farina one part of nitric acid at 1·40 was added, after having been diluted with sufficient water to form with the farina a hard paste, and this then dried slowly and heated in a close chamber for 20 hours, at a temperature of 200 deg. Fahr. a nearly white farina was obtained. It is interesting to observe how so small a quantity as a few thousandths of acid can effect this great molecular change. Since that time, many processes have been devised to attain the same end, and you will remember that, in a paper which I had the honour to read here some years ago, I adverted to a method discovered by Mr. Edward Hunt and I have now the satisfaction of calling your attention to a very interesting process discovered also by one of my late assistants, Mr. Charles O'Neil, and which is valuable as it enables him to convert insoluble farina into soluble farina, or *dextrine*, without any change of colour. This he effects by subjecting starch, farina and other amylaceous substances to the chemical action of muriatic acid gas, or other acid gas or vapour in a cylinder, the exterior of which is surrounded by an atmosphere of steam. This beautiful preparation will extend the employment of soluble farina as a substitute for gum arabic, the colour which was inseparable from farina previous to this discovery excluding its use in many instances. As calico printing in its present extraordinary development requires thousands of tons of soluble materials for thickening the mordants and colours used, a great variety of this class of artificial gums are prepared so as to meet these requirements. Thus, besides farina, sago, rice, slimes and wheaten flour are used; the latter when heated generally bears the name of British gum, which differs from calcined farina in being soluble in water only at a boiling temperature.

If, instead of employing minute quantities of acids, a larger quantity be used, farina and other starches are not only first transformed into gums, but are further converted into sugar, similar to that which exists in grapes and fruits generally. But, in this case, starch undergoes not a mere molecular change, but a complete chemical transformation, by fixing two equivalents of water. On the Continent, where large quantities of this peculiar sugar are employed in the preparation of beer and other beverages, the following process is now adapted. By adding farina gradually to one part of vitriol diluted with 33 parts of water, and carrying the whole to the boil for 30 or 40 minutes, it is converted into sugar, and this is easily ascertained, as that solution yields no colour with iodine. To the solution is then added carbonate of lime or chalk, which forms an insoluble sulphate of lime. It is then sufficient to pour off the saccharine solution and evaporate it to a proper consistency to obtain, after cooling and standing several days, solid masses of sugar, very similar in appearance to honey.

If, instead of continuing the action of sulphuric or other acids upon starch until it is converted into sugar, the operation is stopped as soon as the solution gives a purple colour with iodine, then, by removing the acid, and evaporating the solution, a translucent soluble matter is obtained, having the greatest resemblance to gum, called *Dextrine.* Although the conversion of starch into sugar has been known for a long period, still it is only since 1833 that chemists have been aware how this curious conversion was effected. In that year, Messrs. Payen and Persoz succeeded in extracting, by means of alcohol, from a solution of malt the curious ferment which caused that change, and they gave to it the name of *diastase.* To leave no doubt that this is the agent which converts starch into sugar, they found that by mixing one part of this azotised substance with 2,000 parts of farina and a sufficient quantity of water, these were completely converted, first into, dextrine and then into sugar, at a temperature of 150° Fahr. And, as I observed at the commencement of this paper, this conversion was completely prevented if the temperature was raised to 200° or 212°.

In the discussion which followed the reading of the foregoing paper, many interesting facts were adduced, some of the most useful are given below.

In 1852 Mr. Braithwaite Poole, in his work on the Statistics of British Commerce, had estimated the manufacture of starch in the United Kingdom at about 20,000 tons, which, at an average of £23 per ton, would give a total value of £460,000 per annum. But this scarcely took into account at all the dextrines or gum-substitutes which had mainly grown into importance with the progress of textile manufactures, and were certainly 4,000 to 5,000 tons a year.

In Belgium not long since, a premium of £400 was offered for any substitute suitable for the production of starch, other than a food product. In France, the horse chestnut, which was to be had in abundance, was now converted into excellent starch and vermicelli. Many neglected tropical roots and seeds might be turned into starch; there were hundreds available to be met with in various quarters, and it only resolved itself into a matter of cost of manufacture and price to be obtained to cover shipment, &c.

The so-called arrowroots of commerce are of a very varied character, and were obtained not only from many sources, but from very different plants; indeed it is impossible to state what are the sources of many of the African and Indian arrowroots of the present day. The *canna* or arrowroot tribe, yielded the best from the West Indies; but the *arums, curcumas,* and *cassavas,* and the sago, and other palms yielded starches, which are no doubt, bleached and rendered more saleable.

In the United States, maize or Indian corn—the great grain crop of the country—formed the source of starch production, and the Oswego starch had some repute in the United Kingdom. The demands for manufacturing purposes were on the increase. In town of Lowell alone there were used by manufacturers, in 1855, 13,115 cwt. of starch and 1,545 barrels of flour. The last Australian advices reported that, owing to the low price of potatoes in Tasmania—an article for the production of which the colonists had been famous, the farmers had been compelled to fatten their pigs upon them, not being able to dispose of them. In many instances crops had been allowed to rot in the ground, simply because they would not realise a sufficient price to cover the expense of gathering them in. Some of the farmers, however, had bethought themselves of making starch from the potato, and had found a ready sale for the product.

There is one singular feature in the process of rice starch manufacture, viz., the variation in the time which it took to deposit the starch according to the particular state of the atmosphere, not as regarded the temperature, but possibly the electrical condition of the atmosphere; it had been proposed to introduce an electric current into the ranges, in order to regulate the deposit.

Dr. Calvert replied to an inquiry whether he was acquainted with any good process to give to starch the power of rendering fabrics incombustible. He thought that adding 1 or 1½ per cent. of sulphate of ammonia would have considerable effect. Some processes for producing that result had been patented, but it had long been known that sulphate of ammonia was the cheapest and best substance for preventing combustibility. Messrs. Versmann and Oppenheim had recently investigated this subject, and recommended the use of tunsgtate of soda; but whether this or any other salt, such as sulphate of ammonia, was the best, was principally a question of cost. If they took a piece of cotton wool, and dipped it into sulphate of ammonia, and then dried it, it was rendered uninflamable, and he saw no practical reason why this salt should not produce the same effect when mixed with starch.

BUILDING-STONES AND PRESERVATIVE SOLUTIONS.

From the Chemical News, Nov. 1850.

However inventors may dispute, and scientific men may differ, as to the respective values of the solutions intended to preserve building-stones from decay, they, as well as Parliamentary Committees and architects, are unanimously of opinion that the continued durability of the principal of our public buildings depends on chemistry. The question is one of grave importance; not merely on account of the pecuniary considerations involved, though they are of enormous magnitude; but the character of the nation is concerned in its ability to erect buildings which shall endure to future ages. The present condition of that splendid monument of the late Sir C. Barry's genius—the Houses of Parliament—is even more serious than is generally supposed. Not only do the ornaments crumble and decay, and the surfaces of the stones yield to atmospheric influences, but there is reason to apprehend that this disintegration extends to internal portions of the walls. It is not long since a policeman had a narrow escape of being killed by the falling of the canopy of the niche in which the statute of Charles II, is placed, and the cause assigned is the decay of the stone. The susceptibility of the stone employed in this building to moulder on exposure to the atmosphere is aggravated by the elaborate ornamentation to which it has been subjected. In the case of the flat surfaces, we are told that care has been taken, as far as possible, to hew the stone in such a way as to expose that side to the air which is most capable of resisting its influence; but, as regards the sculptured portions, such precaution was mani festly impossible; hence the reason why these portions exhibit the greatest amount of decay. Considering how large a proportion of the external surface consists of these ornaments, it is clear that if this crumbling becomes universal, their restoration will be almost tantamount to the re-erection of the building, which, seeing the enormous sum that has already been expended, is a contingency which may well make the economists who sit within its walls to tremble.

Before we consider the different preservative solutions which are proposed to remedy this tendency to decay in certain stones, we will briefly describe the nature of those which are available for architectural purposes; so that the causes of decay and the mode of preservation may be better understood. Among the stones which promise the greatest degree of durability is granite; not that it is entirely unsusceptible of alteration, since the crystals of felspar contained in it are liable to decomposition from the action of the carbonic acid held in solution of rainwater. But if this were the only objection to its use, we should attach little importance to it, the verticle position of the stones in a building rendering it impossible for the rain to remain on them sufficiently long to exercise a seriously injurious action, the roughening of the surface observable in very old erections of this material being attributable rather to the mechanical action of the falling rain, than to a chemical action arising from the carbonic acid contained in it. There is, however, a more serious objection to the employment of granite than this, and this is its cost. Of course this does not arise from any scarcity of the material, but from its excessive hardness, which renders it difficult to work; and for the same reason it could not be employed in buildings of a florid style of architecture. There are freestones, which are scarcely inferior to granite in hardness and durability, but these very qualities tend to prevent their general use. The Crayleith stone, which is a good deal used in Edinburgh, is of this kind. It is composed of fine grained quartx and mica, cemented together by a hard, siliceous compound. A similar kind of stone is that used in paving London streets, which is got chiefly from Yorkshire, and is very hard. It is a laminated stone and is liable to flake off when exposed to the wet. There is an instance of this tendency to be seen in the south-east corner of Victoria Square, where the action of the water has had full opportunity of developing itself, with little interference from other causes, very few people indeed walking over it. These sandstones are of different qualities, some being much harder than others; but their lamination would prevent their use in buildings where the ornamentation was elaborate, even if there were not the further objection of hardness. Moreover, in the case of those where carbonate of lime or clay forms the cement which binds the particles of quartz and mica together, the impurities contained in the rain which falls over large cities readily act upon them by dissolving the cementing medium, and consequently destroying the adhesion of the particles of which the stone is composed.

Some of the best building materials at our disposal are the limestones. First in beauty is marble; but its scarcity, and consequent dearness, renders it unavailable for general purposes. Still it may be questioned whether, if it had been foreseen that the Houses of Parliament were to begin decaying before they were finished, it would not have been cheaper in the end to have built them of this stone, seeing that it does not absorb water, and is not acted upon by it unless it contains an acid, so that decay is a thing hardly to be thought of. As to the difficulty of obtaining it in sufficient quantity, that might have been overcome by resorting to other countries. We import considerable quantities of Caen-stone from Normandy, and the expense of freight would not be greatly increased by sending vessels to the Mediterranean, close to the shores of which marble could be quarried to almost any extent. Resembling marble, but containing veins of foreign substances which both weaken it and interfere with its working is the stone termed by geologists carboniferous limestone, but more commonly Portland-stone. This was used by the late Sir C. Barry for the beautiful building he erected at Birmingham, known as King Edward's Grammar School, the design of which is similar to that of his great work at Westminster. It has stood for twenty-five years without showing any signs of decay, except on the undersides of the cornices, string-courses, and projections in the bed-joints, arising from the drip of rain. The quarry from which this was taken is the Darley Dale, and we are assured, by an authority on whom we can rely, that no stone used in Birmingham has withstood the action of the gases contained in the air so well as this. If we judge by experience of the durability of stone, which, after all, is the best test, we presume there are few who will deny that Portland-stone is that which, in this country, should be employed for our public buildings. Look at Somerset House, some of the City churches, and Greenwich Hospital. They do not offer any signs of decay, notwithstanding the length of time which they have been exposed to the influences of the weather. The composition of this stone is almost identical with that of marble, that is to say, almost pure carbonate of lime.

Caen-stone differs in quality, like all others. Some specimens are to be found in good preservation which have withstood the wear of centuries; others, again, have decayed almost immediately on removal from the quarry. We have a striking example of this in Buckingham Palace, which was no sooner finished than portions of it had to be removed and stucco substituted in its place, and to prevent the spread of the evil, the whole front has been painted. Bath-stone, which was that selected by the Dean and Chapter for the restoration of portions of Westminster Abbey,—rather, as we think, on account of the ease with which it could be carved than by reason of its cheapness,—is the worst of all. True it is that buildings can be pointed out at Bath which were built of this stone a century ago, and yet are in good condition; but these stones may have lain in the quarry exposed to the air for months before being used, and any body who desires to see the difference which this makes in the hardness of the stone, has only to cause a block which has been left under these circumstances to be turned over, and then try the point of his knife alternately on the side which has been exposed to the air, and that which has been in contact with the ground. Probably everybody has heard of the rapidity with which the restored parts of the Abbey reverted to their original condition.

Magnesian limestone is that used in building the Houses of Parliament. When thoroughly crystalized it contains equal parts of carbonates of magnesia and lime, and in this state is generally very durable. The Commission appointed to select the stone were shown buildings composed of magnesian limestone from Bolsover, which had stood for ages, and they decided in favour of the same material. So far they were justified in their selection; but it may be questioned whether, when it was found that this quarry did not contain anything like sufficient stone for the purpose, a similar stone from other quarries should have been accepted, without first submitting it to a rigorous examination. There can be no doubt that had proper care been taken in inspecting each block as it was hewn in the quarry, and it had been properly hardened by exposure to the air, and protected from rain, the present alarming condition of the building would never have arisen. The absorbent properties of these stones facilitate the action upon them of the gases contained in the atmosphere; and it is only just to mention that the Houses of Parliament and the Abbey have been more severely tested in this way than any other of our public buildings, from the quantity of gases vomited from the chimneys and factories on the opposite bank of the Thames being borne across to them whenever the wind does not blow in a contrary direction. The result of this action shows itself very rapidly in those parts of the stone where the crystallization is not complete; they become soft, and are ultimately reduced to powder. Of course the proper way of guarding against this accident is to reject those blocks in which the crystallization is imperfect; and, though this would involve increased expenditure in the erection of a building, it would be sound economy to do so.

From what we have said of the composition of stones, it will be seen that those which are best suited for buildings in the Gothic, or any similar style of architecture, are, by the possessiou of that very quality, unfit for employment in the erection of edifices subject to the action of an atmosphere like that which envelopes London and other large cities, unless they can be protected from this action by the application of a substance of some kind. All men are agreed as to the necessity of this; the point on which they differ is the kind of substance to be employed. In the case of Buckingham Palace, paint was the means adopted to arrest further decay, but the objection to paint, apart from its unsightliness, is, that it is no sooner laid on than it begins to yield to influences similar to those it is used to guard against; the oil decomposes and gradually separates from the lead, and the dirty-looking, blackened surface, slowly flakes off, and the whole process has to be gone over again in the course of a year or two. Moreover, the idea of going to the expense of raising a structure of stone, and then painting it, would be considerably more absurd than employing the same means with the view of improving the appearance of the lily. That the fronts of so many large houses in this city are painted, is owing to the use of stucco, which must of necessity be painted in order to give it a false appearance of being what it is not. To preserve stone effectually from the action of the air, and at the same time to allow it to retain its natural beauty, is the problem which chemists have to work out. How far the inventors of the different preservative solutions now in the market have attained this object, is a question which we conceive is not yet decided; at the same time, the fact that these processes are patented is an obstacle to others making researches in the same direction, inasmuch as the number of substances available for the purpose is so limited that it would be difficult to avoid what might be held to be an infringement of patent rights. The method of preserving stone by coating it with a siliceous solution was known to, and employed by the ancients. Colonel Rawlinson says, that he saw, at Behistun, a stone surface, several hundred feet in extent, which was covered with engraved characters, made about 500 years B.C., which yet offered only partial signs of decay, from having been coated with a flint varnish having the appearance of somewhat opaque glass. The discovery of a preservative process of this kind is so simple, that there is no doubt it would have been made ages ago if our forefathers had seen the necessity of guarding against decay in the magnificent structures they raised; but it seems they must have possessed more skill, or exercised more care in the choice of their building materials than we are in the habit of doing, seeing that their edifices remain almost uninjured after the lapse of centuries, while ours begin crumbling to pieces before they are well finished.

With the discovery of the water-glass in recent times the name of M. Fuchs, of Munich, is associated; but his efforts to bring it into extensive use in England were almost ineffectual, though it probably gave the clue to the different modifications of the process now in use. Kuhlman, a French chemist, and others, took up the subject, and experiments were undertaken with the view of making the discovery available in protecting stone, wood, and even mortar used in sub-aqueous works, from decay. All the processes employed are based on the fact that common flint is soluble in a caustic alkaline solution, at a very high temperature, say of 300° Fahr., or thereabouts. This solution is as easily applied to a surface as though it were water; but when so applied, an exposure for a greater or less period,—but in no case a very long one,—renders it extremely hard. The new surfaee would be a hydrate of silica, and, as such, would be liable to the action of the alkaline carbonates contained in the atmosphere; but it is asserted by Kuhlman that when this solution is laid on stone there is a further decomposition, the result of which is to coat it with a silicate of lime, which is not susceptible of this action.

There is room for doubt whether this really does take place in Kuhlman's process; but, as regards Ransome's, there can be no doubt about it, inasmuch as it is obtained by applying two different solutions, the result of which is to produce silicate of lime by double decomposition. His method consists in applying the silicate of soda, prepared in the manner described above, to the stone, and then laying on a solution of chloride of calcium. The result is that silicate of lime is formed, which attaches itself to the stone as closely as silver does to a copper plate in electrotyping, and common salt, which is washed off. Theoretically, nothing could be more certain and perfect than this result; but the experiments tried with it at the House of Parliament seem to prove that in practice it is not altogether so free from defects as it ought to be. The reason of these partial failures, however, we ascribe rather to the conditions under which the experiments were made. At the lectures delivered at the Royal Institution, specimens of stone operated upon by this process were exhibited by Professor Ansted, which were all that could be desired.

Szerelmey's process is so far a secret that it has never been described by the inventor; but, from what has been ascertained, it seems that it differs from Kuhlman's only in the subsequent application of a bituminous solution, or, at any rate, in the addition of bitumen at some stage of the process. Whether this is merely to protect the stone from the atmosphere while the silicate of lime is in course of formation, or whether it enters into the composition of the preservative solution and becomes a constituent part of it, we are, as yet, unable to say. Flint itself, it is said, contains a small portion of bituminous matter, to which it owes its colour, and, therefore there would be no difficulty in adding a little more, if such a course were found advisable. Whatever preservative process may ultimately be preferred, this is accepted as the best at present, but time alone can determine whether it really is so or not. In the letter written by "An Architect," it is stated that the composition applied by M. Szerelmey to the walls of one of the courts at Westminster during the summer is still soft, and can be scratched of with the nail; but we do not think that this is of much importance, unless it be shown that in consequence of this softness the surface beneath continues to decay.

The reason of the partial failure in those cases where the solution has been applied, arises, we conceive, from the condition of the stone at the moment of its application. The surface was frequently rotten; and, where that was not the case, there was, in all probability, so great a quantity of moisture present in the stone that the chemical action was checked, or together prevented. It has been suggested that there was another cause of its flaking off, arising from what has been termed "nitrification"—in other words, the formation of crystals of nitrates, which is frequently observed in stone surfaces, and on the plaster which coats the walls of damp rooms. Whatever may have been the cause, there is no denying the fact that the attempts to cover the stones of the Houses of Parliament with a siliceous varnish, as Colonel Rawlinson terms it, have been almost ineffectual, chiefly, we believe, from the conditions under which it was applied, and the remedy for which we propose to develope.

It will be seen that the difference, if difference there be, between the processes described is so very trifling that the results in either case would be pretty nearly equal. The objection to Kuhlman's, that, in consequence of the slowness of the decomposition of the ingredients of which it consists, it is unfit for use in a climate so changeable as ours, where a shower of rain would probably intervene before the process was completed, and wash off the solution, is as applicable in a minor degree to all the others. But we submit that there is not the slightest necessity for incurring this risk in future. Instead of applying the solution to the building, let it be applied to the stones while in the stonemason's yard. This is a point which we have not seen mentioned in anything we have read oh ths subject. We cannot conceive what difficulty there could be in cutting the stones and then leaving them under shelter, but exposed to a current of air to evaporate the moisture out of them. In this way they would become dry, and, as they dried, they would harden. The pores of the stone being thus freed from moisture, they would absorb the preservative solution into them just as a sponge sucks up water, by capillary attraction; so that it would not be merely a surface protection, which might be gradually destroyed by the mechanical action of the rain driven against it by a high wind, but a solid mass of material, alike unassailable by the chemical action of gases in the atmosphere, or by the mechanical attrition of the particles of dust and rain. This need involve no additional cost for materials, and its adoption would not only obviate the objection to the employment of soft stones, but, as we believe, actually render them preferable, as being even more imperishable than the finest marble; and in the case of magnesian limestone imperfectly crystalised, which, under ordinary circumstances, crumbles to powder, would entirely prevent this decay from being of material consequence by indurating the stone to so considerable a depth.

There is another method of applying the solution which might be even more effectual, but in the case of a large building it would greatly increase the cost, though, if it is a question between raising a building which will endure and one which will require to be renewed piecemeal, the greater outlay in the first instance will be the most economical. Suppose we are using Bath-stone: this can be sawn up when freshly quarried in blocks of any convenient size almost as easily as if it were wood. These blocks may then be placed in an air-tight vessel, and the air exhausted until the stone became desiccated; the solution being then admitted, would be forced into the pores of the stone so thoroughly that there would be no danger of ultimate decay.

We see no reason to doubt that the employment of either of the above methods of applying the preservative solution would have the effect of rendering the stone to which it is applied impervious to all injurious influences; if it be not so, then all future controversies as to the suitability of a modification of the Gothic style of architecture for our public buildings will be vain and ridiculous, and the only course open to us as a nation gifted with common sense, will be to adopt a style in which we may employ the very hardest material at the smallest possible expenditure for mere ornamentation. Hitherto it appears to have been the custom to select the design for the building in the first instance, and to make the choice of material a secondary consideration; in future, unless a perfect preservative solution is employed, it will probably be thought advisable to reverse this order of proceeding.

New Mercurial Electric Light.

The *Chemical News* of Sept. 14th gives a description of this new source of Light, and notices some theoretical objections to its general use as one of the ordinary sources of illumination.

This mercurial lamp seems to be the last improvement which was needed in order to render the magneto-electric machine of Professor HOLMES of practical everyday value. By the latter instrument a two horse power engine is all that is required to grind out a perpetual, and intensely energetic magneto-electric current; whilst Professor WAY's new discovery gives us an equally simple and effective lamp. The magneto-electric machine enables directly to convert motion into electricity; and this new lamp receives the electricity and converts it into light. Nothing can be simpler,—nothing can be more perfect.

The light which mercury gives when a voltaic spark is taken from it is of a very peculiar character. Unlike the light between carbon poles (the ordinary electric light) which evolves rays of every degree of refrangibility, and is consequently capable of illuminating any object with the exact colour which it is best able to reflect, the voltaic light from mercury consists of only six definite and homogeneous colours, each occupying a particular space in the solar spectrum and having wide black intervals between them. The first colour is a faint brick red, the second is a strong yellowish orange, the next a strong emerald green followed by a fainter green of nearly the same colour; then comes a rich ultramine blue, and lastly a violet. Several invisible rays in the chemical end of the spectrum are also present, but as none of these can be rendered sensible, except by special and complicated arrangements, and only one of them is capable of passing through glass at all, they need not further be referred to here. It will be seen from the above how different the mercurial light is from any of the ordinary sources of illumination.

The following details are abreviated from *the Engineer*:—" A fine stream of mercury, which can be regulated according to the battery power and the volume of light required, passes from an upper into a lower reservoir, and is made to conduct the electric current, by means of which it becomes intensely heated and partly dissipated in vapour. The vaporised mercury becomes subsequently condensed, and proceeds to the lower reservoir, whence it again issues, when the upper reservoir is exhausted and the apparatus reversed. The evolution of light by the passage of the electricity through the fluid conductor appears, however, to be due, not alone to the heating effect, but also, as in the case of the light from charcoal points, to the intensity of the current employed. The employment of a mercury stream as a conductor fulfils conditions which would probably be wanting in any other substance which could be used for the purpose of obtaining light by similar means. Thus, although some illuminating effect may be produced by heating platinum wire to whiteness by a quantity current, this conductor is deficient in those characters which enable us, by means of tension electricity, to obtain light from charcoal points, interrupted metallic conductors, and the mercury stream of Professor Way. If, on the other hand, we interrupt the wire, we obtain the electric spark which appears in making and breaking contact with mercury; but we fail to produce the heating effect upon the conductor, to which the illuminating power is partly due in the arrangement under notice. It is obvious, moreover, that the constant renewal of the conductor renders it possible to employ the current of any degree of power, and which would be otherwise inadmissable. The vertical mercury stream must be considered as composed of a multitude of conducting globules separated by an imperceptible interval, and thus affording the vivid spark which occurs in making and breaking contact with the metal. This hypothesis affords an explanation of the fact, that an equal illuminating effect cannot be obtained with a *horizontal* stream of mercury, although the later may be heated to an equal degree. It should be observed, that the apparatus of Professor Way, which may probably before long be employed in lighthouses and for signalling, is rendered airtight, so as to preclude the possibility of any injurious effect arising from escape of vaporised mercury.

Production of Valuable Manure from the Air, by MM. Marguerittc and De Sourdeval.

The value of guano and most other concentrated manures consists to a considerable extent of the ammonia which they contain. As three quarters of the atmospheric air consists of nitrogen, and as hydrogen forms one ninth of all pure water, if some cheap means could be found for inducing the hydrogen of water to enter into combination with the nitrogen of the air in the form of ammonia, this valuable manure could be produced in unlimited quantities, and the agricultural products of of the world enormously increased. The efforts to do this have been, at last crowned with success, as will be seen by the following abstract of some recent continental researches.

Since the remarkable labours of Messrs Liebig, Schalttenmann and Kuhlmann, on the fertilising action of ammoniacal salts, the production of ammonia at a low price has become a problem of the highest interest to agriculture. But to arrive at this result it is necessary to obtain the nitrogen elsewhere than in the nitrogeneous matters; which may, for the most part, be employed directly as manures, and of which the limited quantities and elevated price permits in any event only restricted and costly manufacture.

Atmospheric air is an exhaustible and gratuitous source of nitrogen. However, this element presents so great an indifference in its chemical reactions, that, notwithstanding the numerous attempts which have been made, chemists have not heretofore succeeded in combining it with hydrogen so as to produce ammonia, artificially. This result, so long desired, has been reserved for MM. Margueritte and De Sourdeval, who have obtained it by employing an agent of which the remarkable properties and neat and precise reactions have permitted them to succeed where all others had failed. This agent is baryta, of which notice has recently been taken on account of the recent applications that M. Kuhlmann has made of it in painting, but of which no person suspected the part that it was to be called to play in the development of the agricultural riches of our country. The manufacture of ammonia is based on a fact entirely new, the cyanuration of barium. It had been believed until the present time that potash and soda alone had the property of determining the formation of cyanogen; that the earthly alkaline bases—baryta, for example, could not, in any case, form cynanides.

Messrs. Margueritte and De Sourdeval have ascertained that this opinion is entirely erroneous, and that baryta, much better than potash or soda, fixes the nitrogen of the air or of animal matters in considerable proportions. It is already understood that, for the preparation of Prussian blue, the cyanide of barium presents great advantages over that of potassium, for the equivalent of baryta costs only about the one seventh of that of potash. Thus do we find practically and really obtained the result first announced by Desfosses and vainly pursued in France and England, the manufacture of cynanides from the nitrogen of the atmospheric air. This solution, so important, depends on the essential difference which exists between the properties of baryta, and those of potash; the first is infusible, fixed, porous, and becomes deeply cyanuretted without loss; the second is fusible, volatile, and becomes cyanuretted only at the surface, and suffers by volatilisation a loss which amounts to 50 per cent. After the cyanide of barium was obtained, the grand problem for Messrs. Margueritte and De Sourdeval to resolve was the transformation of the cyanide into ammonia by means at the same time simple, rapid, and inexpensive. The following is the operation:—

In an earthern retort is calcined, at an elevated and sustained temperature, a mixture of carbonate of baryta, iron filings in the proportion of about 30 per cent., the refuse of coal tar, and sawdust. This produces a reduction to the state of anhydrous baryta, of the greater part of the carbonate employed. Afterwards is slowly passed a current of air across the porous mass, the oxygen of which is converted into carbonic oxide by its passage over a column of incandescent charcoal, while its nitrogen, in presence of the charcoal and of the barium, transforms itself into cyanogen and produces considerable quantities of cyanide. In effect, the matter sheltered from the air and cooled, and washed with boiling water, gives with the salts of iron an abundant precipitate of Prussian blue. The mixture thus calcined and cyanuretted is received into a cylinder of either cast or wrought iron, which serves both as an extinguisher and as an apparatus for the transformation of the cyanuret. Through this cylinder, at a temperature less than 300° (Centigrade) is passed a current of steam, which disengages, under the form of ammonia, all the nitrogen contained in the cyanide of barium. It is impossible to forsee all the results of this great discovery. Among other things, it suggests the production of nitric acid from the air by oxidising ammonia.

Alteration of the Hardness of Iron by Magnetism.

If a piece of iron that may be readily filed is put in contact with a powerful magnet, great difficulty will be felt in *filing* when in this position.

NOTICES OF BOOKS SUITABLE FOR MECHANICS' INSTITUTE LIBRARIES.

A Course of Six Lectures on the various Forces of Matter and their relations to each other, by MICHAEL FARADAY, D.C.L., F.R.S., pp. 189.

The name of Faraday is sufficient to commend any work on PHYSICAL SCIENCE to the scientific student, but these lectures were delivered before a juvenile audience, and in order that they might be understood the more difficult technicalities of science had to be relinquished and great truths expressed in simple language, easily comprehended. This has been most admirably accomplished by Faraday and they reveal to the eye and intellect of the young lover of science, those mysteries which the harsh, although sometimes inevitable technicalities of scientific works, make them a sealed book to the great mass of readers. All is bright, clear, simple and comprehensible in these short lectures; and although subjects with forbidding names are discussed, they have been rendered attractive and suggestive by the genius of Faraday. The contents of the volume are:

I. The Force of Gravitation.
II. Gravity—Cohesion.
III. Cohesion—Chemical Affinity,
IV. Chemical Affinity—Heat.
V Magnetism—Electricity.
VI. The Correlation of the Physical Forces.

There is appended a chapter on light-house illumination—The electric light—A notice of the electric light is given on the opposite page.

Ure's Dictionary of Arts, Manufactures, and Mines; new Edition, chiefly rewritten, and greatly enlarged. Edited by ROBERT HUNT, F.R.S.F.S.S., &c., &c. Parts I—XII. London: Longman & Co. October, 1860.

This admirable dictionary should be on the shelves of every Mechanics' Institute Library. The present issue as far as it has appeared is a faithful record of the progress of the Industrial Arts and Manufactures, and is invaluable as a work of reference.

Advanced Text-Book on Geology, Descriptive and Industrial, by DAVID PAGE, F.G.S., second edition. Blackwood and Son, Edinburgh, pp. 403, oct.

This work is intended to exhibit an elementary outline of geological science as now established by the leading workers in Britain, France, Germany and America. The main object of the author has been to render the student such assistance as will enable him to proceed in the field as a practical observer, and to read with appreciation the higher treatises, special monographs, papers and new discoveries of others. It is a very well arranged and admirably written text-book. The illustrations are numerous and good—and the glossary is ample and valuable. In a European work designed for students in Europe, the geological characteristics of American formations cannot be awarded much prominence, and therefore, as a text-book for students of Geology in Canada, the present work can scarcely be recommended without it is used subsequently to the volume which forms the subject of the following notice, and if employed as its sequel it will be found of the greatest value and interest.

Elementary Geology, by EDWD. HITCHCOCK, D.D., LL.D. A new edition, (31st) 1860. Ivison, Plimey & Co., Chicago and New York, pp. 430, 8vo.

Dr. Hitchcock has associated with himself his youngest son Charles H. Hitchcock, A.M., in the preparation of the thirty-first edition of this excellent Elementary Geology. The arrangement of the subject has been greatly changed and improved, many chapters having been entirely rewritten and much new matter introduced. The first part treats of DESCRIPTIVE and DYNAMICAL GEOLOGY. II. Palœontology. III. Bearings of Geology on religion. IV. Economical Geology. V. North American Geology. In the last chapter a more detailed description of the boundaries of American series of formations would have been very acceptible and appropriate, also a more detailed notice of Canadian Rocks would have secured a still higher appreciation in Canada than the preceding editions have enjoyed. The last edition makes this work perhaps the best text-book in Geology suitable to mechanics, and students generally, which has yet appeared on this continent.

Principles of Physics and Natural Philosophy; designed for the use of Colleges and Schools. By BENJAMIN SILLIMAN, M.A., M.D., Professor of General and Applied Chemistry in Yale College. Second Edition, revised and corrected. With seven hundred and twenty-two illustrations. Philadelphia: H. C. Peck and Theo. Bliss. 1861.

The publishers of this work inform us that the second revised and re-written edition of SILLIMAN'S FIRST PRINCIPLES OF PHYSICS or NATURAL PHILOSOPHY, covers the whole ground included by Modern Science under its title. It aims at fulness without redundancy, and conciseness without obscurity, and to present all the principles of the science in clear and exact Propositions, mathematically demonstrated. The design of the author has been to present all parts of his subject with harmonious proportions, and still to keep the volume within the limits of time usually assigned to these subjects in the higher Seminaries of learning in the United States.

No pains have been spared to illustrate the work with a great abundance of carefully selected and excellent wood cuts, many of which are original.

The work is comprised in about 725 pages, small 8vo., containing upwards of 700 illustrations. The retail price is $2.25 per copy. Its contents are:—

PART I.—PHYSICS OF SOLIDS AND FLUIDS.

CHAPTER II.—GENERAL PRINICIPLES — Sec. 1. Definitions and General Properties of Matter; Sec. 2. Of Motion and Force. CHAPTER III.—Sec. 1. Direction and Centre of Gravity; Sec. 2. Laws of Falling Bodies; Sec. 3. Measure of the Intensity of Gravity; Sec. 4. Mass and Weight; Sec. 5. Motion of Projectiles. CHAPTER IV.—THEORY OF MACHINERY — Sec. 1. Machines; Sec. 2. Mechanical Powers; Sec. 3. Strength and Power; Sec. 4. Impediments to Motion.

PART II.—THE THREE STATES OF MATTER.

CHAPTER I.—MOLECULAR FORCES. CHAPTER II.—OF SOLIDS—*Molecular Forces acting between Particles of like kinds*—Sec. 1. Properties of Solids; Sec 3. Crystallography; Sec. 3. Elasticity; Sec. 4. Strength of Materials; Sec. 5. Properties of Solids depending on a permanent displacement of their Molecules; Sec. 6. Collision of Solid Bodies. CHAPTER III.—OF FLUIDS—*Hydrodynamics*—Sec. 1. Hydrostatics; Sec. 2. Hydraulics. CHAPTER IV.—OF ELASTIC FLUIDS, OR GASES—Pneumatics. CHAPTER V.—OF UNDULATIONS—Sec. 1. Theory of Undulations; Sec. 2. Undulations of Solids; Sec. 3. Undulations of Liquids; Sec. 4. Undulations of Elastic Fluids. CHAPTER VI.—ACOUSTICS—Sec. 1. Production and Propagation of Sound; Sec. 2. Physical Theory of Music; Sec. 3. Vibration of Air contained in Tubes; Sec. 4. Vocal and Auditory Apparatus.

PART III.—PHYSICS OF IMPONDERABLE AGENTS.

LIGHT. HEAT AND ELECTRICITY.

CHAPTER I.—LIGHT OR OPTICS — Sec. 1. General Properties of Light; Sec. 2. Catoptrics, or Reflection by Regular Surfaces; Sec. 3. Dioptrics, or Refraction at Regular Surfaces; Sec. 4. Chromatics; Sec. 5. Vision; Sec. 6. Optical Instruments; Sec. 7. Physical Optics. CHAPTER II.—HEAT—Sec. 1. Nature of Heat; Sec. 2. Measurement of Temperature; Sec. 3. Expansion; Sec. 4. Communication of Heat; Sec. 5, Action of different Bodies upon Heat; Sec. 6. Calorimetry; Sec. 7. Liquefaction and Solidification; Sec. 8. Vaporization and Condensation; Sec. 9. Spheroidal condition of Liquids; Sec. 10. The Steam Engine; Sec. 11. Ventilation and Warming; Sec. 12. Sources of Heat; Sec. 13. Correllation of Physical Forces. CHAPTER III.—ELECTRICITY—Sec. 1. Magnetic Electricity; Sec. 2. Statical or Frictional Electricity; Sec. 3. Dynamical Electricity; Sec. 4. Electro Dynamics; Sec. 5. Electro Dynamic Induction; Sec. 6. Other Sources of Electrical Excitement.

APPENDIX.

CHAPTER I.—METEOROLOGY — Sec. 1. Climatology; Sec. 2. Ærial Phenomena; Sec. 3. Aqueous Phenomena; Sec. 4. Electrical Phenomena. Addenda.

STATISTICAL.

Emigration from the United Kingdom.

In the 45 years from 1815 to 1859 inclusive, there left the United Kingdom 4,917,598 emigrants. In the 32 years between 1st January 1815 and 31st December 1846 the emigration amounted to 1,672,156, or an average of 52,254 souls a year. In 4 years only (1832, 1841, 1842, and 1846) did the numbers exceed 100,000.

In 1847 the numbers suddenly sprung up to 258,270; nearly double the number of the previous year, which had been the largest emigration up to that time. They continued to increase, with unimportant variations, till 1852, when the emigration reached its maximum of 368,764. Between 1st January 1847 and 31st December, 1854 the number of emigrants who left the United Kingdom amounted to 2,444,802, equal to 305,600 a year.

After 1854 the emigration declined as rapidly as it had grown, amounting in that and the three subsequent years to only 680,208 souls, or on an average 170,052 souls a year. In 1858 it fell still lower, amounting to only 113,972; in 1859 it amounted to 120,432 souls.

The causes of this sudden decrease are not far to seek. They are to be found in the increased demand for young men in the army and navy, and the departments connected with them, arising first from the Russian war and afterwards from the Indian mutiny—the rapid improvement in Ireland—and the ample employment now offered in this country for almost every description of labour. Add to this that the years 1857 and 1858 were years of embarrassment and distress on the North American continent, which had not altogether passed away in 1859. The inducement to emigration ceased, therefore, on the other side of the Atlantic at the same time that the inducement to remain became strongest on this.

When emigration was at its highest the great majority of the emigrants were Irish. After 1851 the proportion of Irish began to decrease, and the diminution was continuous and gradual, till in 1858 they formed only 38 per cent. of the whole emigration. In 1859 their proportion was 43·95. The decrease was the natural result of the improvement of the country. That it did not arise from want of funds to emigrate, is evident from the large sums of money still remitted to Ireland by those who have gone to America and Australia.

Returns showing the Amounts of Money remitted by Settlers in North America to their Friends in the United Kingdom from 1848 (the first Year in which we have any Information) to 1859, both inclusive.

YEAR.	AMOUNT.
1848	£460,000
1849	540,000
1850	957,000
1851	990,000
1852	1,404,000
1853	1,439,000
1854	1,730,000
1855	873,000
1856	951,000
1857	593,165
1858	472,610
1859	*621,176

Manufacture of Clocks in Connecticut by Machinery.

In Connecticut there are seven manufactories, employing 1,300 persons, and producing annually 800,000 wooden clocks; in Bristol, 14 manufactories with 400 persons, making 200,000 clocks; Plymouth has three manufactories, with 175 workmen, turning out 75,000 clocks; at Ausonio are two manufactories, with 140 persons employed, who make annually 102,000 clocks; at Winshotrad, one manufactory, with 40 persons, 30,000 clocks; at Southampton, two manufactories, with 45 workmen, producing 40,000 clocks, and, lastly, at Newhaven there are three manufactories employing 400 persons, and making 370,000 clocks, so that in the seven above-mentioned places, there are 32 manufactories, employing 2,500 workmen, and producing 1,617,000 wooden clocks.

The frames of the clocks are stamped out of sheet brass, and all the holes are punched simultaneously by a series of punches fixed at the required distances. The wheels also are stamped out of sheet brass, and a round bedding is raised by a press round their rims, for the purpose of giving them lateral strength. They are cut by a machine having three horizontal axes, carrying each a cutter placed about four inches apart. The first cutter is simply a saw, and the second rounds off the teeth. In cutting an escapement wheel, the first cutter is made to cut each tooth entirely round, and then either the second or third axis with its cutter is used for finishing. The pulleys on the three axes are driven by one driving pulley with three straps working over and in contact with each other. The plates forming the clock faces, and other discs, are cut by circular shears. The beaded rims intended to go round the clock faces, varying in size from fifteen inches downwards, are stamped in concentric rings out of a disc, and then made of the required form by means of dies and a stamping press. The ogee form given to the wooden framing of the common clock, is formed by a revolving cutter of the required shape, making 7,000 revolutions per minute, over which the piece of wood is passed by hand—the requisite pressure downwards being given at the same time. Each clock passes through about sixty different hands; more than one half of the clocks manufactured are exported to England, and of these a large portion are re-exported to other markets."

The Sewing Machine.

According to certain detailed computations, it is shown that the value of the sewing in the United States capable of being done by the sewing machines is as least £58,000,000 per annum, and that Howe's machine, even if applied to the work in the exact form in which he first introduced it, would save to the public £34,000,000 per annum. Looking only at the actual results achieved, the sewing machine has already entered into and revolutionized more than 37 distinct departments of manufacture, besides enlarging many and also creating new ones. In the city of New York alone the yearly saving by the machine is asserted to be $7,500,000 on men's and boys' clothing, $360,000 on hats and caps, and $850,000 on shirt fronts; while in Massachusetts, in the manufacture only of boots and shoes, the labour value of its performance is $7,500,000

* £45,708 of this sum remitted from Australia.

NEW INDUSTRIAL PROCESSES.

New Method of Extracting the Perfume of Flowers.

A new and interesting process is that patented by M. Millon, a French chemist, for extracting the aroma of flowers by means of ether, or sulphuret of carbon, which are both powerful solvents. M. Millon operates in this way:—The flowers are placed in a percolating apparatus, and the ether or sulphuret of carbon poured over them; after leaving them in contact for ten or fifteen minutes the liquid is drawn of, and a fresh quantity added, and drawn off in the same way. This completely dissolves all the odour of the flowers, and leaves them quite scentless. The liquid is then distilled, and the ether or sulphuret of carbon becoming volatilised at a much lower temperature than the fragrant principle, is drawn over alone, and leaves a residue containing all the perfume of the flower. This residue is sometimes quite solid, and sometimes semi-liquid, but it always becomes solid in a short time. It is spread in thin layers, and exposed to the heat of the sun, or some equivalent temperature, until it loses the unpleasant smell of the solvent used. It can be left open for any length of time without evaporating, nor is any degree of natural heat capable of altering the perfume or turning it rancid. It has a much finer flavour than any sort of essential oil, which M. Millon explains by stating that the perfume of a flower always became altered by being subjected to a higher temperature than that of the atmosphere If this residue is treated with alcohol it takes up the odour and colouring matter, and a small portion only of the resinous and waxy matters forming the residue. This alcoholate again treated with distilled water gives up the greatest part of the aroma. Plain water, however has no effect on it. The residue is also soluble in grease or oil. This process is very curious in a scientific point of view, as it is the nearest approach that has been made yet to the insulation of perfume from the substances into which it is usually embodied. It is far from being, however, the actual fragrant principle in a solid and palpable shape, nor has Mr. Millon been able to ascertain exactly what proportion it bears to the flowers used. The residue he obtains averages from one to three grammes per kilogramme (or one to three per 1,000) and when it has been treated with alcohol, and given up all its perfume and coloring matter, the inodorous waxy substance left seems to have lost scarcely a few hundred parts of its weight. M. Millon tried to isolate the aroma from alcohol by distillation, but it became lost in the operation, and on his trying to evaporate it with distilled water the water became perfumed, but without leaving the fragrant principle floating on the surface, as is generally the case. He found it therefore, theoretically and practically impossible to solve that interesting question. This process has not yet received any application on a large scale.—*Journal of the Society of Arts.*

On the Preservation of Flesh, by Verdeil.

Having been separated from the bones, and, as far as possible, from fat, the flesh is cut into slices from one to five centimetres (one centimetre = 0·3937 inch) in thickness; the slices being cut as nearly as possible across the grain of the flesh. These are now laid upon hurdles of basket-work, which are subsequently placed in a chamber. As soon as a sufficient number of the trays have been introduced into the chamber, it is closed, and steam under a pressure of three or four atmospheres consequently of 135° to 142° C. [= 273° to 293° F.] is admitted through several openings.

The chamber which may be of lead or iron, must not be absolutely tight, and a small outlet for the steam being necessary, in order that the pressure may not become too great.

After from six to ten or fifteen minutes according to the kind of flesh and the thickness of the slices, the steam is shut off, this part of the process being finished.

The flesh is now very nearly in the condition of boiled meat, but has retained all of its ingredients, the albumen having been coagulated; its taste recalling that of roasted meat. It presents a wrinkled appearance, is of a grey color, and may be readily divided.

Being removed from the steam chamber, the flesh is now placed upon trays, or hung upon hooks, in another chamber, which is warmed, but in which the temperature is never allowed to exceed 40° or 50° C. [= 104° to 122° F.] The drying process is completed in the course of eight or twelve hours.

Packed in tight casks or in tin boxes, so that it may be protected from the action of moisture, and from insects, the flesh thus prepared may be preserved for any length of time which may be desirable. It is nevertheless well to place a layer of salt in the casks, in order that it shall absorb any moisture which the flesh may have retained. Before using this meat it must be soaked for an hour or two in warm water in which it softens and regains its original condition. When boiled with water it affords an excellent soup and passes into a condition in which it cannot be distinguished from fresh meat.—*Le Génie industrial, Boettgir's polytechnisches Notizblatt*, xv. 71.

Electro-Zincing by MM. Person and Sire.

In a hundred parts of water dissolve ten parts of alum, and one of oxide of zinc; this zinc-bath should be kept at a temperature of 15° C. The pieces of metal which are required to be coated with zinc being previously well cleaned, are arranged so as to form the negative pole of a battery, and for the positive pole one or more pieces of zinc are introduced, according to the shape of the articles to be zinced, and having as near as possible the same amount of surface. Contact with the battery being made, by the current from one pair of plates, the dimensions of which should vary according to the surface to be coated, the precipitation of zinc proceeds as easily as that of copper in the ordinary electrotypic process, the deposit taking place indifferently on any metal, on platinum as well as on copper or iron. When copper, coated with zinc, is heated, there is produced a coating of brass; this transformation is likely to receive many applications. The elevation of temperature of the zinced iron augments the adhesion of the surface of zinc. MM. Person and Sire state that the thickness of the layer which is deposited increases in proportion to the time occupied in the deposition; that the reduced zinc has all the properties of the purest metal; and that it completely prevents the oxydation of the object which it coats.

Bitumenised Paper Tubing.

An experiment was made in the Spring of the present year under the Great Clock Tower, Westminster, for trying the strength, by Hydraulic pressure, of a new description of tubing, composed of bitumenised paper, invented by M. Jaloureau of Paris. M. Jaloureau is a contractor for paving Paris, and other towns in France with bitumenous concrete. It happened in the course of his experiments, that some paper which had been coated with bitumen was laid aside in a coiled form, and after some time it became very stiff and solid. Pursuing the idea which thus accidentally occurred to him, M. Jaloureau put several layers of bitumenised paper round a cylinder, and submitting them to internal pressure, he found that a tube a quarter of an inch in thickness was capable of resisting a pressure of 250 lbs. to the square inch. The municipal authorities of Paris tried these tubes for the conveyance of gas, and in the recent experiments made here a piece of tube was produced, which, though stated to have been under ground in Paris as a gas pipe for twelve months, had the appearance of being a new pipe. The tubes subjected to the pressure of the hydraulic pump, bore a strain of 250 lbs. to the square inch without bursting, which is more than they would be ever called on to bear in ordinary use. One of the tubes, half an inch thick, and with a bore of two inches, was also tested by weight, and it only gave way to a pressure of 428 lbs., the bearings being three feet apart. It was stated that the tubes might be submitted to a temperature of 160 degrees of Fahrenheit without any deterioration of the material. The cost of the tubing is said to be less than half that of the ordinary iron piping.

Cheap and Expeditious Method of Preserving Timber.

The method pursued at Closeburn, by the late Sir Charles G. S. Menteith, in preparing wood for the purposes of building, was to saw it into such lengths at the occasion demands; next, to plunge the planks or beams into a pond, of suitable dimensions, having the bottom and sides rendered water-tight. Before receiving the wood, a quantity of fresh-burned lime was thrown into the pond and well-stirred with the water, to dissolve as much as possible of it. Into this strongly-impregnated solution of lime-water the planks or beams were then thrown. As lime-water absorbs carbonic acid from the air, the lime previously held dissolved in the water becomes insoluble and falls to the bottom, and becomes carbonate of lime. Hence the necessity of now and then throwing in fresh portions of recently-calcined lime, that the solution may maintain its strength.

With respect to the time that it is necessary to soak the wood in lime-water, it must depend very much upon the thickness and texture of the wood; roofing timber of fir will require at least a fortnight; larger and closer grained wood, as oak and other ship timber, ought to be steeped for three or four weeks, or even a longer time.

After removing the wood from the lime-water pond, it must be allowed to dry and season before it is used.

Among the benefits that this preparation of wood by the late Sir C. G. S. Menteith presents, we may safely enumerate the following, viz:—

1. The lime which is absorbed by the pores of the wood appears to alter or destroy the albuminous and saccharine principles, and, destroying the food of the worm, saves the wood from its ravages.

2. The last elements, the albumen and sugar, having been so acted upon by the lime, there is less apprehension of the wood being infected by the dry rot.

3. The wood soaked in lime water becomes firmer in texture and more durable. It is the well-known property of waters holding lime in solution, called "petrifying wells," to penetrate and deposit upon all substances exposed to their influence small crystals of carbonate of lime. When wood is plunged for some time in a strong lime-water solution, a slight petrifaction of the wood is observable. The carpenter who has to work up the wood taken out of the lime-water pond, complains grievously that the edge of his plane is constantly blunted, and re-

quires to be again and again sharpened. This arises from the small crystals of carbonate of lime covering the surface of the wood, and also from their having insinuated themselves into the pores of the wood; the plane coming in contact with these has its edge taken off. Were the wood, prior to being put into the pond, smoothed with the plane, this objection of the carpenter would be prevented.

Photography—The "Instantaneous Process."

"It is always desirable that the photographer should have at his command the means to take that limited class of pictures or views in which there are moving objects—such as street views, vessels in motion, &c. For this object, different methods, called 'instantaneous processes,' have been devised. The following is one that has never been published, and gives very good results:—The first thing to be done is to make a very sensitive alcoholic collodion, as follows:—To 4 fluid ounces of sulphuric ether (sp. gr. ·720), add 4 fluid ounces of 95 per cent alcohol; in this, dissolve 140 grains of soluble cotton made in rather weak acids, so that it has a short structure, and, when all dissolved, add 12 fluid ounces more of alcohol which finishes the plain collodion. To 20 ounces of this collodion, add 2 fluid drachms of a saturated solution in water of iodide of potash and 30 grains of bromide of cadmium: allow the undissolved particles held in suspension to subside, and the collodion is complete. Use a neutral 45-grain nitrate of silver bath; develop with water, 16 ounces; protosulphate of iron, 1 ounce; acetic acid (No. 8) 1 ounce; alcohol, 1 ounce. Fix the picture, as usually done, with cyanide of potassium. When the picture has been thus far complete, it lacks the required degree of intensity for a negative, and the following method is resorted to for this object:—After it has been fixed and well-washed, pour over the plate a saturated solution of bi-chloride of mercury, after which wash the plate well; then pour over it some water in which 2 or 3 grains of iodide of potassium or iodide of ammonium, (which is the best) have been added to the ounce, when the plate is to be again well-washed. If the intensity is not sufficient, this process is repeated until the required intensity is obtained."—(*Humphrey's Journal of Photography*, by L. M. Dornach.)

MISCELLANEOUS.

Proposed Private Telegraph Extension.

The establishment of private telegraph wires in the United Kingdom is rapidly rising in public estimation. In order to obtain privacy of information and almost instantaneous communication between public or private offices, the Universal Private Telegraph Company has been instituted in London.

Instead of having wires as in ordinary cases, they suspend from posts a rope containing a multitude of wires—perhaps thirty, or, if that is not enough, forty or fifty, or more. One feature of such a plan is, that all parties can have a telegraphic communication at a very reasonable rate. The expense of erecting telegraphs according to the patent system, is about £65 per mile; but by the plan proposed by the new company, of multitudinous wires, parties were enabled to rent a wire at a sum of £4 per mile per annum. Therefore, merchants residing, one, two, or three miles from their places of business, or having places of business so far apart, can have private communication at either £4, £8 or £12 per annum. Another great feature connected with the establishment of this company is this, the apparatus is so simple, that parties require no instruction in the use of it. To send a message it is only necessary to press the key opposite any of the letters of the ordinary English alphabet, which are marked on the index, and by turning a little handle the message is immediately transmitted to a corresponding instrument at the other end. Another thing connected with the instrument is the total absence of battery power, the current being produced by turning a piece of soft iron near a magnet. The power being so generated, and the magnet not being liable to deteriorate, the instrument is at all times in perfect order. People might leave their houses for six months, and when they went back they would find it in order.

In Manchester, Mr. W. Fairbairn, the eminent engineer, had consented to carry out the principles of the company, and Professor Wheatstone had undertaken the management in London. Mr. Reuter also intended to have wires erected between his office in the Exchange and all the principal newspaper offices in London; and it was also contemplated to lay wires from the Houses of Parliament to the several newspaper offices in the same way. In London all the stations were being connected, and lines of communication were being extended in every conceivable direction. In Glasgow many of the leading firms had already consented to co-operate with the police, and no fewer than twenty-three of these firms had become shareholders in the company, not only because they approved of the system, but also on public grounds, that there might be no doubt of its being carried out.

Lighting Picture Galleries by Gas.

The Commission consisting of Professors Faraday, Hoffman, and Tyndall, Mr. R. Redgrave, R.A. and Captain Fowke, R E., appointed for the purpose of reporting to the Lords of the Committee of Privy Council on Education *On the Lighting of Picture Galleries by Gas, and on any precautions (if necessary) against the escape of Gas, and the products of its combustion, report as follows :—*

There is nothing in coal gas which renders its application to the illumination of Picture Galleries objectionable. its light, though not so white as that of the sun, is equally harmless; its radiant heat may be rendered innocuous by placing a sufficient distance between the gas jets and the pictures, while the heat of combustion may be rendered eminently serviceable in promoting ventilation.

Coal gas may be free from sulphuretted hydrogen compounds, and in London is so at the present time; it then has little or no direct action on pictures. But it has not as yet been cleansed from sulphide of carbon, which, on combustion, yields sulphurous acid gas capable of producing 22½ grains of sulphuric acid per 100 cubic feet of present London coal gas.* It is not safe to permit this product of the combustion to come in contact with pictures painted either in oil or water colours; and the Commission are emphatically of opinion that in every system of permanent gas lighting for Picture or Sculpture galleries, provision should be made for the effectual exclusion or withdrawal of the products of combustion from the chambers containing the Works of Art.

The Commission have examined the Sheepshanks' Gallery as an experimental attempt to light pictures with gas, and are of opinion that the process there carried out fulfils the conditions of effectually illuminating the pictures, and at the same time removing the products of combustion. According to the indications of the thermometer required and obtained, it does this in harmony with and in aid of the ventilation, and does not make a difference of more than one degree Fahrenheit at the parts where the pictures are placed between the temperatures before and after the gas is lighted.

* Hoffman.

Glasgow Athenæum.

At the public opening of the class session of the Glasgow Athenæum, Oct. 18th, Sheriff Strathern delivered an able address on the advantages which the Athenæum placed within reach of the industrial classes, and on the success of Scottish students in competing for the certificates and prizes of the Society of Arts.—Subjoined is an abstract of the address:—

Sheriff STRATHERN said the effect of the ever progressive condition of the country had been to drag education along with it; and the state of society would have been singular if improvement in education had not been conspicious as in any other human pursuit. It was satisfactory to know, that the progress of recent legislation had rendered it in a great degree compulsory on workmen in more than one industrial calling, to acquire some learning by making it the condition of employment. But if there was one circumstance more remarkable than another in showing what he now advanced, it was the pleasing and most important one, that from the labouring classes, places of trust, of management, of superintendence—requiring intelligence, integrity, and education—are being filled. Our public works and factories would furnish abundant evidence of the fact, and the growing thirst among the working classes for education and information still further attested it. The advent of cheap literature, about 25 years ago, might have paved the way for this desirable consummation, but he was persuaded its realisation had been mainly attributable to the establishment of mechanics' and other similar institutes throughout the country. Nor did this important phase in the character of the working population stand alone. Among the industrious of the middle ranks has a similar transitional improvement been noted. The youth of the country, destined for commercial life, had been stimulated to stretch beyond the acquisition of mere rudimentary mercantile rules, and sought a higher and still more intellectual flight in the prosecution of their studies. The Metropolitan Society of Arts has done much, especially of late years, to encourage and foster this turn in commercial training, but the immediate cause he believed to be the facilities furnished by the numerous educational establishments and societies with which our large cities abounded. The reports of the past year showed the continuing usefulness of the Athenæum; its annual meetings had been honoured and dignified by the eminent and influential of the city; and the noble and great of the land had been numbered among the lecturers. It was one of the very few institutions in Scotland which formed an alliance with the Society of Arts of London. From that connection much good had already arisen, and the programme for the present session, containing also the results of the last, left no room to doubt the permanency of its benefits. The system of examinations prescribed guarranteed the value of its training; no student could pass if he was superficially taught, and the number who had achieved distinction during the past session incontestibly established the solid character of the tuition and the skill of the teachers. The competitive plan for stimulating study had been most successfully followed by the Society of Arts, and the prizes and certificates which it distributed were not earned by the slothful or careless. Such testimonials were the honourable tributes to assiduous study, and could be purchased by that toil which alone could bring knowledge. These considerations gave worth to such certificates, intrinsically, for to a dunce they had no value,—but to the industrious and zealous such certificates were above estimate. The success of the Athenæum in the last session had been very marked indeed, the success of the Scotch students generally had been very great. About 500 certificates in all had been awarded to students in England, Ireland, and Scotland. Of these, 110 had been assigned to Scotch, and the remainder to English and Irish students.

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 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 Mechanics' Institute Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

The present issue of this Journal is TWO THOUSAND COPIES, and in order that future issues may be as large as is consistent with the duties of the Board of Arts and Manufactures for Upper Canada, it is desirable that Mechanics' Institutes should communicate to the Secretary of the Board the number of copies they are willing to take, with the least possible delay. The attention of Inventors and Patentees is also called to the advantage of communicating at an early date; and the Publishers to whom this Journal may be sent are requested to intimate whether they will be prepared to furnish, from time to time, works for review, of the class likely to meet with favor among the members of Mechanics' Institutes.