THE JOURNAL

OF THE

BOARD OF ARTS AND MANUFACTURES

FOR

UPPER CANADA.

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

(PROFESSOR OF CHEMISTRY AND GEOLOGY IN THE UNIVERSITY OF TRINITY COLLEGE.)

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* Died August 9, and T. B. Harris elected to fill the vacancy.

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THE JOURNAL
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JANUARY, 1863.

PAPER MATERIALS AND THE MANUFACTURE OF PAPER.

One of the great objects of commercial men belonging to certain departments of trade is the production of cheap paper. This useful article is now employed in so many different ways, and is in such constant and increasing demand, that, like cotton, its price is rising beyond all precedent, and unless some new discovery of a material cheaper and more suitable than rags is made, or the public choose to submit to an inferior article, the price of many mental necessaries of civilized life will undoubtedly rise. Paper for printing purposes must be possessed of certain properties, such as strength, smoothness, pliability, tenacity, and a uniform colour, whether pure white, delicate cream, or rose, purple or blue, it matters not which, the colour must be uniform, the surface smooth, and the material strong, or the public will not be satisfied. If any person examines some of the publications now daily or weekly issuing from the English press, they will find that the paper used is often delicately tinted; the *Illustrated London News*, for instance, is printed on paper possessing a very beautiful pink hue when viewed in a proper light. Many of the best descriptions of new works are printed on straw or cream coloured paper, but elastic and perfectly uniform in texture. Colour conceals many defects, and is much used for this object. The number of substances which have been used, with different degrees of success, for the manufacture of paper is almost incredible. Nearly every kind of plant has been experimented upon; shavings, sawdust, hay, straw, rushes, &c., are all even now used more or less for the production of printing paper when mixed with a certain proportion of rags, and alone or mixed together to form the coarser wrapping and room papers.

Even the mineral world has been searched for materials for paper, and a patent was taken out in 1853, in England, for the preparation and use of asbestos, for this purpose. The pulp was mixed with alum, and an indestructible paper produced. The *Mechanics' Magazine*, probably unaware of the patent just named, introduced the following paragraph respecting this new paper material:

"In the Northern States of America, asbestos is found in rather large quantities, in fine, long, silky threads. The low price of this mineral, its power of resisting heat, and its low heat-conducting power, have led to experiments for using it in paper making. This paper contains about one-third in weight of asbestos. The paper burns with a flame, and leaves a white residue, which keeps the shape of the sheet if carefully handled. Any writing in common ink is percepiible, even after the organic substance of the paper is consumed."

The machinery for the manufacture of this important material from rags may be said to be almost perfect, but this perfection has been gained at the expense of much labour, time and money.

Paper in more senses than one has ruined many an industrious and honest man. The very machine which now supplies the world with an endless sheet of paper, invented by Louis Robert, proved the ruin of the liberal and once wealthy firm of Messrs. Fourdrinier of London. They spent $300,000 in giving form and power to this beautiful piece of mechanism, which, with the improvements it has since received, has culminated in the astonishing results which may be now witnessed in certain printing establishments in Europe. Waste cotton or rags, or, for the sake of experimental illustration, a number of old shirts or pocket handkerchiefs, may be put in at one extremity of the machine, and traced through each step in the changes and processes to which they are subjected, until, after a comparatively few minutes, they fall into the hands of the wondering experimentalist, a printed sheet of paper containing the latest news of the day, or a stereotyped engraving of the interior of the late Exhibition at London. By the agency of the paper machine, the old common process of manufacturing this article by hand, which occupied about *three weeks*, is now reduced to *about three minutes*. In all the details of the manufacture, after the pulp is produced, the modern complete paper machine may be said to be perfect. The distance the material has to travel in a large machine, from the time the rags are introduced to the moment when it becomes fit to print on, sometimes exceeds 1,000 feet; and fine writing paper is now made seventy inches in breadth, at the rate of sixty feet a minute. The operations of sizing, drying, and cutting into sheets, is included in the time stated. It is the material from which the pulp is made that is the grand desideratum of the day among paper manufacturers.

Next to rags, straw is generally acknowledged to be the best available material for this purpose. It is largely used for newspapers when mixed with a certain proportion of rags, and the proportion of straw used in connection with rags or paper shavings varies from 50 to 80 per cent.

The cost of making paper from straw or rags is nearly the same, (if the price of the rags are 10 to 12 times as great as that of the straw, where chemicals are cheap, as in England. This arises from the small quantity of pulp which straw gives, being not more than one half its weight, while that of rags is two thirds; the much greater expense of the machinery, chemicals and labour, required in making straw pulp to approach rag pulp in quality, and the market difference in the price of the two articles, owing to the brittleness of the straw paper, its transparency, and its lack of perfect uniformity. As long as the price of rags continues below a certain limit, they will be used for making paper, or largely mixing, at any rate, with straw. But as it appears very probable that the price of rags will continue to rise, and reach a point which must either compel a considerable rise in the price of paper, or the adoption of an inferior article, the successful manufacture of paper from straw or any other fibrous material equally cheap and adapted to the purpose, becomes a very important desideratum.

With respect to one state alone, namely, that of New York, the late census returns reveal the fact that more capital is employed in carrying on the printing trade than in any other business. Six thousand persons are employed in printing, $5,000,000 worth of raw material is used up annually, and the amount of capital invested exceeds $8,800,000 ! These vast interests depend upon paper, consequently upon rags, or on such other materials as may be converted into paper.

The *Scientific American* of December 20, 1862, speaks in favourable terms of paper from maize or Indian corn; but in this case it appears that a mixture with cotton fibre is necessary.

" A few weeks ago, we published some account of the progress made in Austria in the manufacture of paper from the fibre of maize corn. We may learn something from Austria in the manufacture of both cloth and paper from maize fibre, as a substitute for cotton. We have lately examined a very beautiful pamphlet prepared by Professor J. Arenstein, and printed on paper composed of pulp made of maize, cotton, and linen fibre. The quality of this paper resembles that of the fine 'Indian wove' that is used for the prints of steel engravings. We are informed that a great number of works in the German language are now printed on maize paper at the Imperial Printing Office in Vienna. There are also establishments at Vienna and Schloglmule, where maize flax is spun and woven into cloth in considerable quantities. It is to this substance that we wish to direct particular attention at this time. There is no country in the world where the raw material for maize paper can be obtained in such abundance and perfection as in the United States. Its fibre—unlike that of cotton —is not free, but is cemented and imbedded in vegetable gluten and albumen, which require to be removed by chemical and mechanical processes before it is fit for making paper. What the expense of these processes may be we are unable to say; but the present high price of cotton rags warrants us in urging experiments with this material, in the confident hope that it may be economically employed in the manufacture of paper."

Nine cents a pound is now being paid in New York for old newspapers, pamphlets, books, &c., while rags are worth 12 cents a pound, coloured rags eight. In Toronto they scarcely fetch 3 cents a pound.

Rags have never been systematically collected in Canada. There is no doubt a considerable supply, as well as of material for paper stock, might be accumulated; but even were all odds and ends gathered together, the cry would soon come for more. In this age of progress, the means of distributing knowledge broadcast throughout the land must not be checked, and we must earnestly set to work to discover a substitute for rags for paper, or be content with an inferior article, of questionable durability and unpleasant exterior.

THE PRESENTMENT OF THE GRAND JURY AT THE RECORDER'S COURT.

The following paragraphs are extracted from a very voluminous presentment of the Grand Jury at the Recorder's Court, at the close of a recent sitting in this City. The extraordinary want of information on the different subjects which the Grand Ju: y bring under the notice of the Recorder is in marked contrast to the unusually good style, as far as diction is concerned, in which the presentment is worded. It is a pity that where the capability to give expression to wants is so palpable, that the existence of means in our midst, adequate to supply those wants, are apparently unknown or purposely ignored.

" We turn to a more agreeable subject. We believe that the time has now arrived when public attention should be directed to a want which has hitherto been but partially felt. We mean the absence of a public library; not where works of fiction and the lighter elements of *Belles Lettres* may be obtained, but where access may be had to those more sterling works of recondite research, indispensable to the student of science, history or literature, and which should alone be permitted to be read within the walls of the library. In the former instance the Mechanics' Institute, to a certain degree, fills the void, and in the department of Law, Osgoode Hall is to some extent well supplied. We also deem it due gratefully to advert to the courtesy of the learned President and Professors of the University, who always throw open their shelves to any who may wish to consult them, and to aid the inquirer with their advice. But we think unanimously and earnestly, that the city should entertain the project of granting some aid to a library, the property of the city itself. It is true that this suggestion may have the phase of novelty, for we regret to say that few corporations on this side of the Atlantic show sympathy with learning or its votaries, but we are in the hope that Toronto will prove an honourable exception and will lead the way in an altered state of thinking. We would therefore recommend that an annual sum should be appropriated toward such a library, and it seems to us that the Canadian Institute presents an admirable basis for the formation of such an institution. And if arrangements could be effected with the Institute, in a few years a library would exist which, while it would be a source of pride to all connected with the city, would most beneficially react on the tone of thought and the habits of the community."

Besides the splendid library at University College, the Law Library of Osgoode Hall, the Scientific Library of the Canadian Institute, the popular Library of the Mechanics' Institute, to which reference is made in the foregoing paragraph, there is the excellent and rapidly increasing Library of the Boards of Arts and Manufactures.

The following advertisement is a standing one in the Journal of the Board, and has appeared in the different local daily newspapers :—

"The Library of Reference and Model Rooms are open to the public, free, from 10 a.m. till noon, and from 1 to 4 o'clock p.m., daily, and on Tuesday and Friday evenings from 7 to 10 o'clock, in the New Hall of the Toronto Mechanics' Institute.

"The Library contains several Hundred Volumes of valuable Books of Reference in Architecture, Decoration and Ornament, Designing, Encyclopœdias, Engineering and Mechanics, Manufactures and Trades, General Science, Patents of Inventions of Great Britain, the United States and Canada, &c., &c., &c.

"The Model Rooms contain Models of Patented Canadian Inventions, and the commencement of a Museum of Specimens of Foreign and Canadian Manufactures."

The Library of the Mechanics' Institute is open daily from 9 a. m. to 10 p. m., and contains nearly 6,000 volumes.

The whole of the works are now arranged on the shelves, and in the catalogue, on the following plan of classification :—

SECTION I.—Biography.
" II.—History (Civil).
" " " (Natural).
" " " (Religious).
" III.—Novels and Tales.
" IV.—Poetry and the Drama.
" V.—Periodical Literature, Reviews, Magazines, &c.
" VI.—SCIENCE, ART, &c.,—
Agriculture, Botany and Gardening.
Architecture and the Fine Arts—Decorative Art—Music.
Geology, Mineralogy, &c.
Legal and Political Science—Political Economy.
Manufactures, Trades, Commerce—Mercantile Arts.

SECTION VI.—Medical Science, Physiology, Phrenology, &c.
Moral and Intellectual Philosophy, Education, &c.
Natural Philosophy, Astronomy, Mathematics, &c.
Science and Art, General.
" VII.—Voyages and Travels.
" VIII.—Miscellaneous.
" IX.—Religious Literature.
" X.—Library of Reference.
" XI.—Valuable Illustrated Works, &c.

The Library of the Canadian Institute contains
Cyclopœdias, &c., 90 volumes.
Journals, Periodicals, &c., 540 volumes.
Pamphlets, 500 to 1,000.
Jurisprudence, &c., 180 volumes.
Architecture Engineering, 190 volumes.
Zoology, Geology, &c., 300 volumes.
Chemistry, Mathematics, &c., 80 vols.
Travels, Geography, &c., 230 volumes]
Maps, &c., 60 volumes.
History, Statistics, &c., 250 volumes.
Ethnology, &c., 60 volumes.
Biography, Literature, &c., 580 vols.
Novels, &c., 60.
Catalogues, &c., 100.

In addition to these facts, we must call the attention of the Grand Jurors to the following extract from the Consolidated Statutes :—

Con. Stat. of U. C., 54, sec. 243, sub-sec. 4: "For granting money or land in aid of the Agricultural Association of Upper Canada, or of any duly organized Agricultural or Horticultural Society in Upper Canada, or of the Board of Arts and Manufactures for Upper Canada, or of any Incorporated Mechanics' Institute within the Municipality."

We must protest against Grand Jurors making presentments concerning matters respecting which they have not properly informed themselves, however grandiloquent may be the terms in which they choose to express themselves.

A PLEA FOR INEBRIATE ASYLUMS,*

There is no more common source of individual degradation and wretchedness, than the inordinate use of alcoholic liquors; yet there is no vice so prevalent, none so little hemmed in by law, or so lightly condemned by public opinion. The slow but sure steps which the habitual indulgence in drinking to excess leads its victims to disgrace and misery, are not only daily witnessed, but are permitted to progress with scarcely an effort being made to stay them, and often without any apparent compunction on the part of those who appear to be models of propriety, philanthropy, and trust in the mercy of God.

"SHALL WE RECLAIM THE DRUNKARD?" asks Dr. Bovell:

* A PLEA FOR INEBRIATE ASYLUMS, COMMENDED TO THE CONSIDERATION OF THE LEGISLATORS OF CANADA. *By* JAMES BOVELL, M.D., *Trin. Coll., Toronto.*

"It seems strange that one should consider such a question necessary, but really if we reflect on the apathy which exists amongst us as a body of Christians, or as a Nation, it does seem to be very necessary that our people should be asked whether they intend to reclaim the Drunkard, and to interpose to save the rising generation from falling into evil courses. Unfortunately we have not yet fully recognised the magnitude of the evil, nor realized the important bearing which it has on our social system; we are not yet quite aware of the amount of crime which is begotten by it, and how certainly intemperance supplies victims for the prison and the gallows. Everything has hitherto been left to private benevolence; and strenuous have been the efforts to combat the demon passion, but so deep seated is the malady and so surrounded with difficulty, that we fear not boldly to declare that it cannot be left to private interference, nor indeed is it advisable, that in a matter of such consequences involving the liberty of the subject, and it may be, disturbing family relationships, private interposition should be permitted."

Few, perhaps, if we except the clergy, have the same opportunity which medical men possess, of witnessing the effect of habitual drunkenness on the inebriate and his children, to say nothing of the awful misery of a drunkard's home, the blank desolation and despair, without a gleam of hope, which settles on his family; and beyond all these that unknown FUTURE, when a life of weariness and wretchedness is closed.

"The records of our criminal courts annually furnish a long list of cases, from the crime of petty larceny to that of murder, which are traceable to hours misspent in debauchery—to days and nights wasted in drunken revels—to the companionship of fools, who gloried in the degradation which they worked one with the other. Painful as it may be to look on the stupid sot, decaying in body and mind, how much more sad, to realize the train of wretchedness and misery which follow in the track of his depravity—a cheerless home awaits his return from the haunts of his folly—a broken-spirited and care-worn wife, neglected and ragged children —these are sharp irons which enter into his very soul, and add bitterness to a heart not dead to the obligations of duty. But experience proves that by this as by every other vice, the conscience becomes more and more seared, until at length, regardless of all consequences, feelings of shame cease to arise, domestic misery is not recognized, and a career of crime, or the sudden perpetration of some desperate criminal act, plunges the wretched victim into the felon's cell."

All this is but too true. It was written three thousand years ago: "Who hath woe? who hath sorrow? who hath contention? who hath babbling? who hath wounds without cause; who hath redness of eyes? They that tarry long at the wine; they that go to seek mixed wine."

It is the same to-day. The records of our prisons and asylums tell the same story, and bring that story to its sad close. Consumption, broken health, ruined constitution, imbecility, insanity, are the fearful words attached to the names of the intemperate inmates of the prisons and hospitals cited by Dr. Bovell.

The remedy proposed for the increasing evil of habitual intemperance, proposed by Dr. Bovell, is to provide an asylum for inebriates, supported in part by the Government, in part by the labour of inmates and by private benevolence.

"It is proposed at present to ask the Government to establish two Institutions to serve as models for the management and construction of others, as well as to illustrate the benefits which arise from well directed efforts of reclamation. It is, however, an open question as to whether two large Asylums would be better, one in each section of the Province or Asylums in each County to be supported by a local county rate, and therefore under the control of the County Councils."

Dr. Bovell's work is illustrated with a plan of an Inebriate Asylum, from which an excellent idea of the system proposed to be established may be drawn. Work-shops, libraries, reading rooms, garden, racket court and gymnasium are supplied, to wean, by healthful employment and exercise, the inebriates from the fatal desire which reduced them to the sad necessity of becoming an occupant, and to prepare them for once again taking their part in the duties of life with their fellow-men. The whole scheme is distinguished by that philanthropy and singleness of heart which is well known to characterise the author of "A Plea for Inebriate Asylums." It demands the attention of all thinking men, and the special attention of our legislators, before whom the subject will be brought next session. Is is capable of conferring not only many advantages on Society at large, but it is designed to win from the road to ruin and the despair of a miserable death, hundreds who are heedlessly following the one, to find themselves suddenly overtaken by the other. It is a work of great philanthropy, and one which will, we may all hope, if properly carried out, be most assuredly blessed. It has already received the cordial approval of many good and influential men among us, and it safely commends itself to the thoughtful consideration of those who have the power to add this blessing to our country. But it is a work which, although well begun, must be faithfully urged to completion, and no temporary rebuffs or want of sympathy unnecessarily retard its progress. It must be borne in mind that while the foundation even of the building is being laid, hundreds are hastening to ruin, and many unconsciously preparing themselves for an abode in it, where they may find the means of regaining their lost position and self-respect. It is a work which recalls to the mind the warning: "He who putteth his hand to the plough and looketh back, is not worthy of the kingdom of heaven."

We congratulate Dr. Bovell on the excellent plea he has advanced in favour of the wretched inebriate, and we earnestly hope that so excellent and philanthropic an effort will meet with the warmest encouragement, not only from our legislators but from all who can feel a lurking wish to save the drunkard from the misery which awaits him, and his children from the sorrows of which they are the almost certain inheritors.

MR. E. B. SHEARS ON PETROLEUM GAS.

Mr. E. B. Shears, of Clifton, C. W., has forwarded a printed circular and a description in manuscript relating to his process for making illuminating gas from Petroleum, for publication in this Journal. As the printed circular is not merely a very lengthy advertisement of his business, but contains besides a number of statements which appear to be contrary to fact, we refrain from giving it insertion. If Mr. Shears had not intimated to us in a letter which accompanies the printed circular that he has already distributed that document, we should have refrained from making any allusion to the discrepancies which it embodies. With reference to the manuscript portion of Mr. Shears' communication we shall omit those portions which narrate the history of what Mr. Shears calls his "discoveries," being contented to refer him to the *American Gas Light Journal* for the details of his process published early in the present year, and to the patent which was taken out by parties in Philadelphia for an apparatus designed to accomplish the "discoveries" claimed by Mr. Shears, some months before he states "he conceived the idea." Mr. Shears may have made his "discovery" independently of the *American Gas Light Journal* or of the Philadelphia patentees; but it is reasonable to suppose that one who attaches to his name the designation "Gas Engineer" would peruse the only publication devoted to gas illumination issued in the United States, and before he takes out a patent would endeavour to see that he has not been anticipated. Mr. Shears errs also in the statement he makes with reference to other patents for the manufacture of illuminating gas from Petroleum, and before he gives a more extended circulation to to his "circular" it would be well for him to examine with more care than he seems to have bestowed, the claims of other parties in the same field.

Mr. Shears says: "Last spring I found that by mixing about 30 per cent. of atmospheric air with the gas, I produced a gas that would burn in large burners without smoking, giving a flame equal in size to that of coal gas without injuring the brilliancy of the light." * * * * "Considering the discovery of so much importance, I procured a patent for it, also for a process of mixing the air with the gas in a thorough manner, which is done *by inserting a pipe connected with an air press or pump into the main gas pipe leading from the works to the gas-holder*, by which means I mix the air with the gas as it is made and is passing through the pipe Upon the air pipe I put a guage cock to regulate the flow of air, that the mixture may be in proper proportions. While passing through the pipes together they become throughly mixed. By which means I produce between four and five thousand feet of gas from a barrel of crude oil."

We do not in the least degree discredit the fact that the mixture of 30 per cent. of air with Petroleum gas will give a large flame free from smoke; the air acting as a diluent and containing oxygen ensures the entire combustion of the carbon of the gas, and will enable large burners to be used with gas of comparatively less illuminating power. In fact Petroleum gas when mixed with different and increasing quantities of air can be made of any candle power the operator wishes, within limits which are now well known, and if Mr. Shears was in possession of a *safe* process for effecting the combustion of Petroleum gas, diluted with air, we should have nothing further to say on the subject but to wish him success. It is, however, our duty to point out the danger of Mr. Shears' process. According to his description he furnishes his patrons with a large quantity of most dangerously explosive mixture, within or close to the limits of their dwellings. A gas-holder, holding 1,000 cubic feet and containing 30 per cent. of air, would possess explosive power sufficient to blow up any of the buildings into which Mr. Shears alleges he has introduced his gas. One of the properties which all illuminating gas in common use possesses is, that it contains little or no free oxygen, hence flame will not travel down a pipe filled with such gas; but when oxygen is introduced with the 30 per cent. of air Mr. Shears mixes with it before it reaches the holder, flame may travel down through the service pipes and mains, force back, by the expansion caused by heat, the seals which are usually introduced, and reach the explosive mixture in the holder—the result it is needless to say would be frightful, and might be attended with serious loss of life. It is ridiculous to suppose that insurance companies would have anything to do with a building which contained so near it the elements of its own destruction as Mr. Shears, innocently, no doubt, places within or near them. That air can be advantageously mixed with Petroleum gas we think probable, and that it can be done with perfect safety we are equally satisfied, but it must not be mixed in the gas-holder—it must be a subsequent operation, so that all danger of explosion is avoided. We consider it a public duty to point out the imminent source of danger which arises whenever air is mixed with gas in the holder, because we find the idea prevalent that the mixture is advantageous and harmless. In justice to Mr. Shears we may state that he has received testimonials from the proprietors of the Clifton House Niagara Falls, the Monteagle House, Suspension Bridge, and others, speaking favourably of the economy of his process; but at the same time we must remind those who are innocently enjoying the result of his mixture of air and gas in the gas-holder, that they are like men living above a volcano, which may some day unexpectedly astonish them with an explosion, from the effects of which escape will be nothing less than providential.

THE ADDRESS OF THE PRESIDENT OF THE UNITED STATES.

Abraham Lincoln in his recent somewhat celebrated address calculates that the population of the United States will amount to over one hundred millions in the year 1900 or thirty seven years from the present time. He rests his calculation upon the assumption that the whole of the territory of the United States is as generally fit for the abode of man as Europe.

"At the same ratio of increase which we have maintained on an average from our first national census in 1790 until that of 1860, we should in 1900 have a population of 103,208,415, and why may we not continue that ratio far beyond that period? Our abundant room, our broad national homestead is an ample resource. Were our territory as limited as the British Isles, certainly our population could not expand as stated. Instead of receiving the foreign-born as now, we should be compelled to send part of the native born away. But such is not our condition. We have 2,963,000 of square miles. Europe has 3,800,000, with a population averaging 73½ persons to the square mile. Why may not our country at some time average as many? Is it less fertile? Has it more waste surface by mountains, rivers, lakes, deserts, or other causes? Is it inferior to Europe in any natural advantage? If, then we are at some time to be as populous as Europe, how soon? As to when this may be. We may judge of the past and the present; as to when it will ever be depends much on whether we maintain the Union. Several of our States are above the average of European population of 73½ to the square mile, Massachusetts has 157, Rhode Island 133, New York and New Jersey each 80, also two other great States, Pennsylvania and Ohio, are not far below, the former having 63, and the latter 59. The States already above the European average, except New York, have increased in as rapid ratio since passing that point as ever before, while no one of them is equal to some other parts of our country in natural capacity for sustaining a dense population. Taking the nation in the aggregate, we find its population and ratio of increase for the several decimal periods to be as follows:—1790, 3,929,827; 1800, 5,305,937; ratio of increase, 35 62-100 per cent; 1810, 7,239,814; ratio, 36 45-100; 1820, 9,688,131; ratio, 33 13-100; 1830, 10,866,029; ratio, 33 49-100; 1840, 17,089,453; ratio, 32 67-100; 1850, 23,193,876; ratio, 35 87-100; 1860, 31,433,700; ratio, 35 58-100. This shows an average decimal increase of 34 60-100 per cent. in population through the seventy years. From our first to our last census taken, it is seen that the ratio of increase at no one of these seventy periods is either two per cent below or two per cent above the average, thus showing how inflexible, and, consequently, how reliable the law of increase in our case is assuming. That it will continue, it gives the following results:—1870, 42,323,372; 1880, 58,966,216; 1890, 76,677,872; 1900, 103,208,415; 1910, 138,918,526; 1920, 186,986,335; 1930, 251,680,014. These figures show that our country may be as populous as Europe, at some point between 1920 and 1930, say about 1925; our territory at 73½ persons to the square mile, being of the capacity to contain 217,186,000, and will reach this too, if we do not relinquish the chances by the folly and evils of disunion, or by long and exhausting war, springing from the only great element of discord among us."

In opposition to these astounding calculations based upon the assumed capability of the whole of the United States to support comparatively as many people as the whole of Europe (which it may do in many centuries, but not between 1925 and 1930, as the President assumes), we have the important fact that *one third of the area of the United States*, namely, about 1,000,000 square miles is incapable of being inhabited by civilized man. The testimony of Dr. Joseph Henry, of the Smithsonian Institute, and of Major Emory, of the Mexican Boundary Survey is in strong contrast with the bold but baseless assumptions of the President of the United States.

Major Emory says: "The term plains is applied to the extensive inclined surface reaching from the base of the Rocky Mountains to the shores of the Gulf of Mexico and the valley of the Mississippi; and form a feature in the geography of the western country as notable as any other; except on the borders of the streams which traverse the plains in their course to the valley of the Mississippi; scarcely any thing exists deserving the name of vegetation." * * * *

"Whatever may be said to the contrary, these plains west of the 100th meridian are wholly unsusceptible of sustaining any agricultural population, until you reach sufficiently far south (the Red River of Louisiana) to encounter the rains from the topics."

Dr. Joseph Henry says—"The general character of the soil between the Mississippi River and the Atlantic is that of great fertility, and as a whole, in its natural condition, with some exceptions at the west, is well supplied with timber. The portion also on the western side of the Mississippi, as far as the 98th meridian, including the States of Texas, Louisiana, Arkansas, Missouri, Iowa, and Minnesota, and portions of the territory of Kansas and Nebraska, are fertile, though abounding in prairies, and subject occasionally to droughts. But the whole space to the west, between the 98th meridian and the Rocky Mountains, denominated the Great American Plains, is a barren waste, over which the eye may roam to the extent of the visible horizon with scarcely an object to break the monotony.

"From the Rocky Mountains to the Pacific, with the exception of the rich but narrow belt along the ocean, the country may also be considered, in comparison with other portions of the United States, a wilderness unfitted for the uses of the husbandman; although in some of the mountain valleys, as at Salt Lake, by means of irrigation, a precarious supply of food may be obtained sufficient to sustain a considerable population, provided they can be induced to submit to privations from which American citizens generally would shrink. The portions of the mountain system further south are equally inhospitable, though they have been represented to be of a different character. In traversing this region, whole days are frequently passed without meeting a rivulet or spring of water to slake the thirst of the weary traveller."

"We have stated that the entire region west of the 98th degree of west longitude, with the exception of a small portion of western Texas and the narrow border along the Pacific, is a country of comparatively little value to the agriculturist; and, perhaps, it will astonish the reader if we direct his attention to the fact that this line, which passes southward from Lake Winnepeg to the Gulf of Mexico, will divide the whole surface of the United States into two nearly equal parts. This statement, when fully appreciated, will serve to dissipate some dreams which have been considered as realities as to the destiny of the western part of the North American continent. Truth, however, transcends even the laudable feelings of pride of country; and, in order properly to direct the policy of this great confederacy, it is necessary to be well acquainted with the theatre on which its future history is to be enacted and by whose character it will mainly be shaped."

Who are we to believe, Abraham Lincoln or Dr. Joseph Henry?

Board of Arts and Manufactures

FOR UPPER CANADA.

PROCEEDINGS OF THE BOARD.

TORONTO, January 13, 1863.

The Board met this day, according to adjournment, at one o'clock, p.m., at the Board Rooms in the Mechanics' Institute.

The members present were, the President of the Board, J. Beaty, Esq., M.D., President of the Cobourg Mechanics' Institute; W. Craigie, Esq., M.D., Vice President of the Board, and William Michael, Delegates from the Hamilton Mechanics' Institute; Rev. Professor Hincks and Professor Buckland, of University College, Toronto; Rice Lewis, Esq., President, and Messrs. H. E. Clarke, R. J. Griffith, W. H. Sheppard, H. Langley, W. S. Lee, P. Freeland, and W. Edwards, Delegates from the Toronto Mechanics' Institute; Thos. Sheldrick, President of the Dundas Mechanics' Institute; John Shier, Esq., President, and Messrs. J. Bengough and M. O'Donovan, Delegates from the Whitby Mechanics' Institute; and E. A. McNaughton, Esq., President of the Newcastle Mechanics' Institute.

The several certificates of appointment by the Mechanics' Institutes represented at the meeting, were submitted.

The minutes of the previous annual meeting were read and confirmed.

The Secretary read the annual report of the Sub-Committee, and an analyzed statement of the receipts and expenditure for the year.

Moved by Mr. Lewis, seconded by Mr. McNaughton, and

Resolved, That the report be adopted, and that Mr. W. S. Lee and Mr. R. J. Griffith be requested to audit the finance statement prior to its publication.

The election of Office Bearers and Committee for the ensuing year was then proceeded with, when the following named gentlemen were elected:—

President.—J. Beaty, Esq., M.D., Cobourg.

Vice-President.—Rice Lewis, Esq., Toronto.

Secretary & Treasurer.—Mr. Wm. Edwards.

Sub-Committee.—W. Craigie, M.D., Hamilton; John S. Shier, Whitby; E. A. McNaughton, Newcastle; Professor Hind, Professor Hincks, Professor Buckland, W. H. Sheppard, P. Freeland, and W. S. Lee, Toronto.

The meeting then adjourned.

ANNUAL REPORT.

The Sub-Committee at the close of their term of office, beg to submit to the Board the following report of their proceedings.

Six Mechanics' Institutes have been represented at the Board during the year, namely, Cobourg, Dundas, Hamilton, Toronto, Newcastle and Waterdown. Your Committee cannot but regret that so few of the institutes take an interest in the operations of the Board, the consequence of which is, that it is impossible to enter into any discussion, or carry out any plans that would be of general benefit to the several institutions.

Your Committee fear that a large number of the Mechanics' Institutes in the Province are languishing, not only on account of the withdrawal of the legislative aid formerly granted, but for want of a comprehensive plan of action, whereby an interest in the operations of the institutes might be created and kept up in the communities in which they are respectively established, and their beneficial objects be successfully carried out. Surely some good would result if the Presidents of the various incorporated institutes were to attend the general meetings of the Board, prepared to make and receive suggestions as to the class of books most suitable for their libraries; the kind of lectures desirable and the best mode of obtaining them; the conducting of well-appointed reading rooms; the character of classes most beneficial to establish, and the best means for promoting and rendering them successful. The discussion of such subjects as these are among the legitimate objects for which this Board was established, but which can only be carried out by a more general and united action on the part of the proper representatives of the institutes.

Your Committee feel called upon to repeat the expression of regret contained in the report of their predecessors, as to the very limited sum placed at their disposal for carrying out the objects of the Board. These objects are, as stated in the Act of Incorporation, the establishment of a museum and model rooms, illustrative of the arts and manufactures; a free library of reference; a school of design, and a school or college for mechanics; the employment of lecturers on subjects connected with the mechanical arts and sciences; the obtaining from other countries models of improved implements and machines; and the publication and distribution of such reports, essays, lectures and other literary compositions, as convey useful information to mechanics, artizans and manufacturers.

These are objects which, if carried out, would be of incalculable benefit to the mechanical industry of the country; but with the small grant of $2,000 per annum, your Committee have only been able to undertake these to a very limited extent, confining their exertions principally to the Free Library of Reference, the Model Room, and the publication of the monthly Journal of the Board.

When the Board was first established, the several incorporated mechanics' institutes were in receipt of an annual grant from the legislature of $200, and it was provided that no institute could elect delegates unless on payment of one-tenth of such grants to the Board; thus providing a fund that might have been used for the general benefit of the whole. The withdrawal of the grant, however, shortly after, took away from the Board this source of revenue, and caused the managers of most of the institutes to feel indifferent as to its operations.

No one can deny the paramount importance of developing the agricultural interests of the Province, and your Committee submit that the arts and manufactures are also entitled to consideration and support, for establishing and maintaining well-appointed mechanics' institutes, with their judiciously selected libraries of books; well-organized classes for adult instruction; and popular lectures on mechanical and scientific subjects; where our mechanics and artizans, and the agriculturists also, may resort for that information which their own scanty libraries will not afford, but which is, in numerous cases, indispensable to the successful carrying out of their industrial operations. Your Committee therefore trust that the Legislature will, at its next session, see fit to renew the grants to mechanics' institutes, on the basis of a plan contained in a memorial to both houses, and published in the Journal of the Board for April last, or upon such other plan as the Legislature in its wisdom may see fit to adopt.

Finances.

The Treasurer's detailed statement of the finances herewith submitted, shews total receipts for the year, $4,169.52; expenditure, $3,118.68; leaving a balance in hand of $1,050.84; assets on account of the Journal, $413; shewing the whole balance in favor of the Board, $1,463.84.

Library of Reference.

Your Committee have great pleasure in reporting that the excellent Library of Reference established in connection with the Board, is becoming more and more appreciated by the public, and especially by the industrial classes, not only by residents of this city but by visitors from other places. 231 volumes of valuable books have been added since the last annual report. The total number now in the library is 1,048, of which there are of British, American and Canadian Specifications and Plates of Patents 557 vols.; Statutes, Journals and other Parliamentary publications, 135 vols.; Transactions of Societies, 14 vols.; and of the latest Cyclopoedias and standard works on Architecture, Decoration, Designing, Engineering and Mechanics, Manufactures and Trades, and General Science, 342 vols. Of these, your Committee acknowledge as donations from the Board of Agriculture for Upper Canada, 14 vols. of Transactions and Journals; from the Literary and Philosophical Society of Manchester, 3 vols. of Memoirs, &c.; from Mr. Hadfield, 1 vol. of U. S. Patent Office Reports; and from the Smithsonian Institution its Annual Report for 1861; also from the heads of departments of the Government of this Province the regular transmission to the rooms of the Statutes, Journals, Sessional Papers, Blue Books and other Parliamentary documents.

Prior to the 1st of April last, the Library was only open to the public from 10 A.M. to 4 P.M. each day. This arrangement did not allow of any large number of operative mechanics, or persons employed in daily labors participating in its benefits; your Committee, therefore, made provision for lighting the rooms with gas, and opening them free to the public every Tuesday and Friday evening also, from 7 to 10 o'clock. The attendance of the class of persons for whom this arrangement has been more especially made is very satisfactory.

Model Rooms.

As all the models of new patents have now to be sent to Quebec with the applications of the inventors, but few additions have been made to the Model Rooms during the year. Your Committee would, however, acknowledge the receipt of a German Stove, donated to the Board by W. Wagner, Esq., of Berlin, Prussia. This stove is made of strong sheet iron, lined with a species of fire-clay, and faced on the outside with Porcelain or *Dutch Tiles.* They would also acknowledge some fine specimens of roofing slates from Mr. B. Walton, taken from his quarries in Melbourne, C. E.; and from Mr. Wright, some very excellent specimens of cotton bags and cotton yarn, from his factory in Dundas.

Your Committee hope that a much larger number of contributions of this character will be sent to the rooms during the ensuing year, by manufacturers and others throughout the Province.

Annual Examinations.

The programme of annual examinations of members of Mechanic's Institutes in certain branches of study, adopted two years ago, has not yet been productive of any good results, except that it establishes the fact of the indifference of the adult industrial classes to self-improvement or class-organization and instruction in the several Institutes. Examinations, of which the programme of this Board is a counterpart, are in Britain considered very important; large numbers of the working classes, in every department of business, avail themselves of them, after having passed through a course of class instruction in their Mechanics' or other educational institutions; and the result is, that the holders of certificates from these examinations are always sure of employment at the highest rates of remuneration. Your Committee are aware that in one Mechanics' Institute in U. C., there are at this time upwards of 150 pupils undergoing a systematic course of class instruction in seven different branches of study, and it is hoped that several of them will come up for examination in May next, so that a beginning may be made which cannot but result in good to all who engage in it.

The Journal.

Your Committee congratulate the Board on the completion of the 2nd volume of the *Journal*, and the favor with which it has generally been received by the subscribers. As an evidence of this it may be stated, that, during the past year the subscribers have nearly doubled, and that only about 25 have withdrawn their names. Owing to the increase in the circulation, and the difficulty of collecting two or three rates of subscription, it has been announced that the ensuing vol. will be published at the uniform rate of fifty cents per copy, or 11 copies for $5; so that a much larger increase may be expected in the subscription list during the ensuing year.

When it was first decided to publish the *Journal*, it was believed that a large number of the Mechanics' Institutes would avail themselves of its pages as a medium for communicating with each other; your Committee regret that such has not been the case, nor has the Journal Committee been able to obtain abstracts of the annual reports of more than four of these institutions, although their publication would be beneficial to the whole. It would also have been gratifying to have noticed a much more extensive correspondence on the various manufactures of the Province. These subjects will, however, no doubt gradually find a more frequent place in its pages.

Your Committee also regret that the means placed at their disposal have not appeared sufficient to warrant the engagement of writers on mechanical and engineering subjects, and the obtaining of a larger number of engraved illustrations, so valuable in a work of this nature; and would therefore recommend that in any memorial that may be presented to the Legislature at its next session, the increasing of the annual grant for the above purpose be specially urged.

Amendments to Act.

Owing to the early prorogation of the last session of the Legislature, the amendments to the Act of Incorporation as adopted by this Board, and introduced to the House of Assembly, were not passed. Your Committee recommend that steps be taken as early as possible to secure the passage of the amended bill. While upon this subject it may be worth while to consider the propriety of petitioning the Legislature to introduce such other amend ments as will devolve upon the Incorporated Mechanics' Institutes in cities and towns, the duty of promoting the interests of arts and manufactures, as now contemplated in the organization of Electoral Division Societies — the grants of money now made to said Societies to be likewise transferred to the Institutes, for such purpose.

The agricultural interests in the cities and towns being very small, it appears but natural that the control of the Arts and Manufactures which these societies are principally established to promote, should be placed under these institutions, where, with one organization, instead of two as at present, a more economical management could be secured.

Patent Laws.

During the year your Committee memorialised the several brauches of the Legislature to amend the Patent Laws of this Province, so as to enable citizens of foreign countries to avail themselves of the right to take out letters patent on the same conditions as Canadians, and thereby securing to our citizens equal privileges with American subjects in taking out patents in the United States, which they are now restrained from doing, having to pay a discriminating fee of $500.

Your Committee beg herewith to present a draft of a memorial to the Legislature, praying that the amendments to the Act of Incorporation as introduced in the House of Assembly may, with certain modifications, be passed during the coming session.

All which is respectfully submitted.

JOHN BEATTY, JUN., *President.*

WM. EDWARDS, *Secretary.*

BOOKS ADDED TO THE LIBRARY OF REFERENCE DURING THE MONTH.

Shelf No.		
F. 23.	A Treatise on Wood Engraving, Historical and Practical, with upwards of 300 illustrations on wood, 1 vol. 8vo, 1851	*Jackson & Chatto.*
H. 47.	Treatise on Mills and Millwork. Part I. on the Principles of Mechanism and on Prime Movers, 1 vol. 8vo, 1861	*W. Fairbairn.*
H. 51.	The Commercial Products of the Vegetable Kingdom: a Practical Treatise and Handbook of Reference for the Colonist, Manufacturer, Merchant and Consumer, 1 vol. 8vo, 1854	*P.L.Simmonds.*
J. 36.	Useful Information for Engineers, 1 vol. 12mo, 1860	*W. Fairbairn.*
J. 37.	The Art of Cleaning, Dyeing, Scouring and Finishing, on the most approved English and French methods; by a Working Dyer and Scourer, 1 vol. 12mo, 1855	*Thomas Love.*
L. 21.	Curiosities of Food, 1 vol. 12mo	*P.L.Simmonds.*
L. 22.	Waste Products and Undeveloped Substances; or Hints for Enterprise in Neglected Fields, 1 vol. 12mo, 1862	"
M. 44.	Half Hours with the Microscope; being a popular guide to its use as a means of instruction and amusement, 1 vol. 12mo	*Dr. Lankaster.*
	Statistical Tables relating to Colonial Possessions, &c., of Great Britain, submitted to the Imperial Parliament. 1860-1861. 2 vols.	"

BRITISH PUBLICATIONS FOR NOVEMBER.

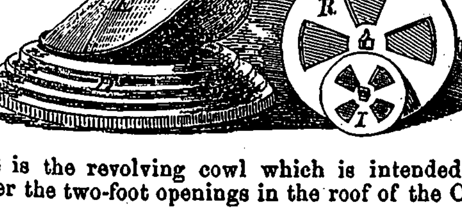
	£	s.	d.	
Adams (W. H. D.) Memorable Battles in Eng. Hist., where and why fought, &c., post 8vo.	£0	7	6	*Griffith & Far.*
Arnold (Thos.) Manual of English Literature, Historical and Critical. post 8vo	0	10	6	*Longman.*
Bremer (Fredrika) Greece and the Greeks, transl. by Mary Howitt, 2 vols. post 8vo.	1	1	0	*Hurst & Black.*
Brine (Lindesay) Taeping Rebellion in China; a Narr. of its Rise & Progress, p. 8vo	0	10	6	*Murray.*
Brodie (Sir Benj. C.) Psychological Inquiries. The First Part. 4th edit. fp. 8vo.	0	5	0	*Longman.*
Burgoyne (Sir J.) On Blasting and Quarrying of Stone for Buildings, &c., 5th edition, 12mo	0	1	6	*Virtue.*
Chambers (Sir W.) Decorative Part of Civil Architecture, rev. by W. H. Leeds, 4to	1	1	0	*Lockwood.*
Cole (Wm.) Life in the Niger; the Journal of an African Trader, post 8vo.	0	5	0	*Smith & Elder.*
Curtis (John) Farm Insects, with coloured engravings, roy. 8vo. red. to	1	2	0	*Blackie.*
Cust (Sir Edward) Annals of the Wars of the Nineteenth Century, Vols. 1 and 2, fcap. 8vo	0	10	0	*Murray.*
Denton (Rev. W.) Servia and the Servians, post 8vo	0	9	6	*Bell & Daidy.*
Dundas (James) Illust. of the Tools and Machinery which he Manufactures, fc. 4to	1	5	0	*Weale.*
Elements of Success (The); a Book for Young Men, fcap. 8vo	0	2	6	*Houlston.*
Faraday (M.) Lecture on Various Forces of Matter and Chem. History of a Candle, 1 vol. fcap. 8vo	0	5	0	*Griffin.*
Fifty Celebrated Men: their Lives and Trials and Famous Deeds, sq. 12mo	0	3	6	*Ward & Lock.*
Hunter (Rev. Jno.) Treatise on Logarithms, with copious Tables, 18mo, 1s.; Key	0	0	9	*Longman.*
Marsden (J. Benj.) Influence of the Mosaic Code upon Subsequent Legislation, 8vo	0	2	6	*Hamilton.*
Martin (Wm.) First English Course, based upon the Analysis of Sentences, 12mo	0	2	6	*Longman.*
O'Neil (Charles) Dictionary of Calico Printing and Dyeing, 8vo	0	6	0	*Simpkin.*
Parlour Gardener (The) a Treatise on House Cultivation of Ornamental Plants, royal 18mo	0	2	6	*Low.*
Simpson (Rev. Wm.) Epitome of the History of the Christian Church, 4th edition, fcap. 8vo	0	3	6	*Macmillan.*
Smiles (Sam.) Lives of the Engineers, Vol. 3 (George and Robert Stephenson) 8vo	1	1	0	*Murray.*
Thompson (D.) Lunar and Horary Tables for ascertaining Longitude, &c., 55th ed. royal 8vo	0	10	0	*W. H. Allen.*

THE VENTILATION OF RAILWAY CARS.

Mr. A. Wallace surveyor and engineer has recently read a paper before the Literary and Historical Society of Quebec of which we have received a copy. Mr. Wallace describes his plan in the following words:—

The only effectual way of ventilating a Railway Carriage, or other apartment, is to force out the impure air, or give it means of egress. If this be done, fresh air will come in,—must come in,—to fill up the place of that ejected, and by this means a current of air will be kept up. If the roof of a Car were taken off, the ventilation would be perfect; but soot and smoke, rain and snow would interfere with the comforts of passengers. The roof, therefore must be left on, and other means must be adopted to act upon the same principle, a means of egress for the foul air. If two or more large openings, about two feet in diameter each, were made in the roof of the Car, this means of egress would be obtained. If these openings were covered with revolving cowls, open at one side, and if these cowls were made so as to be self-acting in their movements, they would prevent soot, dust or smoke from coming in through the openings, and would not prevent the egress of the impure air. If, in connexion wich these openings in the roof, a number of much smaller openings were made in the sides of the Car, under the windows, fresh air would rush in to supply the place of the foul air ejected, and a constant current of air would thus be formed in the Car, rendering it pleasant and agreeable. If the smaller openings in the sides of the Car were fitted with a contrivance to keep out the dust, soot and smoke from coming in with the fresh air, and if the windows and doors were shut, to aid in keeping out all impurities, the system of ventilation would be so near perfection, that Railway travelling would become a pleasure, instead of a nuisance, as it is at present.

A system of Railway Car ventilation on this principle was patented in Canada nearly two years ago. The Grand Trunk authorities, after examination, pronounced it good; but the financial difficulties of the Company prevented their trying it; although the expense would have been very small. In fact, it would have been no expense to the company; for the increased travel in consequence of the improvement would have more than paid the alteration in the Cars. As the road, however, must double its rolling stock before it can become a paying concern, it may be hoped that the new Cars, or some of them, will be ventilated on this principle.



E is the revolving cowl which is intended to cover the two-foot openings in the roof of the Car. It is fixed on a tripod stand, resting on the pedestal D, and is so nicely balanced, and has so little friction, that the least breath of air will cause it to turn its back to the current of air caused by the motion of the train, which current if air will keep it in that position. This is called the Exhauster, for it not only allows the foul air to ascend through the opening in the roof of the Car; but will draw it out; and the faster the train goes, the greater will be the draught. The current of air caused by the motion of the train, will strike the back of the Exhauster, and pass over and around it, leaving it at the mouth, or front, causing a draft which will exhaust the impure air immediately under it. As this operation will go on constantly, while the train is in motion, there will constantly be presented, under these exhausters, a certain quantity of impure air to be taken out by their draught, as well as by its own gravity, or rather by the gravity of the outer air. In this manner no quantity of impure air can accumulate in the Car.

The Register R, or one of any other pattern or make, is to be place on the inside of the opening, under the exhauster, to regulate the amount of ventilation when necessary. The small register I, which should not be more than six inches in diameter, is to be put on the inside of an opening of the same size in the side of the Car, under the window, to admit the fresh air and cause a current in conjunction with the exhausters in the roof. There should be one of these openings and registers under each window. By this means, if the Car be full, every second passenger can regulate the amount of incoming air, and have as much only as suits his own taste. This will prevent passengers from changing seats to suit their fancies and their constitutions. A piece of wire gauze is to be placed on the outside of the smaller openings in the sides of the Car, opposite the small, or inlet registers, and will keep out the dust, soot and smoke; as the current of air passing along the side of the Car will be parallel to it. In winter these small registers may be kept shut; in ordinary cold weather partially so, in fact, the ventilation, by means of these registers, is under the immediate control of the passengers; while the exhausters, being self acting, will always be at work. If rain fall on the exhauster, it will run into a drain and out through two openings, one of which is shewn at D, and escape across the roof of the Car to which ever side it inclines or curves, or to both sides on straight lines. The soot and smoke striking the back of the exhauster, and coming over and around it, will be carried onward or backward from the direction in which the train moves, by the current of air caused by the velocity of the train; and the current of air coming from the inside will be carried with it. Should snow fall on the exhauster, or into the drain, the constant tremulous motion of the exhauster will keep the drain clear, and prevent its choking. Should it happen, in very cold weather during sleet or snow, that a Car is left stationary out of doors until the exhauster becomes fixed by ice, which will seldom or ever happen, it will merely have to be put in order before starting the train. In building new Cars, with fast windows, the saving in fastenings and bolts would almost pay for this system of ventilation; so that the cost of this improvement to the comfort of travellers would be nearly nominal. The windows being fast, would also prevent nearly all the noise of the wheels from being heard inside, and as they would not shake, the greatest source of noise would disappear.

It has now been shewn that by fastening the windows, putting springs on the doors, and adopting this system of ventilation, a Railway Carriage may be made as clean and comfortable, and kept as well ventilated, as a drawing room.

Proceedings of Societies.

TORONTO MECHANICS' INSTITUTE.

The fortnightly meetings of this Institute for the discussion of *subjects of practical interest to mechanics* are being continued, and promise to form another pleasing and profitable feature in the operations of the Society. On the 3rd and 17th of October, Mr. Henry Langley, architect, read interesting papers on *Homes for the Industrial Classes.* On the 14th of November, Mr. J. J. Withrow, builder, read a carefully prepared paper on *The best Form and Covering Material for Roofs of Buildings,* with special reference to their suitability for this climate. On the 28th of November, Mr. W. H. Sheppard, marble worker, read a paper on *Mechanical Force,* pointing out and enlarging upon the several agents by which power is brought into mechanical action, namely: the tides; the winds; the descending streams; animal strength, steam and hot air; and chemical action.

On Friday evening, December 12th, Mr. W. Edwards read a paper on "Canadian Manufactures and the obstacles to their progress;" the principal portion of which we publish at the request of the gentlemen who listened to it. After some introductory remarks, Mr. Edwards said:—

I will, therefore, with what ability I possess, direct your attention to some of the articles we manufacture in Canada, the production of which ought to be, and with proper encouragement might be, largely increased.

From the Official Trade Returns for the year 1861, I have selected a few branches of manufactured goods that were largely imported into the Province, but which we have the facilities for manufacturing at home to a much greater extent than we do.

I would first call your attention to the following list, with the invoiced value of the goods imported in each of the 28 classes, shewing an aggregate value amounting to $8,137,172. Of these

Ale, Beer and Porter amounted to......	$15,127
Blacking......	3,011
Boots and Shoes......	157,547
Clothing......	125,695
Confectionary......	23,899
Cabinet Ware......	43,957
Candles......	$36,227
Carpets......	140,028
Carriages......	43,950
Cordage......	75,854
Cigars and Manufactured Tobacco......	354,494
Cheese......	185,930
Gunpowder......	23,083
Hats, Caps and Bonnets......	334,979
Hosiery......	124,822
Iron and Hardware......	1,489,645
Leather Manufactures......	111,191
Musical Instruments......	139,766
Machinery and Steam Engines......	156,158
Pickles and Sauces......	26,378
Preserved Meats, Poultry, &c......	10,418
Printed and Lithographed Bills......	15,701
Soap......	50,604
Starch......	18,441
Varnishes......	33,614
Vinegar......	25,043
Wood Manufactures......	100,604
Woollen Manufactures......	4,271,276
Total......	$8,137,172

One-half, at least, of these goods ought to have been manufactured at home, thus saving upwards of $4,000,000 of what was paid by Canada for foreign goods during last year.

I believe it cannot be objected that, under certain conditions, there is not one of the classes of goods I have enumerated, but what we have the facilities for producing. Taking the first article mentioned in my list—*Ale, Beer and Porter*—if people will partake of such beverages—why should we, when we have the raw materials for its manufacture all at hand, or might be produced in the country, import so large a quantity from abroad. The same may be said of blacking, candles, carpets, cordage, tobacco, cheese, pickles and preserves, soap, starch, vinegar, wood manufactures and woollen goods. Of the other classes of goods, such as boots and shoes, clothing, confectionery, cabinet ware, carriages, gunpowder, hats, caps and bonnets, hosiery, iron and hardware, leather manufactures, musical instruments, machinery, printing and lithography, and varnishes, if we do not produce all the necessary raw materials for these in the Province, we do of a large portion required for each class, and the remainder may be imported more conveniently in the raw state than when manufactured.

Is it not an anomaly that our Province should abound in forests of valuable timber, adapted for almost every branch of manufacture in wood, and yet that we should in one year import of such goods to the value of about $200,000? or that we should export 1,630,531 lbs of wool during the past year, for which we received but $400,272, and for the same year import in woollen goods, not including hosiery and clothing, to the amount of $4,271,-276? or that we should sell a pound of wool for 24 cents, and buy the same back again, manufactured into cloth, for perhaps 80 or 90 cents; thus losing the benefit of the difference that ought to have remained in, and circulated through the Province. Who can for a moment justify us in expending for foreign pickles and preserves upwards of $26,000 per annum, when the raw materials here are left to waste, or the land lying uncultivated that might produce them? The same argument might be used in reference to many other articles I have named, but it would be useless entering more into details than I have done, unless this branch of my subject were to be taken up and fully discussed, which alone would furnish matter for a lengthy paper, and would also require a more intimate knowledge than I possess of our manufactures and raw materials, and the cost of producing them.

Seeing then that we have, or might produce, such an abundance of raw material, and possess such ample facilities of water-power, and of internal water and railway communication, why is it that we do not manufacture more than we do? The reasons are obvious:—1st. *The want of sufficient capital;* and 2nd. *The want of sufficient protection* to our infant manufactures, or of confidence on the part of capitalists in the present measure of protection being permanent.

1st. *With regard to the want of capital.* Any one at all acquainted with the subject is aware, that, unless the manufacturer has sufficient means to enable him to take advantage of the markets in purchasing his raw material, and in procuring the most approved machinery and skilled labor; as well as to be able to allow the merchant sufficient time to make his returns, it is almost impossible for him to succeed in establishing any new branch of manufacture, or successfully to carry on an old one.

2nd. *The want of sufficient protection, &c.* On this point I have no doubt my opinions will be considered as belonging to the age of old fogyism, when the blessings of free trade were unknown. Be that as it may, I hold that no new country can succeed in establishing extensive manufactures in the absence of a protective or high revenue tariff; that no country has ever become a great manufacturing country under free trade or low tariff principles; and that no country can become great or prosperous where it depends solely upon agriculture for its prosperity.

On the first of these propositions I remark that, in the absence of protective duties, foreigners have the monopoly of our markets. We know that in Canada multitudes of manufactures have been started, and having struggled on for a short time, have had to succumb to the overwhelming competition of the foreigner. And how is this? Take, for example, the manufactures in india rubber, boots and shoes, stoves and other castings, printing papers, &c., &c.; numerous manufactures of these articles have been established, and with cheering prospects; but so soon as success seemed to be crowning their efforts, the foreign manufacturer, deeming that his *craft was in danger*, has immediately thrown his surplus stock into our markets at ruinous prices, and crushed out our infant manufactures in their bud. That accomplished, the old monopoly has been re-established, and the high prices of goods restored. Some of my hearers will perhaps argue that a protective tariff must necessarily increase the price of the goods to the consumer. Such, however, is not the case. When the tariff on india rubber goods was but five per cent., two or three attempts were made in Lower Canada to establish manufactures of these goods, but so soon as they got well started they were crushed by the process I have already alluded to. How is it now? Under a duty of 20 per cent. the Montreal manufacturers, having the Canadian market almost exclusively to themselves, can afford their goods at a much lower price than when the duty was but nominal. Here the duty is not paid by the consumer but by the foreigner, if he chooses to sell in our market; for having the Canadian manufacturer to compete with, he must offer his goods to the consumer or retailer as low as the Canadian producer, although he, the foreigner, has already paid to our customs the 20 per cent. duty thereon. Thus not only are our home manufacturers protected against an unfair foreign competition, but the revenue of the Province—if we will use imported manufactured goods—is paid by the foreigner instead of by ourselves.

The same argument may be used in regard to stoves, an article so largely in demand with us. Before the tariff was raised to what it now is, stoves were, at least 25 per cent. higher than they are under the present high tariff. Thus has an impetus been given to this branch of manufacture, and the public are supplied at a lower price than under the low tariff.

What is true in regard to the manufactures just alluded to, is equally so of others. When the duty was increased from 5 to 20 per cent. on printing and wrapping papers, the price was immediately reduced in an equal ratio by the Canadian manufacturer: and this is easily accounted for. Under the old system, the American manufacturer, who had a large surplus stock on hand, rather than sacrifice it at home, and injure his market there, would ship it to Canada, and undersell and cripple our home producers. This being accomplished, the old monopoly of our markets was sure to be re-established; but under the 20 per cent. duty the sacrifice is too great to enable him to do so to any any serious extent, and our market being thus nearly free from foreign interference, a sufficient competition has sprung up at home to prevent the prices of paper ever ranging higher than will allow of fair remunerative profits.

A more striking example than any to illustrate this point is, that when ale was admitted duty free it was sold at $6 per barrel, and when $1 per barrel duty was put upon it, it was said it would be taxing the consumer for the benefit of the brewer; but, instead of that being the case, the protection afforded by the new tariff caused breweries to be established in the country, and home competition being thus created, the price was reduced from $6 to $5 per barrel.

But allowing that the goods we consume may possibly, in some cases, be increased in price by the operations of a high tariff, we are still immensely the gainers if home manufactures are thereby established; for it is certainly easier to pay 6d for an article if the money is kept to circulate in the country, than to pay 5d if our cash is continually being sent away to pay for foreign goods.

Look at the balance of trade that is shewn to be annually against us, averaging for the last 4 years $5,161,614 per annum, thus keeping our exchange on Britain up as high as from 11 to 13 per cent.

If we used goods of our own producing, instead of imported goods, beyond the amount of our exports, exchange would be nearly at par, and the price of foreign goods that we cannot profitably produce or manufacture, but which we require, would be thereby reduced to an equal extent.

Again, by establishing centres of manufactures in our midst, the idle and now vagrant population of our cities and towns would be employed; markets would be established for many products of the farm which are now scarcely cultivated in the absence of such markets, and the farmer would be enabled to cultivate his land on a more correct principle than he does, that is, by the proper rotation of crops, thus enriching him, and through him the whole country to an extent more than equivalent to the small increase of price, which we have admitted—for the sake of argument—may be the result of a protective tariff.

Why should we go on always selling our wool to the Americans for a few cents per lb., and buying it from them again in its manufactured state at such a great increase in price? Or why should we continue to export our woods, our flax, and other natural and waste products, and purchase them again after several hundred per cent. has been added to their value by the processes they have undergone in foreign hands, thus losing the whole profit of their manufacture, and the difference in value in hard cash to the Province?

To my mind there is no sentiment more unbecoming the statesman or the patriotic commercial man, than that of "Buying in the cheapest market, and selling in the dearest. It is a principle that enriches the few importing merchants, and impoverishes the masses; and the sooner the sentiment is discarded the more honourable for all concerned.

If we buy more foreign goods than we are able to pay for by our exports, the balance must be borrowed, and interest thereon be paid—thus opening up another source for exhausting our means and impoverishing the country. Our motto as Canadians should be: *Produce all we can, import as little as we can, and borrow none*—except purely for the construction of such public works as will be the means of opening up to profit the natural resources of our country.

Could the capitalists of Britain be sure that our present system of duties would remain permanent, imperfect as that system is, they would establish manufactures within our borders, and thus—within a few years—build up such a manufacturing and commercial system that free trade would no longer cause us any uneasiness: even now, were customs duties altogether abolished between us and our neighbors on the south side of the lakes, we would have nothing to fear; for although our markets would then be filled with American goods in competition with our own, the whole of the United States markets would be open to us also. Some branches of business would undoubtedly suffer, but on the whole, our sphere being enlarged, general benefit would be the result; but however any Canadian can, in view of our now limited markets and means, and of the very heavy tariff—from 20 to 100 per cent.—imposed by our American friends on all Canadian manufactures crossing the lines, advocate the abolition of our protective or high tariff duties—except on principles of reciprocity—is more than I can comprehend.

See how the exorbitant American duties affected us before our present high revenue tariff was adopted, in regard to the introduction of capitalists amongst us, and how it still affects us on account of the doubts that exist of free trade principles more fully prevailing than at present with our Government:—We will suppose that the old standard of duties again prevails, say from five to ten per cent., and a capitalist comes to Canada intending to establish an india rubber or a paper manufactory; he sees that a large demand for these articles exist, and that he can obtain a cheap site, with admirable water-power, suited to his purpose; but, comparing the tariff of Canada with that of the United States, he inevitably arrives at the following conclusion: "If I establish my business here, I have only the Canadian market to depend on, as the American duties are nearly prohibitory upon Canadian manufactured goods; but if I cross the lines, and establish myself within the borders of the United States, the whole of their markets will be open to me, and the markets of Canada also, as the small duty of 5 or 10 per cent. is of no consequence to me at all, in view of the greater advantage of having the whole of the United States market"—and thus have numerous capitalists been lost to Canada through a defective tariff policy.

I said in a previous part of this paper, that "no country can succeed in establishing extensive manufactures in the absence of a protective or high revenue tariff." Shall we refer to Great Britain to prove the contrary? No,—she has prospered altogether on high protective duties, far higher than ever prevailed here. She proclaimed free trade in manufactures, when in capital, machinery, labour, skill, and means of transit she stood without a rival; but even Great Britain, up to as late as the year 1857 or 8, enforced as high duties on imported goods as we do in Canada at the present time, for example, on ale, the duty was $5 per barrel; on boots and shoes, from $1.13 to $3.50 per dozen pairs; on india rubber manufactures 9 cts. per lb.; gloves from 75 cts. to $1.25 per dozen pairs; pianofortes, from $10 to $15 each; paper, 5 cts. per lb.; silks, 15 per cent., and spirits, $3.75 per gallon, &c., &c. These examples will serve to show what free trade meant in Britain less than five years ago, and establishes the fact that she has not attained to her present greatness in trade and commerce by the policy of free trade.

Let us look also at the position of the Eastern States of the American Union. What is it that has caused her barren soil to be covered with a wealthy and busy population, and all her water-power to be economised and used in the establishment of numerous manufactories, but the high protective tariff of the Federacy of which she forms a part?

We frequently read articles in our public journals pointing to the prosperity of the country, as evidenced by our large importations, without any enquiry or allusion as to how our exports will square with them; and holding up to the admiration of all the importing merchant, as the best friend the country has. This, I think, is a mistake. The importing merchant introduces as much of foreign products as he imagines he can dispose of with profit to himself, and without any regard to the wants of the country; and also, as a general thing, when any new branch of manufacture is commenced in the Province, he uses his best endeavor to import goods to undersell the articles so manufactured—rarely lending a helping hand to further their introduction to the consumer. The manufacturer, and not the importer, is the best friend of his country.

It is only a few days since a friend of mine in the boot and shoe business in this city, informed me that before the increase of duty on that class of goods, he had imported from Boston in one year boots and shoes to the value of $6,000. This business is now stopped, and his goods are all manufactured at home. Is he not serving the interests of his country much more now than when he was importing from abroad the principal part of his stock, and sending his cash to another country to be circulated?

Look again to the advantage of home manufactures to our steamboat and rail-road companies. Goods imported from the United States are as often as not landed on our shores by American forwarders, leaving the mere distribution of these goods to inland towns and villages to Canadians: on the other hand we would have the conveyance of the raw material to the various manufacturing establishments, and then the whole distribution of the manufactured articles throughout the length and breadth of the Province.

One other proposition I ventured to state, that "No country can become great or prosperous where it depends solely upon agriculture for its prosperity." This, I believe, will hardly require any argument to prove, as I am convinced modern history will testify: I shall therefore leave with objectors to show the contrary.

I will now explain the principles upon which I believe a protective tariff should be based, so that I may not be understood as advocating the adoption of a system that would be sweeping in its application to all the articles we require for use.

1st. I would admit free of duty, or at the lowest possible rate, all raw materials that would enter into use in our home manufactures; and also all articles of provision, such as tea, coffee, sugar, molasses, &c., &c., so that the artizan and laborer should be able to live at the least possible expense, and thus lessen the cost of labor on our home manufactures.

2nd. All materials partially manufactured, and all merchandize or manufactures that we have not the facilities for producing to advantage, to be subject to a pure revenue tariff.

3rd. All articles for which we have the facilities for manufacturing, such as the list I read in the first portion of this paper; and all articles of pure luxuries, to be charged a protective or high revenue tariff; but not so high as to induce smuggling into the Province, as that would be an evil more than counterbalancing all the good I would anticipate from protective duties.

I have paid particular attention to any arguments I have heard, and read many articles upon this subject during the past 3 or 4 years, and I have failed to perceive how free trade can in any way be beneficial to Canada, situated as we are alongside of a country maintaining a high protective policy.

I am firmly persuaded that the adoption and permanency of such a tariff policy as I have here attempted to sketch out, would have the effect of furnishing cheap living for the working man; the establishment of prosperous manufacturing communities, and the furnishing of profitable markets for the farmer; the equalisation of our imports and exports, and reducing of exchange nearly to par, thus cheapening of goods that we must of necessity continue to import; and, consequent upon these advantages, the improvement of our financial and commercial position, and the general prosperity and happiness of all classes of the community.

Patent Laws and Inventions.

ABRIDGED SPECIFICATION OF ENGLISH PATENTS.

584. F. B. Houghton. *Improvements in the manufacture of paper.* Dated March 3, 1862.

This consists in boiling the chaff (which the patentee prefers to be cut longer than heretofore say from an inch to an inch and a half) to an extent sufficient to reduce the more fibrous parts to a pulp, having the knots and weeds as little disintegrated as may be, and then, having washed out the alkali, a coarse knotter is used, which will allow the disintegrated vegetable matter to pass, whilst the extraneous matters will be arrested. The pulp so obtained will retain its fullest strength and weight, and require the minimum of bleaching material to act upon it. The "knotter" he prefers consists of a plate with square or oblong holes, sufficiently small to impede the passage of knots and weeds.

603. W. E. Newton. *An improved process and apparatus for reducing wood, straw, and other vegetable substances to pulp, for the manufacture of paper.* (A communication.) Dated March 5, 1862.

This consists in disintegrating wood and other fibre-yielding vegetable substances for the production of paper stock, by subjecting such substances to the mechanical operation of breaking, beating, or grinding, while it is immersed in and under the chemical influences of highly heated water, and under the presure due to such high temperature.

911 W. Turner. *Improvements in machinery or apparatus employed in the manufacture of dough, and especially of fermented dough.* Dated April 1, 1862.

This invention consists of apparatus for the mixing of dough, in which standards or a frame made of wood, metal, or other convenient material, are or is employed for supporting the rest of the machinery or apparatus. On the upper part of these standards or frame are bearings in which run two cranked or other conveniently shaped shafts or axles, which said shafts or axles revolve in opposite directions. The patentee attaches to each shaft or axle an iron bar, rod, or arm, which bar, rod, or arm, as the aforesaid shaft or axle revolves, slides or moves up and down in a slot; or the bar, rod, or arm itself may be slotted, in which case it would slide or move up and down on a pin or stud.

The slot, pin, or stud, which may be provided with friction rollers, to facilitate the sliding or moving of the bar, rod or arm, is attached to the standard or frame work in a perpendicular line with the bearing carrying the shafts or axles. The bars, rods or arms are employed for the purpose of communicating motion to the mixers in the mixing trough, the path or range of which said motion will be determined, partly by the distance at which the slot, pin, or stud is placed from the shaft or axle, and partly by the length of the bar, rod, or arm. He attaches to each arm a mixer, and these mixers are composed of bars of iron or wood, or other convenient material, which may cross each other at every revolution of the shaft or axle, or less frequently if desired. These mixers do not revolve on their own axis, but each of them passes through the dough, one in one direction and the other in an opposite direction, and thus will incorporate the flour with the liquid without the excessive manipulation which has been hitherto required, and is injurious to fermented dough. Power is communicated to the mixers without piercing the trough at either end, or at the sides thereof; the dough therefore, is perfectly even throughout.

1125. J. L. Perin. *Improvements in machinery for mortising wood.* Dated April 17, 1862.

This consists in the use of a rose drill or fraise to which the patentee imparts three self-acting motions: the first, a rapid rotary motion, for cutting away the wood; the second a to and fro movement, which is determined by the length of the mortise to be cut; and the third, a penetrating motion, according to the depth of the mortice to be cut. The two latter motions, if necessary, can, however be imparted by hand. The timber operated on remains stationary during the triple action of the drill. In order to square out a mortise hole thus obtained, he makes use of a right-angled tool, which is impelled by hand. He also attaches to the machine embodying the improvements in drilling machinery to pierce round holes preparatory to mortising, or for other purposes, if necessary.

Selected Articles.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Balloon Navigation.

Professor Challis communicated two papers; one on the extent of the earth's atmosphere, and the other on the effect of the atmospheric refractions of the sun, moon, and planets. In the former it was maintained on theoretical grounds that the terrestrial atmosphere is definitely bounded, and does not extend so far as the moon; and reference was made to balloon ascents as likely to furnish data for an approximate calculation of the actual height. In the second paper reasons were given, from the results of calculations applied to astronomical observations, for inferring that the moon has an atmosphere of very small extent, the effect of which is perceptible in the occulations of stars.

Professor Hennessy read a paper on some characteristic differences between the configuration of the surfaces of the earth and moon. He pointed out that the peculiarities observed on the surface of our satellite could be ascribed to the sole action of volcanic forces, whereas those which we find on the earth result from a combination of volcanic and atmospherical agencies. In order more perfectly to study these contrasts he called attention to the most characteristic feature of all lunar volcanoes, namely, the ring or hoop-shaped crater, surrounded by circular or nearly concentric ridges. On the earth's surface volcanoes deviated more or less from this type, and if the deviations be due to the differences between terrestrial and lunar superficial forces it must follow that such differences will be most distinctly manifested in those cases where such terrestrial forces possess the highest degree of energy. He illustrated this proposition by referring to the peculiar structure of the volcanoes in the island of Java, where the action of tropical rains and hurricans has been effective in producing the very widest differences between the terrestrial volcanic summits and those observed on the moon's surface. Instead of the hooped structure of the latter, we see at Java specimens of radiating ribs, like those of a folded lamp-shade, or an umbrella half-closed—an appearance due to the very regular manner in which the tropical torrents scoop out the friable and scoriaceous summits of the craters.

Mechanical Science.

Section G, Mechanical Seience, assembled in the Schools; Mr. W. Fairbairn, L. L. D. and F. R. S., President.

The President opened the proceedings by delivering an interesting address on the progress of mechanical science, especially during the past year. He then passed on to the Exhibition, and said:—"A very casual glance at this Exhibition, when compared with that of 1851, and that of Paris in 1855, shows with what intensity and alacrity the public mind has been at work since the people of all nations were first called upon to compete with each other in the peaceful rivalry of mechanical art. As one of the jury I examined with care and attention the whole of the mechanical inventions and machines in the International Exhibition. There is no new discovery of importance, except that the machines are more compact and better executed than at any previous exhibition. Taking the Exhibition as a whole, there is no very great, nor very important, discovery in mechanical science, but there is a great deal to be seen of a character both interesting and instructive. In land steam-engines there is nothing particularly attractive, if we except the growing importance of the horizontal, which is rapidly supplanting the beam, or vertical, engine. To the horizontal system may be applied economy in the first cost, and nearly equal efficiency in its application to mills and for manufacturing purposes. Another important feature in these engines is their smooth and noiseless motion, their compact form, and the facility with which they can be applied as helps, or assistants, to those of larger dimensions. They are, moreover, executed with a degree of finish and accuracy of workmanship which cannot easily be surpassed. In the agricultural department the same observations apply to this description of engine, where it is extensively used on a smaller scale. They are equally well made, and the country at large are chiefly indebted to our agricultural engineers for many ingenious contrivances and for their successful application, not exclusively to the farm, but to many other useful purposes in the economy of rural life. From ths motive power employed in our manufactories and its adaptation to agriculture, let us glance at the beautiful execution, compact form, and colossal dimensions of our marine engines, and we shall find in combination simplicity of form, concentration of power, and precision of action never before equalled in this or in any other country. Those who have examined the specimens of Mr. Penn and Messrs. Maudslay and Field in the International Exhibition must have been struck by the beauty and exactitude with which these engines are manufactured. In this department of construction we are without rivals, and it is a source of pride that this country, as the first maritime nation in the world, should stand preeminently first as the leader of naval propulsion. In locomotive as in marine constructions we are not behind, if we be not in advance of, other nations; although it must be admitted that several splendid specimens of engines from France and Germany are exhibited by some of the best makers of those countries. There is, however, this distinction between the continental locomotives and those of home manufacture, and that is, in this country there is greater simplicity of design, compactness of form, and clearer conceptions in working out the details of the parts. These operations, when carefully executed to standard guages, render each part of an engine a fac-smile of its fellow, and hence follows the perfection of a system where every part is a repetition of a whole series of parts, and in so far as accuracy is concerned, it is a great improvement on the old system of construction. The other parts of the Exhibition are well entitled to a careful inspection. In minerals and raw materials the collections are numerous and valuable, to an extent never before witnessed in any exhibition, and the articles, fuel and ores, will be found highly instructive. The machinery for pumping, winding, and crushing is upon a scale sufficiently large and comprehensive to engage the attention of the mechanic and miner, and it is only to be regretted that in every case competent persons are not in attendance fully prepared to explain and initiate the inexperienced student in the principles of the workings, and the cases of instruments so neatly classified and spread before him for instruction. In the machinery department, although there is nothing that strikes the observer at first sight as new, yet there are many useful improvements calculated to economize labour. and facilitate the operations of spinning and weaving, and in toolmaking there never were at any former period so many hands and heads at work as on the occasion pending the opening of the Exhibition. I do not believe that at any former period there has been such an exhibition of machines and of tools, which are the creators and makers of the machines themselves. Some of the tools, such as the turning, boring, planing, and slotting machines, are of a very high order, and the tool machinery for the manufacture of fire-arms, shells, rockets, &c., is of such a character as to render the whole operations, however minute, perfectly automaton, or self-acting, with an accuracy of repetition that leaves the article when finished identical with every other article from the same machine. Such, in fact, is the perfection of the tool system as it now exists that in almost every case we may calculate on a degree of exactitude that admits of no deviation beyond a thousandth part of an inch. Among the many interesting mechanical objects exhibited in the two annexes may be noticed, as original the spool machine for the winding of sewing thread on bobbins; the machine for making paper bags, invented by a pupil of my own; the saw riband machine, and others of great merit as regards ingenuity of contrivance and adaptation of design. In manufactures, in design, and in constructive art there is everything that could be desired in the shape of competitive skill, and, without viewing the success of the Great Exhibition of this year in a pecuniary point of view, we may safely attribute its great success to the interesting and instructive character of the objects submitted to public inspection." The President concluded with some observations on iron-clad ships, and recent gunnery experiments, with which our readers are conversant.

Mr. James Nasmyth described his solid bar valve motion, which as an improvement on the ordinary "link" valve motion was found most successful, and, since he contrived it in 1852, has been introduced with great success by Mr. Humphreys, as might be seen in his magnificent marine engines at present in the International Exhibition. The great simplicity of Mr. Nasmyth's solid bar link motion and its many practical advantages were, as it appeared, well calculated to cause its very general adoption, as the most simple and effective form of that important detail of the steam-engine.

Economizing Fuel.

Mr. Edward Ellis Allen, of London, read a paper "On the Importance of Economizing Fuel in Iron-plated Ships of War," and described a new double expansive marine engine, constructed according to his patent by Messrs. J. and G. Rennie, exhibiting photographs of the same, taken at their works. The author pointed out in detail the principles of marine engine construction which experience had shown to be absolutely essential in order to economize the fuel—viz., full expansion of the steam, surface condensation, superheating the steam, heating the feed water, jacketing the cylinders, and proportionately increasing the boiler power; and contended that in the ordinary marine engines now fitted to the iron-plated ships, though by the best makers, and of the most admirable workmanship, economy of fuel was impossible. The necessity of largely increasing the cylinder capacity to admit of expansive working, rendered an entire change in the forms of marine engines imperative, the large diameter short-stroke engines of the present day consuming as much as 4½lb. of coal per indicated horse power per hour, whereas double expansive engines, on the plan suggested, and every way suited for Government vessels, would save 50 per cent. of the present consumption of fuel. The amounted yearly voted for coals for the navy now exceeds £300,000 per annum, and the author stated it as highly probable that it would rise to upwards of a million sterling, when our iron-cased fleet was complete, unless changes were made in the construction of engines employed in war steamers. The engines referred to had been frequently submitted to our Admiralty, and the author hoped there were prospects of his plans being tried, Messrs. Rennie being prepared to guarantee their efficiency and economy. He concluded by referring to the engines proposed by him in 1855, and similar in principle to those made by Messrs. Rennie, but worked by means of a trunk instead of double piston rods, the former plan being, he believed, adopted for the engines of the "Poonah," now constructing for the Peninsular and Oriental Company by Messrs. Humphreys and Tennant.

Mr. Scott Russell said they were all agreed that the short-stroke engine was wasteful of fuel in marine engines, and of the powers to gain speed. The importance of saving fuel to the Admiralty was so great that they ought to take the lead in experiments for this purpose. Without saying that Mr. Allen's invention was the best that could be devised, he would say that the combination he suggested offered considerable hopes that an economy of fuel would be attained without reducing the work performed by the engines.

The President said that he had always found that experimental tests in working steam by expansion were always more successful than they were found to be in the actual working. Unless, therefore, the experiments were carried out on a large scale and on a long voyage, and an average obtained, they could not be considered altogether satisfactory.

Mr. Allen said that the "Moolton's" voyages gave very successful results.

A New Marine Boiler.

Dr. F. Gramaldi read a paper on "A New Marine Boiler," the principle of which was that the whole boiler, which consisted of a cylinder nearly filled with tubes, was kept slowly revolving during the time of working. Detailed drawings were exhibited of a boiler of 100-horse power, which occupied less than half the space of ordinary marine boilers of the same power, and was of less than half the weight. The fire-grate, placed beneath the boiler, has the whole shell brought gradually over it, the hot gases passing through all the tubes, part of these being covered by the water and part in the steam space, thus rendering the boiler a steam generator and a superheater.

In the discussion which followed, and in which Mr. Siemens, Mr. Allen and Mr. Scott Russell took part, the general principle of the boiler was fully approved, and it was stated that Mr. J. Stewart, of Blackwall, was about to construct one suitable for for a steam vessel. The plan had been tried on land, and details of the experiments were given.

Mr. Thorold read a paper "On the Failure of the Middle Level Sluice, and the means of preserving such sluices." Mr. Thorold attributed the failure to the silty nature of the soil being too weak to withstand the great hydrostatic pressure brought against it at high tides, and he proposed to remedy and secure such sluices from the possibility of failure in future by the erection of a duplicate sluice at the back of the sea-sluice, for the purpose of keeping up a head of tidal water to a medium height between the two sluices when the sea-sluice was closed by the tide, and he showed by a diagram how this was to be accomplished, avoiding three-fourths of the usual pressure without detracting from the utility of the sea-sluice.

Mr. Vignoles, while fully approving Mr. Thorold's plan for securing such sluices, suggested that, as there was to be an excursion to the dam and syphons on Saturday next, and as there were so many questions arising out of the failure, legal and otherwise, he thought it most prudent that the discussion on Mr. Thorold's interesting paper should be deferred until Monday next, when, after having seen the site of the old sluice and dams, members would be in a better position to discuss the whole subject of failure, and the questions of dams and syphons.

Mr. Vignoles' suggestion was approved by the section.—*From the Mechanics' Magazine.*

Mechanical Properties of Projectiles.

The President made some observations on the result of some experiments on the "mechanical properties of projectiles." He commenced by stating that, in the investigations which had taken place with regard to projectiles and armour-plated ships, one great difficulty that had arisen was to get plates of sufficient thickness, and vessels of sufficient tonnage to carry those plates. It appeared that they were limited to plates of five inches in thickness; with plates heavier than that a ship would not be what was technically called "lively." He had attended the experiments at Shoeburyness from the commencement, and they had reference to the force of impact. He would state the results of the more recent experiments, which had not yet been published. The first series of experiments had reference to the quality of the plates and the properties of the iron best calculated to resist impact. There were three qualities required—1st, that the iron should not be crystaline; but, 2nd, that it should be of great tenacity and ductilty; and, 3rd, that it should be very fibrous. The president produced specimens of spherical and flat-ended shot, and proceeded to give the statical resistance of each.

The mean statical resistance to crushing of the two flat-ended specimens of cast iron is 55·32 tons per square inch. The mean resistance of the two round-ended specimens is 26·87 tons per square inch. The ratio of resistance, therefore, of short columns of cast iron with two flat ends to that of columns with one flat and one round end is as 55. 32 to 26·87, or as 2·05 to 1—an extremely close confirmation of Professor Hodgkinson's law. Applying this same rule to the steel specimens, it would appear that the flat-ended shot would have sustained a pressure of 180 tons per square inch before fracture. In the experiment it actually sustained 120 tons per square inch without injury, excepting a small permanent set. In the experiment with cast iron the mean compression per unit of length of the flat-ended specimens was ·0,665, and of the round-ended ·1,305. The ratio of the compression of the round-ended to the flat-ended was, therefore, as 1·96 to 1, or nearly in the inversed ratio of the statical crushing pressures. Applying this law to the case of the steel flat-ended specimen, we may conclude that the compression before fracture would have been only ·058 per unit of length. The determination of the statical crushing pressure of the flat-ended steel shot as 180 tons per square inch and its compression as ·058 is important on account of the extensive employment of shot of this material, size, and form in the experiments at Shoeburyness. In the case of the lead specimens, the compression with equal weights was the same, whether the specimen were at first round-ended or flat-ended. This is accounted for by the extreme ductility of the metal and the great amount of compression sustained. In regard to the wrought-iron specimens, it may be observed that no definite result is arrived at, except the enormous statical pressure they sustain, equivalent to 78 tons per square inch of original area, and the large permanent set they then exhibit:—

	Statical resistance in tons per square inch.		Dynamical resistance in foot lb. per square inch.
Cast-iron, flat-ended ...	55·32	......	776·8
Cast iron, round-ended	26·87	......	821·9
Steel, round- ended ...	90·46	......	2,515·0

In the experiments on the wrough-iron specimens the flat-ended steel specimen, and the lead specimens, no definite termination was arrived at, the material being more or less compressed without any fracture ensuing. Hence it is difficulty to draw conclusions from these results, but the great amount of work expended in compressing the wrought-iron specimens, amounting in one case to 4,340 foot lbs., or nearly twice as much as was required to fracture the round-ended specimen of of steel. On the other hand, the low statical resistance of lead corresponds with a dynamical resistance almost equally low. The work required to crush similar specimens of cast iron is nearly the same whether the ends be rounded or not, the round-ended requiring rather more work to be expended than those with flat ends. It is, therefore, obvious that there is no analogy between the law deduced for statical forces by Professor Hodgkinson and the law regulating the dynamic resistance. The mean resistance of the specimens of cast iron is 800 foot lb. per square inch; that of the specimen of steel is 2,515, or rather more three times as much. The conditions which would appear to be desirable in projectiles, in order that the greatest amount of work may be expended on the armour plate are—1st, Very high statical resistance to rupture by compression. In this respect, wrought iron and steel are both superior to cast iron; in fact, the statical resistance of steel is more than three times, and that of wrought more than two-and a-half times, that of cast iron. Lead is inferior to all other metals experimented on. 2nd, Resistance to change of form under great pressures. In this respect hardened steel is superior to wrought iron. Cast iron is inferior to both. The shot which would effect the greatest damage to a plate would be one of adamant, incapable of change of form. Such a shot would yield up the whole of *vis viva* to the plate struck; and so far as experiment yet proves, those projectiles which approach nearest to this condition are the most effective.

The President stated that steel shots might be made at comparatively small cost. Mr. Bessemer had informed him that if he had a large order he could produce steel shot at very little more than the price of wrought iron. But if ingots as cast had to be rolled or hammered to give them fibre, they would cost something like £30, instead of £8 or £10 per ton.

Penetration of Projectiles.

Mr. T. Aston, M.A., read a paper on "Rifled Guns and Projectiles adapted for Attacking Armour-plates." After alluding to the interest with which the contest between artillery and armour-plates has been watched by the country, he explained what was the actual condition of this important question so late as May last by quoting a statement made by Sir W. Armstrong at a meeting of the United Service Institution on the 20th of May last, as follows:—"It certainly may be said that shells are of no avail against iron-plated ships; but, on the other hand, I may say that neither 68-pounder nor 110 pounder guns, with solid round shot, are effective against such iron vessels. The fact is, what we want is a gun, in addition to our 110-pounder rifled gun, especially adapted for breaking through iron plates. That is what we are in want of now." This candid confession is startling when it is considered that long ago France armed her Gloires and Normandies with rifled 90-pounders proved to be efficient against iron-plates and it caused the country serious anxiety to hear Her Majesty's ministers state, as they did in Parliament last session (of course on the authority of their scientific advisers), that after all the vast expenditure upon our new artillery, the navy of England is compelled to arm her navy with the old smooth bore, and that is the best gun the navy actually possesses, though declared by Sir W. Armstrong to be so inefficient. Such being the state of the question a few months ago, Mr. Aston proceeded to consider, first, the reason why the artillery hitherto employed in the service (including rifled guns and smooth-bores) has always failed to make any impression on the plated defences at ordinary fighting range; and, secondly, by what means artillery science has lately reconquered its lost ground. Three conditions were laid down as necessary to enable artillery to attack successfully armour-plate defences—1st, the proper projectile must be of the proper form; and 3rd, be propelled from a gun able to give it the necessary velocity. The artillery of the Ordnance Committee failed because they utterly neglected the first two conditions, and had recourse to the brute force of the smooth-bore for the third. The expression accepted as representing the penetrating power of shot was "velocity square, multiplied by weight," but the form of the shot and the material were conditions altogether omitted from the expression, and the importance of the omission will be obvious at once if an analogous case, say a punching machine employed to perforate wrought-iron plates, be taken. What would be the result if the punch, which is made of suitable shape and material, were removed, and a round-headed poker of brittle cast-iron or soft wrought-iron were substituted in its place? The great importance of velocity was conceded at once; it is a *sine qua non* condition, but there has been great misconception in supposing that the old smooth-bore gives a greater initial velocity than the rifled gun, as the results obtained will show. The average initial velocity of the 68-pounder is, in round numbers, 1,600 feet per second, with a charge of powder one-third the weight of the shot, the length of the shot being, of course, one calibre. Sir W. Armstrong stated that, with a charge of powder one quarter the weight of the shot, he obtained with his rifled gun an initial velocity of 1,740 feet per second. He did not state the length of his projectile. Mr. Whitworth, with a projectile two calibres long, obtains an initial velocity of 1,100 feet per second, and with a projectile one calibre long, like that of the smooth-bore, an initial velocity of 2,300 feet per second, being greater than that of the smooth-bore in the proportion of 23 to 16. The following table shows the actual results obtained by various:—

Gun.	Range.	Projectile.	Powder Charge.	Penetration into Armour Plate.
Armstrong. 110-pounder	200	110lb. solid	14lb.	1½ to 2 inches.
68-pounder smooth-bore	200	68lb. solid	16lb.	2¼ to 3 inches.
Whitworth 70-pounder	200	70lb. shot and shell	12lb.	Through plate and backing.
Whitworth 120-pounder	600	130lb. shell	25lb.	Through plate and backing.

The first two results show that the Armstrong rifled gun is a worse compromise than the old gun it was intended to supersede. It is worthy of notice, that the velocity of the Whitworth heavy projectile after traversing 600 yards (a good fighting range was 1,260 feet, being 50 feet greater than the initial velocity of the Armstrong projectile, which is 1,210 feet at the muzzle of the gun. The total results in respect of penetration being so decidedly in favour of Whitworth, it follows that he has adopted the best compromise, by combining all three necessary conditions of proper form and material of projectile and sufficient velocity. That the velocity, though perhaps at the muzzle of the gun slightly below that of the smooth-bore, is sufficient, when combined with proper form and material of projectile, is shown by the penetration result, which in the case of the Whitworth is through and through both armour-plate and backing; in the case of the smooth-bore it is barely through half the armour-plate, and in the Armstrong is not half through. The form of projectiles, both shot and shell, employed by Mr. Whitworth for penetrating armour-plates were then described. The material of which the projectile is composed is what is termed homogeneous iron, combining the toughness of copper with the hardness of steel. It undergoes a carefully-regulated process of annealing. The same metal is used for the Whitworth field guns, and practical improvements now enable it to be worked in masses of any requisite size, whose quality may be henceforth depended upon with certainty. Mr. Whitworth is, therefore, now making his heavy ordnance with both interior tubes and outer hoops of homogeneous metal of the improved manufacture, so that the guns will be constructed throughout of one uniform metal, without any welding at all. Experience justifies the expectation that they will be free from the objections which it is well known are inherent in all welded guns, and be fully able to resist the severe and searching strain that is sure, sooner or later, to disable a gun built up of forged coiled tubes, if it be called upon to do its full work, by discharging heavy projectiles at efficient velocities.

Professor Tyndall's Lecture on "*On the Forms and Actions of Water,*" was illustrated by some brilliant experiments. The professor dwelt at the outset on the energy of molecular forces In the combination of oxygen and hydrogen to form a gallon of water, weighing 10 lb., an energy was expended—the atoms clashed together with a force —equal to that of a ton weight let fall from a height of 23,757 feet. In falling from the state of vapour to that of water an energy was exerted equal to that of a ton falling from a height of 3700 feet, or of 1 cwt. from a height of 74,000 feet. The moving force of the snow avalanches of the Alps was but as that of snow-flakes compared with the energy involved in the formation of a cloud, In passing finally from the liquid to the solid state, the atoms of 10 lb. of water exercised an energy equal to that of a ton weight falling down a precipice 550 feet high. The Lecturer then halted to consider some of the phenomena connected with water in its vaporous state. Its action upon radiant heat was extraordinary. Though forming only about 0.5 per cent. of the entire atmosphere, for every ray of terrestrial heat struck down by the air, fifty, sixty, or seventy rays were destroyed by the aqueous vapour. The vapour of the lecture-room was shown by condensing it on the surface of a vessel containing a freezing mixture, on which it precipitated itself in such quantity that, when scraped off, a snowball was formed of the condensed vapour. Aqueous vapour was the "barb" of our atmosphere; it permitted the solar rays to reach the earth, but intercepted the terrestrial rays in their escape towards space. The Desert of Sahara showed us what would be the effect of its removal. There, where "the soil is fire and the wind is flame" during the day, the nights are intensely cold; ice, in fact, has been known to be formed. Were the aqueous vapours removed from the air which covers England, no doubt a single summer night would destroy all plants incapable of bearing a freezing temperature. The Professor then dwelt briefly on the liquid state of water, and passed on to consider its solid form. Ice was chosen, and shown to be eminently brittle. Pieces of it when placed together froze together. This freezing was shown to occur in hot water. The ice was scraped to fine powder, and the frozen powder placed in a mould, was squeezed to a sphere of hard ice by the pressure. Cups were formed from the ice powder; and in the presence of such experiments it was easy to see how the snow of the Alpine mountains should compress itself to ice, and how the ice could be squeezed through the moulds formed by the valleys. From existing glaciers the Professor passed on to those of a former epoch, and showed that a diminution of the sun's heat would not account for them. They were as much a proof of heat as of cold. They were a proof of powerful condensation, but to produce the vapour for condensation an enormous expenditure of heat was necessary. To produce a glacier required as much heat as would raise five times the weight of that glacier of cast-iron to its melting-point. What was wanted, then, to produce a glacier epoch was not a less powerful sun, but a more powerful condenser; and the speaker conceived that this was most easily obtained by assigning to the Alps a greater mean elevation than they now enjoy. For ages they have been planed down by glaciers and by atmospheric denudation generally. The valley of the Po is overstrewn with their ruins; by the wear and tear of time they must have been lowered, and hence rendered incompetent to condense the vapours necessary to produce the glaciers of a bygone age.

A COURSE OF SIX LECTURES,

On some of the Chemical Arts, with Reference to their progress between the Two Great Exhibitions of 1851 *and* 1862, *by Dr.* Lyon Playfair, *C. B., F.R.S., Professor of Chemistry in the University of Edinburgh.*

Calico Printing—Showing the Important Chemical Manufactures dependent on this Art, and some of its Preliminary Processes.

Lecture III.

I now pass to the subject of mordants. The application and fixation of mordants form the most important parts of the preliminary operations of the calico printer's art. The mordant is the material which is fixed upon the cloth, and which has the power of taking the coloring matter out of the drug. You will find that among these specimens here I have a pattern printed upon this cloth. The pattern is printed with what are called the mordants. These mordants are generally oxides of iron, oxides of tin, or oxides of aluminium or alumina, most of them being oxides which play the part in the operation of weak acids. Now you will understand what the operation of a mordant is, if I give you some elementary experiments upon this cloth. I dip the cloth into a mordant which, in this instance, is a solution of oxide of iron. Now, the object of the mordant is to enter into the material, and by combining with the color to render it insoluble within the pores of the cloth. I have got the mordant within the pores of the cloth, and if it be immersed in a color-giving liquid, the mordant will combine with it and render the color insoluble within the pores of the cloth. I now dip it in this solution, and you see that it immediately becomes of a deep blue. In this case I have used prussiate of potash. That blue color is rendered insoluble in the cloth, and will bear washing. By means of these mordants it is possible to render insoluble the color, which would otherwise be soluble and wash out. It penetrates the pores of the cloth, and the action of the mordants being to render it insoluble, the color remains.

The art of the calico printer, however, consists in trying to produce several colors at one operation. I will represent that also to you in an elementary way. I have here the means by which I may produce two colors by one operation. In this case I have copper in one part and iron in another. If I add a little acid to this and stir it, and then put the cloth into the solution, I have no doubt that after a little time you will see that one part will come out of a mahogany color, and the other, as it gets wet will become blue. You see in this case we are producing two different colors by one operation. We can always manage, by a little chemical artifice, to get different colors out of the same material.

The calico printer's art, however, would not be contented with such a simple and elementary experiment as that. He sometimes desires to produce twenty colors instead of two colors. You must follow me carefully in order to understand how he gets such a great success in his art. I must now stop my explanation of the action of mordants by interpolating it with an important operation which he performs, and which, though simple, is important. I will here try to print a cross on this cloth with cochineal. You see that I produce nothing but an ugly smear. The color runs aside all over the cloth as it would do upon blotting paper, and I cannot produce the cross that I desire because the color runs about and produces no definite character. The calico printer has to overcome this difficulty. He must print on his mordant in such a way that it may not run, and so that the pattern may be precise, as you see on these print patterns, and that there may be no running at the edges. Now, he effects this by a very simple operation, He puts a certain quantity of gum into the substance, and the adhesiveness of this gum prevents it from running, so that now I can produce exactly any figure which I desire. I produce here a cross, and this cross will be as precise as I happen to paint it on, because the gum in this case prevents the liquid from running at the edges of the cloth. It is by mixing it with gum, or "thickeners," as it is termed, that a precise pattern is produced. Now this thickening has in itself created quite a set of new works. The making of thickeners for the calico printer has caused a large trade to arise in the manufacture of "British gum," as it is termed. Acetate of iron and acetate of alumina are the two common mordants which are used. These mordants are thickened and mixed in the necessary proportions which I shall presently explain, and are printed in the desired pattern on the cloth. The most elementary way of doing this is by a process which was followed in Hindoostan long ago. The pattern was cut out on a block, and then the thickened mordant was taken upon an elastic drum and spread on the block, and the pattern of the block was then printed on the cloth. But as mechanical contrivances became improved, the process of printing by machinery was adopted. We will show you the machine in the next lecture as we are coming more upon that part of the subject then; but here is the means by which it is done. The impression is made upon a roller like these. The rollers are generally much larger than this. They are so made to work by mechanical contrivances, one into another, that they will produce from five to twenty impressions by acting in harmony with one another so as to form a unity in the design. It is a beautiful contrivance of the mechanist, but it is not a chemical subject upon which we can at all dwell.

Now, before completing the subject of mordants I have still another thing to bring before your attention, and that is the resists and discharges. There would be no beauty in our designs were we not able to preserve the white portions upon them, either to introduce new colors afterwards, or to produce certain desired patterns. For instance, in this yellow pattern you observe these whites which are left quite white, although they have been in the bath. Now, the resists and discharges are merely means of preventing the mordant fixing itself to particular parts of the cloth, where it is not desired to have the color produced. Certain acids, oxalic acid, lime juice, or citric acid, are placed upon the parts where these oxides are not desired to fix themselves, so that while the oxides run over the whole of the rest of the cloth they meet with these resists where they have been applied, and those parts come out uncolored. This is a matter which may be readily understood.

One of the most important of these resists or discharges is oxalic acid. This was an expensive substance — so expensive that the consumption throughout the whole world was supposed to be recently only fifteen tons weekly. It is the acid which exists in the common sorrel, and is often called salt of sorrel. It has been made, until within the last year or two, by acting upon starch or sugar with nitric acid. Now, starch and sugar are what some chemists call hydrates of carbon; that is to say, they are compounds of carbon in which hydrogen and oxygen are present in the same proportion as in water. The starch and sugar are themselves expensive materials, and the nitric acid is still more expensive. There is however, a hydrate of carbon which is very cheap. It is a waste material which we have not known what to do with until about a year ago. This is common sawdust. It is of the same chemical composition as starch or sugar. When sawdust is thrown upon a fire it unites with oxygen, burns, and produces carbonic acid. If this oxidation be stopped half way oxalic acid is produced. Oxalic acid is half way between oxidation of any of the hydrates of carbon and complete oxidation for the formation of carbonic acid. Now, this sawdust within the last year or two has been made to produce oxalic acid by a beautiful manufacture. A process often employed to produce imperfect oxidation is to heat the organic body with hydrate of potash. In this case the water of the hydrated alkali is decomposed, the oxygen entering into the organic body and decomposing it, while the hydrogen escapes either free or sometimes carrying some carbon in its flight. Messrs. Roberts and Dale, of Manchester, have followed this plan very successfully. Soda being a substance which is much cheaper than potash, it naturally suggested itself as equally fit for the purpose of producing this partial combustion, but practically it is found that it does not produce oxalic acid by its action on sawdust. Potash which will produce it is too dear to be employed on it exclusively. It has been found, however, that two equivalents of hydrate of soda, and one equivalent of hydrate of potash answers admirably. It is curious that soda will not do alone. The sawdust is mixed with these quantities, and allowed to remain in contact for a little time, and it assumes this brown appearance. It is now heated for three or four hours at a temperature of 400° in shallow pans having cast-iron bottoms; and now it gradually gets into an intermediate product, but only contains about two or three per cent. of oxalic acid. It is now heated still further, and is converted into oxalic acid in combination, of course, with soda and potash, forming the oxalates of those alkalies. Here comes a beautiful process, one which is still mysterious to the chemist. This mixture of oxalate of potash and oxalate of soda is thrown upon a filter, and a solution of carbonate of soda is passed through it, and probably from the oxalate of soda being more insoluble than oxalate of potash the oxalate of soda reminds behind, while carbonate of potash filters through. This oxalate of soda is now mixed with lime and forms oxalate of lime, liberating the soda. The soda is added to the potash which came through in the filtering. Sulphuric acid is now added to the oxalate of lime. Sulphate of lime is thus formed, and oxalic acid remains dissolved in the water, from which it is afterwards crystallised, and you get this beautiful material oxalic acid. Two pounds of sawdust will yield one pound of oxalic acid. Roberts and Dale, who have perfected this process in Manchester, now make nine tons per week; and the price of it has fallen from fourteen or fifteen pence a pound, to eightpence or ninepence a pound.

Now I want to shew you the application of these acids—oxalic, tartaric, and the various others—to the purpose of discharges. You can understand these readily as resists. They protect the white places and keep them uncoloured; but you may not so readily understand how they act as discharges. A "discharge" is a term applied to an agent which is used for the removal of the colour from this red cloth, how am I to accomplish it? I remove it by a very pretty artifice. Chloride of lime bleaches on account of the chlorine that it contains. Now, supposing I desire to get a white place upon this cloth, I have merely to print an acid, such as tartaric acid, upon my red material, and then dip it in chloride of lime. The acid used will unite with the lime and liberate the chlorine, and then a spot will be discharged so that the fabric will be bleached at that spot. I think I can show you this in a simple manner. I have here a solution of chloride of lime, and there are little spots printed on the cloth with tartaric acid. I have here also some Prussian blue printed along with the tartaric acid where the colour will be discharged. Now, if I dip this in chloride of lime and leave it, see how the colour is gradually discharged from the place where the acid was put, producing my white pattern, and at the same time bringing out these beautiful blue spots. This is a topical production of chlorine at the particular place and under the precise circumstances in which we desire to have it. Now, many applications of this principle are made. For instance, I have in this case nitrate of lead and bichromate of potash, which will produce a yellow, and in the same way I can bring out the colour, and produce yellow spots as well as white,—white around the yellow. We can by this means produce a large number of different kinds of patterns, by using my discharger topically, and producing the colours exactly as they are required. Thus, these dischargers, or acids, which are a manufacture of themselves, become an extremely important means of producing various patterns in the calico-printing art.

Now, let us return to the mordants, for they are very important. The mordants are printed on the cloth. Now, these mordants are printed by the machine—acetate of alumina for the red, a dilute solution of acetate of iron for the black, and a mixture of acetate of iron and acetate of alumina for chocolate. But all these are soluble, and wash off in water. The object now is to render them insoluble, so that the colour may be lodged within the pores of the cloth itself. That is done by what is termed "the process of ageing." This formerly consisted of hanging up the cloth in certain folds in rooms heated to summer temperature, for five or six days, and often for longer, according to the amount of iron which is present in them. During this time, while they are heated up to a summer temperature, the acetic acid escapes from the mordants, and the oxide of iron and oxide of alumina are left upon the cloth. But a large establishment was until recently required for the process of ageing. You required extensive rooms in which to hang up the cloths, and great delay was caused in the dyeing. Within the last year or two an improvement has been introduced, by which the necessity for these extensive rooms is removed. We have only a decade of discoveries to treat of here, between the Exhibitions of 1851 and 1862. In 1856, Mr. Walter Crum, of Glasgow, a man of science, to whom the art of calico printing already owed much of its perfection, discovered a beautiful mode of ageing which is now getting generally adopted. The printed cloths are passed up into a room heated to about 100 degrees, and moistened by steam which comes into the apartment through a trumpet-mouthed opening. By this process the printing material absorbs in fifteen minutes a large quantity of moisture, and it quickly loses acetic acid. It has not, however, become sufficiently aged, and it is therefore now taken from this room and folded up loosely, but simply in single folds. It is put in rooms heated to 80 degrees, and is still kept moist. Here in the course of two or three days it absorbs oxygen and becomes sufficiently aged.

Now comes a curious feature of the operation, which startles one at first as a means of cleansing the cloth. It is necessary, if you will allow me to use the expression, to scour the surface of the cloth in order to make it clean enough for the purpose of the calico printer. You recollect that these mordants have been put on by means of thickeners of gum and various other materials, and it is necessary to remove all these thickeners and other substances by scouring the surface of the cloth, so that the printer can use it. Now, if nothing more than this was required, it would be sufficient to pass this printed material through ordinary hot water, and that would take off the thickeners and leave the cloth in the proper state; but that is not sufficient, and for this reason: all the mordants are not decomposed in the process of ageing. Some of them still remain in a soluble state, and if you simply use a bath of hot water the soluble mordants would attach themselves to the portions of the cloth which are to be left white, and would foul them, so that in dyeing, the cloth would be smeared over by the portions of the mordants thus dissolved. To prevent this the calico printer made use of a curious process, which was to pass the cloths through baths in which the dung of cow houses was placed. In this way all the soluble mordants were converted by the cow refuse into insoluble substances, which could no longer attach themselves to the cloth and cause a confusion of the colours. In consequence of this operation large dairy establishments were connected with print works, so that the printer might have a sufficient quantity of cow refuse for this purpose. After a time, when the action of this substance began to be properly understood, chemists asked themselves whether some substitute could not be used, so that this objectionable process might be dispensed with. They soon discovered that the peculiar action of this refuse upon the mordants was due to the phosphates which it contained to a considerable extent; and it was then easy to make artificial phosphates,—phosphates of soda and phosphate of lime,—and these were mixed together with glue, and sold for a long time under the name of "dung substitute." Within the last few years chemists have found that even these phosphates are not required, and that it is better to use arseniate of soda—arsenic acid united with soda. You may have some idea of the enormous quantity of this highly poisonous salt that is used, when in Lancashire alone 500 tons of this arseniate is annually made for the purpose of the calico printer. The use of this substitute has a great advantage. The material is added to the bath, and you may pass several thousand pieces through the same bath, by adding a little additional arseniate of soda. The same bath may thus be used for several thousand pieces without being changed; but in the old plan, where cow-dung was used, it was necessary to change the bath after a few pieces had been passed through it, so that the application of these phosphates and arseniates to the purposes of the calico printer has enormously aided him in diminishing the necessity for labour. I am, however, sorry to say that calico printers do not know what to do with the waste of these arseniate baths after they have used them, and they require changing; and, in order to get rid of this arseniate, they have turned it into the nearest stream in the neighbourhood of the works; and then this stream passes in course of time into the reservoirs in which the water is stored for the purpose of being supplied to the inhabitants of the district; so that they are obliged to drink the arseniate which the calico printers have used. Only a few months ago I was sent down to Stockport, in Cheshire, where they suspected that they were drinking arsenic in the water supplied to them. The town is supplied with water from streams which have passed some print works. The mud of the reservoirs was highly charged with arsenic and lead, and the water which the inhabitants drank had arsenic in it, but in such a small quantity that it was not hurtful. This practice of throwing the arseniates into the streams cannot be too highly reprobated. As calico printing is increasing, these poisonous materials are also increasing in their consumption; and however we may wish to allow manufactures to proceed without any legislative interference, it is clearly quite wrong that they should think so slightly of the health and life of the rest of the population, as they appear to do when they pour these poisonous materials into our streams.

I have now, as my hour is drawing nearly to a close, to allude to the last part of our preliminary subject, that is, the process of dyeing; but as we shall deal with that more fully in the next lecture, I will now only allude to it very slightly.

The oxide of iron, the oxide of alumina, and the other mordants which are employed, have a great disposition to unite with colouring matters and to produce insoluble precipitates. There are some of these insoluble precipitates produced here. For instance, this is with the colouring matter of cochineal, and the mordant employed is acetate of alumina. The precipitate consists of cochineal and alumina.' The process has carried down the colouring matter, and produced an insoluble substance which is called a lake. Here is a lake which has been produced by iron.

Now, the most common colouring matter which is employed is the material called madder, of which there are several specimens there. This colouring material, madder, forms, with these mordants, various degrees of colour. I have here an interesting series of the true colouring matters produced from madder, or extricable from madder, by various chemical reagents; for these I am indebted to Dr. Schunk. You will see here a large number of them; but the most important of the substances is this beautiful crystalline material alizarine, the chief principle in the madder. What are the lakes or insoluble substances which the colour produces with these mordants? Alumina produces with the colouring-matter of madder, a red; iron, when weak, produces purple; iron, when strong, produces, with the colouring-matter of madder, black. Now, you may easily conceive that you may have any mixture of red, purple, and black, according as you take a larger proportion of one out of the other. If you wish to produce a chocolate upon your calico you mix the colouring matter with alumina, which produces purple, and with iron which produces red, and the red and the purple together produce chocolate. You may also produce any shade of these colours that you wish, according as you make the solutions of the mordants strong or weak. In this way, by the use of these various substances and by printing these mordants in various strengths and admixture upon the cloth, you can produce a large number of colours.

Now, let us see how this takes place in the arts. After you have printed these mordants upon the cloth, aged it, and dunged, you have got it into the state which is represented there. You now pass it through madder and blow in steam, gradually raising the temperature in about two hours to the boiling point. You must not do it too quickly. When you have put the alumina alone it becomes purple; where you have put a weak solution of iron it becomes red; where there is a strong solution of iron it becomes black; and where you have applied a mixture of alumina and iron it becomes chocolate. Now, this specimen is of an unpromising colour. It is ugly and smeary, and has been dyed too strong intentionally. It is now cleaned by soap, which, you see, cleans it very much, and produces a much better effect. It cleanses the whites, and also cleanses the purples. The effect is thereby much improved. It is then finally passed through a weak solution of chloride of lime, and this bleaches the various portions of colour which may have got attached to the white, and brings it into a state in which it is capable of being sold. You see now that Pliny's explanation was the best which could be given. The mordants are painted in a pattern upon the cloth, and when it is put into a bath, the bath really "paints as it boils." It paints the different colours according to the nature of the mordant which was placed upon it, producing various shades and various colours, according to the chemical nature and the strength of the mordants which are employed.

In the next lecture I propose to bring before you the discoveries which have taken place in this interesting art during the last ten years.

UNBRANNING OF WHEAT.—IMPORTANT TO MILLERS.

In the report on the alleged grievances of the journeymen bakers, made by Mr. H. Seymour Tremenheere, to the Secretary of State for the Home Department, a process of unbranning wheat is described, which seems likely to exercise an important bearing on the supply of food. Messrs Hadley, of the City Flour-Mills, stated to Mr. Tremenheere as follows:

"We have been making experiments for some time on the mode of unbranning wheat, invented by Mr. Bentz about the year 1846, in America, and subsequently patented. The object of this process, is to separate the outer cuticle, which is wholly innutritious, from an interior section of the wheat berry, which contains mostly nitrogenous matter, and which has hitherto been lost as human food.

"There are two leading advantages in this process. First, the cleanliness of the flour produced. In grinding by the ordinary process it is impossible to render the flour entirely free from dust and dirt. After putting the wheat through two or three processes of cleaning in the common way, there will be still some dirt remaining in it. All flour always contains more or less of this dust. There is also a portion of the beard of the wheat, a kind of fibrous appendage, which is always ground up with it; no process hitherto known has been able to get rid of it

"By Mr. Benty's process, as the exterior cuticle is entirely removed previously to grinding, the flour is necessarily perfectly clean, and free both from dust and this fibrous down.

"Secondly, by the ordinary mode of grinding, the result obtained is 76 per cent. of flour for human use. By the new process we find, after a series of very careful experiments, extending over several months, that we obtain about 86 per cent. of the whole berry available to make bread.

"The money value of this increase of 10 per cent. is subject to a deduction of about one-half in consideration of the lessened quantity of offal, the value of which we may take at half of that of the flour if used as human food. The offal is used for many purposes, which give it a value larger than would at first sight be conjectured.

"In addition to this net increase of 5 per cent. in value of flour available for human food, the flour made by by this process, containing all the nitrogenous or nutritious matter existing in the berry hitherto lost, yields a large increase in the number of loaves per sack. From the trials which we have ourselves made, we are satisfied that that increase may be safely stated at 20 lbs. of bread per sack of flour. This, taking the common average yield of a sack of flour at 90 four-pound loaves or 360 lbs. of bread, amounts to an increase of upwards of 5 per cent. on the bread (18 lbs. would be exactly 5 per cent.)

"The aggregate gain in flour may, therefore, be safely stated at 10 per cent.

"There is also another source of gain in a national point of view, in the increased nutritive value of the whole mass of the flour made by this process."

Dr. Dauglish, whose paper descriptive of his process of making aërated bread was read before the Society of Arts, in reference to the unbranning, states as follows:—

"The invention was brought under the notice of the French Emperor, who caused some experiments to be made in one of the French bakeries, to test its value. The experiments were perfectly satisfactory, so far as the making of the extra quantity of fine flour was concerned; but when the flour was subjected to the ordinary process of fermentation, and made into bread, much to the astonishment of the parties conducting the experiments, and of the inventor himself, the bread was brown instead of white. The consequence, of course, has been, that the invention has never been brought into practical operation. But about four years ago, a French chemist, M. Mége Mouriès, directed his attention to the subject of utilising for the purpose of white bread, the nutritious substances ordinarily thrown away with the bran, and the results of his enquiries were communicated in a memoir to the Academy of Sciences, on June 9, 1856, and have since been reported on by MM. Dumas, Pelouze, Payen, Peligot, and Chevreul.

"These results explain most satisfactorily the cause of failure of the flour prepared by the American method to make white bread.

"Before the publication of M. Mouriès' researches, the nutritious substance attached to the bran was considered by chemists to be a portion of the gluten of the grain, but it now proves not to be gluten at all, but chiefly a new nitrogenous body analogous to gluten, which the discoverer has named 'cerealine,' with a portion of another well-known nitrogenous body—'vegetable caseine.'

"Among the properties of this body, cerealine, M. Mouriès gives the following:—

"It is soluble in water, and insoluble in alcohol. It acts as a ferment on starch, dextrine, glucose, or grape sugar. It alters gluten extremely, and gives to the altered matter a brown colour. Its peculiar action, when brought into contact, in the process of fermentation, with the ordinary constituents of fine white flour, is the true cause of the dark-brown colour imparted to the bread made from flour in which the cerealine was retained.

"M. Mouriès, having satisfied himself as to the properties of cerealine, adopted a method by which its peculiar action was neutralized, and then made bread by the ordinary process of fermentation, in which the whole of the bran contained in the internal coat of the grain was allowed to remain. The result was a loaf having merely an orange colour, but none of that dark-brown colour which always results when the bran contained in the internal coat of the grain is used in bread made by the ordinary method.

"In like manner, by my process, in which the fermentative changes are never allowed to take place, bread made from wheaten meal, from which only the coarse bran has been separated, is so free from the dark-brown colour that it is difficult to persuade people that it is made from wheaten meal at all."—*Chemical News.*

KAMPTULICON,

So called from its flexible character, is designed to supersede the ordinary floor-cloth. Its chief recommendations are great flexibility, softness, imperviousness to damp and dust, great warmth (owing to its non-abstraction of caloric from the feet), noiselessness and extreme durability. Its natural colour is not pleasing to the eye, but it capable of being ornamented with any design, and with every variety of colour, so as to resemble encaustic tiles, tessellated pavement, or the best styles of floor-cloth. It is composed of cork and india rubber, chiefly that obtained from the East Indies, and the invention is claimed for a Mr. Fanshawe, who made the first kamptulicon composition in the square shot tower near Waterloo-bridge, where he ground the cork in an old common coffee-mill. A patent was, however, granted to Elijah Galloway in 1843.

Kamptulicon is manufactured in London by Gough and Boyce, 12, Bush-lane, Cannon-Street; Trestrail and Co., 20, Walbrooke; and Taylor, Harry, and Co., Huggin-lane, Cheapside.

The buildings for the manufacture of kamptulicon ordinarily consist of one large room, with several ante-rooms attached for the purpose of measuring and cutting, blocking or painting, drying and storing.

The first thing that arrests a visitor's attention is an immense quantity of cork shavings, the refuse of cork-cutting establishments. Kamptulicon has given a value to this refuse, which it did not posess when it was only employed for the purpose of stuffing fendoffs, &c. The cork is first thoroughly cleansed from dirt and other foreign substances.

It is then placed in a machine, which cuts it up into very small chips; these are then submitted to the grinding action of two large millstones, worked in the ordinary manner, until the chips are completely pulverized and reduced to what may be called an extremely fine cork dust. The only other substance entering into the composition of kamptulicon is india-rubber; a quantity of this is placed in a hollow cylinder, in which an axle armed with strong teeth is made to revolve rapidly, the cylinder being heated by the admission of steam into a surrounding box or chamber. The machine itself is very properly termed a *masticator*, and in a short time reduces the rubber to a kind of resinous pulp, having the consistency of baker's dough. When sufficiently masticated the mass is removed from the masticator and placed upon a table, at one end of which is a pair of powerful rollers. The mass is sprinkled with the cork dust and passed between these rollers which are likewise heated by the admission of steam. Each time it passes through the rollers an additional quantity of cork dust is applied until the mass of india-rubber is completely permeated with it, and becomes an amalgam of rubber and cork dust; this we may term the kneading process for the whole manufacture is only a repetition on a large scale, and by means of powerful machinery, of what is done by the pastry-cook with other materials in the manufacture of puff-pastry. When a sufficient quantity of cork is incorporated with the rubber (and this is the delicate point in the manufacture) the mass is subjected to what may be termed the laminating process. For this purpose it is taken to another table, which is of the length and width which the piece of kamptulicon is required to assume. It is then passed through a pair of rollers (likewise heated by steam) of the exact width intended for the piece; the space between these rollers is regulated by a screw, which is of such power as that it is possible by its action to bring to a standstill a high-pressure steam-engine of 45 horse power. Through these rollers the mass is passed again and again, rolled out into a thin layer, then folded over and rolled again, until the cork and rubber are completely amalgamated, and a vast number of thin layers have been formed. all bound inseparably together by the nature of the materials themselves. The proper length of the required thickness being secured, it is taken to an adjoining apartment and laid with others upon a long bench or table, where it remains several days or weeks to become seasoned. If intended to receive a design, it is next removed into the painter's rooms, where, by means of blocks, it is painted according to the style intended, the paint is allowed to dry and harden, and the kamptulicon is then ready for service.

In addition to those already named, kamptulicon certaintly possesses some very marked advantages over the ordinary floor-cloth. It can be joined together so neatly as to defy detection except upon the minutest investigation, so that although it is not found advantageous to make it in pieces exceeding 35 or 40 feet in length, and 4 or 5 feet in width, the largest area could be covered with it, and present the appearence of one single piece. This is done in the following manner:—The two edges are brought together with great exactness; they are then moistened with a small quantity of india-rubber solution; the under surface of each length at the proposed joint is slightly coated with the same solution, and a narrow strip of cotton, linen, or fine canvas being placed along the proposed seam, the edges are brought closely together. In a very short space of time the appearence and strength of one piece is secured. Width after width might thus be added *ad infinitum.*

Another advantage of the kamptulicon, being so easly joined, is that a border of any design may be attached, no matter how small or numerous the recesses of the room or hall in which it is proposed to lay it down. This is done by the manufacture of narrow strips for borders, which are stamped with the required design and colors, and joined, as already stated, to the centre piece, It would be impractible to do this in the case of ordinary floor-cloth, as the exact form of the area to be covered would be first required, and then the cloth to be painted with the required border before the pattern for the centre was imparted to it. With this border kamptulicon presents a very pretty and unique appearance, and is well adapted for bathrooms, halls, small rooms, or offices. For bathrooms we consider it the *ne plus ultra* of anything yet produced. Ordinary floor-cloth is objectionable, as although it is impervious to water so long as the painted surface remains intact, it invariably strikes cold to the feet, which is both unpleasant and dangerous. Woollen carpets, again, become saturated and thus keep the atmosphere of the room damp, and themselves soon decay by being constantly moist, Owing to its warmth and extreme durability (we have seen some that after fourteen years' hard use bore scarcely any signs of being worn) it is admirably suited for nurseries; the ordinary floor-cloth is too cold, and carpeting is costly and dusty for rooms occupied by a family of young children. For public and private offices, assembly rooms, churches, and chapels, where both warmth and quiet are indispensable, kamptulicon is an excellent, and in the long run, a cheap material. And we can only hope that the rising price of india-rubber will not stop the production of this useful article.

We were informed of a (to us) novel application of kamptulicon in the Royal stables at Windsor, and other places. By planking or paving the stable with it, the stable is not only kept warm, dry and clean, but the usual straw bedding can be dispensed with, and by using it for partitions between the stalls, horses are less liable to injure themselves by kicking against it, and inasmuch as the noise occasioned by kicking against the wooden partition is often the cause of a horse becoming a confirmed kicker, the use of kamptulicon, which is noiseless, will tend to prevent this evil, and has been known to cure horses of the habit.—*Building News.*

ON THE FORMATION OF AMMONIA BY M. SCHŒNBEIN.

It results from the experiments, of M. Schœnbein that, whenever pure water, or an alkaline solution, is evaporated, nitrite of ammonia is formed. After prolonged contact with the air, the nitrites or nitrates are visible on the surface of all bodies which have been damped and dried in the air. The author has remarked the presence of nitrite of potash on the surface of glass, especially of roughed glass, which, by reason of its texture, retains more water, and dries more slowly.

Though unable to give a practical solution to this theoretical question, the author is of opinion that the formation of nitrite of ammonia can be explained only by the direct combination of atmospheric nitrogen with water:

$$4N+3H_2O=N_2O_3+(NH_3)_2.$$

He reserves the question, whether evaporation in the midst of pure nitrogen gives the same results, and whether it is necessary to effect the combination. However, he has remarked, that in water left for several weeks in contact with the air, in closed vessels, the salt is not formed.

Nitrite of ammonia being, as we have seen, formed by the concurrence of water, air, and heat, it was probable that this product would be found in all products of combustion.

We have seen that nitrite of ammonia is formed in many cases, of combustion; and it is probable that the same compound is formed in all cases.

M. Schœnbein ascribes the formation of this salt, not to the combustion itself, but to the concurrence of heat, water, and air. He observes, that these results are of great importance to the theory of nitrification.

Chemists admit that nitric acid is formed by the oxidation of ammoniacal salts proceeding from nitrogenised matters, and that atmospheric nitrogen has nothing to do with it. While recognising all the importance of this remark, the author is of opinion that evaporation is the chief agent in nitrification.

Everywhere water is to be found evaporating, especially on the ground; nitrite of ammonia ought also to be found everywhere; and by contact with alkaline bases, alkaline nitrites are formed, which oxidise in the air, and are transformed into nitrates. †

In our rainy countries, nitrites are carried away by the water, and, consequently, do not accumulate; but it is otherwise in hot countries, and especially in certain parts of the West Indies, where the dry season is of several months' duration, and where there are to be found vast plains of alkaline earth.

The presence of nitrogenised matters is not a condition *sine qua non* of nitrification; nitrate of potash is formed in Bengal, in places where no nitrogenised matters exist capable of furnishing ammonia.

According to the author, attempts should be made to produce saltpetres artifically, aided by the data contained in this memoir.

The presence of ammoniacal salts in volcanic vapours, recently confirmed by M. Charles Deville's researches, should be ascribed, says the author, to evaporation only, for it is impossible to admit the presence of nitrogenised matters in volcanoes. Hydrochlorate of ammonia is formed by contact with hydrochloric acid and nitrite of ammonia. Disengagements of hydrochloric acid have likewise been observed by M. Deville.

The formation of nitrite of ammonia is of great importance also in vegetable chemistry. Chemists have proved that plaints cannot assimilate free nitrogen. To render assimilation possible, the nitrogen must exist in certain combinations; ammonia and nitrates are supposed to contain nitrogen in a suitable form. If such be the case, nitrite of ammonia, produced by evaporation, contains nitrogen in an assimilable state. Each plant, itself a cause of evaporation, furnishes the portion of assimilable nitrogen necessary to it, whilst the salt is formed, in like manner, in earth moistened by rain.

Saliva contains nitrite of ammonia. With addition of sulphuric acid, it colours starched iodide blue. Treated with potash, it throws off white vapours, by contact with hydrochloric vapours, and browns turmeric. These reactions, however, sometimes fail; but that may be caused by the presence in the saliva of sulphocyanide of potassium, which decolorises blue starched iodide. The colour appears only when the nitrite is in excess.

This process is inadmissible for the detection of nitrite in urine, because this liquid has also the property of decolorising blue starched iodide, as M. Pettenkofer's experiments prove.

The pituitary secretions show the reaction of the nitrites; but it varies in different persons, and is not always constant in the same individual. The presence of nitrite of ammonia in these liquids has not been previously observed.—*Verhandlungen der Naturforschenden Gessellschaft in Basel.* 1862, p. 342.

† The author has observed that the "pure" potash of the laboratory almost always contains nitrite, proceeding from the evaporation of alkaline solutions, as can be proved by dissolving it in water, and adding *pure* sulphuric acid and the starched iodised reagent. It is the same with sulphuric acid, and generally with water, distilled or not.

Statistical, &c.

THE ALKALI TRADE OF GREAT BRITAIN.

The quantity of raw material consumed, the amount of capital employed in the manufacture; the number of hands engaged, and the value of the commercial product, chiefly consisting of carbonate and caustic soda, are truly enormous; and serve to impress our non-manufacturing people with the vast importance of encouraging home productions of this kind, so great is their influence upon other branches of industry.

Statistics of the Alkali Trade of Great Britain, 1862.

Annual value of finished products	£2,500,000
Weight of dry products	280,000 tons

Raw Materials consumed per annum.

	Tons.
Salt	254,600
Coals	961,000
Limestone and Chalk	280,500
Pyrites	264,000
Nitrate of Soda	8,300
Manganese	33,000
Timber for Casks	33,000
Total	1,834,500

Capital employed in the Manufacture.

In Land	£235,000
In Plant, Buildings, &c.	950,000
Working Capital	825,000
Total Capital	£2,010,000

Annual Cost of Materials for Repairs.

Stones, bricks, slates, iron, lead, timber, &c. £135,500

Labor, not including Labor in transit.

	No. of Hands.	Souls.	Annual Amount of Wages.
			£
Directly employed	10,600	53,000	549,500
Employed in getting coals	3,100	15,500	112,840
" making salt	420	2,100	16,380
Getting & break'g limestone.	660	3,300	25,740
Getting pyrites	4,030	20,150	157,150
Felling & sawing timber for casks	330	1,656	10,140
Total labor employed in the manufacture, and in the preparation of raw materials used in it	19,140	95,700	871,750

Manufactures depending upon the Products of the Alkali Trade.

Soap.	Woollen.
Glass.	Color making.
Paper.	All chemical manufactures of any magnitude.
Cotton, all.	
Linen.	

STATISTICS OF UNITED STATES.

Population and Agricultural and Mineral Products of the United States.

The following is a tabular statement which was appended to a recent circular from the Commissioner of Agriculture, on the present agricultural, mineral, and manufacturing condition and resources of the United States:

POPULATION, AREA, AGRICULTURAL PRODUCTIONS, &c.

Population, white	26,975,575
" free colored	477,996
" slaves	3,953,760
Total, including Indians	31,749,281
Area of the United States..sq. miles	3,250,000
Aggregate of real and personal property ....dollars	16,159,616,068
Value of productions of industry...	1,900,000,000
Cash value of farms	6,650,872,507
Cash value of farming implements and machinery	247,027,496
Value of live stock	1,107,490,216
Value of lands improved	163,261,383
Value of lands unimproved	246,508,244
Wheat crop ....bushels	171,183,381
Rye crop	20,976,286
Indian corn	830,451,707
Oat crop	172,554,688
Rice ....pounds	187,140,173
Tobacco	429,390,771
Ginned cotton ...bales, 400 pounds	5,198,077
Wool ....pounds	60,511,342
Peas and beans ....bushels	15,188,013
Irish potatoes	110,571,201
Sweet potatoes	41,606,302
Barley	15,635,119
Buckwheat	17,664,914
Value of orchard products...dollars	19,759,361
Wine ....gallons	1,860,003
Productions of market gardens..dol.	15,541,027
Butter ....pounds	460,509,854
Cheese	105,875,135
Hay ....tons	19,129,128
Clover seed..................bushels	989,010
Grass seed	900,386
Hemp, dew rotted ....tons	83,247
Hemp, water rotted	3,943
Hemp, other prepared	17,800
Hops ....pounds	11.040,012
Flax	3,783,079
Silk cocoons	6,562
Maple sugar	38,863,884
Cane sugar .....hhds., 1,000 pounds	302,205
Cane molasses..................gallons	16,337,080
Sorghum molasses	7,235,025
Maple molasses	1,944,594
Beeswax and honey ....pounds	26,386,855
Value home-made manufactures.ds.	24,358,222
Value of cotton goods produced in the year ending June 1st, 1860...	115,137,926
Value woollen goods produced	68,865,963
Leather produced	63,090,751
Boots and shoes manufactured in the year ending June 1st, 1860...	89,549,900
Value of animals slaughtered	212,871,653
Number of horses	7,300,972
Number of asses and mules	1,296,339
Number of sheep	24,823,556
Number of neat cattle	28,987,347
Number of swine	36,022,275
Agricultural implements produced in the United States	17,802,514
Value of sewing machines...dollars	5,605,345
Number of patents issued for improvements and inventions in agriculture in 1851	521
Newspapers and periodicals, 1860.	4,051
Value of steam engines and machinery..................dollars	47,118,550

MINERAL PRODUCTS, &c.

Gold from California in the year 1859 ....dollars	47,744,472
Silver coined at mint	610,011
Quicksilver ....flasks	45,023
Quicksilver, value of..........dollars	2,000,000
Copper ....tons	14,432
Copper, value of..............dollars	3,316,516
Pig iron ....tons	884,474
Pig iron, value of..............dollars	19,487,790
Zinc ....tons	11,800
Zinc, value of..................dollars	72,600
Lead, value of	977,281
Nickel ....tons	2,348
Nickel, value of..............dollars	27,176
Coal, anthracite..................tons	9,389,330
Coal, bituminous	5,775,077
Coal, value of..................dollars	19,365,765
Area of coal in U. S.......sq. miles	200,000
Coal oil ....barrels	1,092,450
Coal oil, value of..............dollars	1,092,450
Coal oil, daily flow from wells in Pennsylvania..............barrels	5,717
Salt, value of manufactured in the U. S., 1860 ....dollars	2,265,302

FISCAL RESOURCES, NATIONAL DEBT, &c.

Aggregate value of imports in the year 1860..................dollars	334,350,453
Aggregate value of exports	248,505,454
Value of imports under recip'y t'y	20,019,427
Tonnage of the United States..tons	5,539,813
Tonnage, value of ....dollurs	221,592,092
Indirect trade	34,224,444
Fisheries, the products of 1860	12,924,092
Excess of specie and bullion imports over exports	16,548,531
Revenue from customs and public lands	40,452,784
Total of the national debt December 1st, 1861	267,540,035
Estimated quantity of coin in the U. S................$275,000,000 to	300,000,000
Number of banks	1,642
Bank capital..................dollars	421,890,095
Circulation of banks	207,102,477
Spirituous liquors, distilled.gallons	88,002,983
Spirituous liquors, value of..dollars	24,253,176
Malt liquors, brewed.........barrels	3,239,545
Malt liquors, value of........dollars	18,001,135

RAILROADS, &c.

Aggregate length of railroads in 1860 ....miles	31,196¼
Cost of construction..........dollars	1,166,422,729
City passenger railroads......miles	402
Cost of construction ....dollars	14,862,840
Length of internal navigation.miles	30,000
Length of lines of telegraph	40,000

By act of Congress of July 1, 1862, a charter was granted to the Attic and Pacific Railroad Co., with a capital of ....dollars	100,000,000
For the construction of a railroad, with branches, from the Mississippi River to the Pacific Ocean.................... ......miles	1,800
In aid of this colossal enterprise Congress has made a very liberal donation by grants of public lands lying on the route, and a loan of thirty years' six per cent. Un'd States bonds to the amount of about ....dollars	60,000,000

EDUCATIONAL.

The number of principal colleges and professional schools in the United States, including theological, law, and medical, in 1860, was 233. By an act of Congress of July 2, 1862, about 10,000,000 acres of public lands were appropriated for the support of colleges and schools for the benefit of agriculture and the mechanic arts in the several States and Territories of the Union. Five millions of persons received instruction in the educational institutions of the United States in the year ending June, 1860. The system of common school education has been adopted in nearly all of the free States.

Miscellaneous.

On the Artificial Formation of Populine, and on a New Class of Organic Compounds. *

The interesting substance, populine, was extracted in 1830, by Braconnot, from the mother-liquors which had deposited salicine, when the latter was obtained from the leaves of the poplar tree, *populus tremula*. In 1852 Piria showed that in a variety of circumstances populine split up into benzoic acid and salicine. Dr. Phipson shows that salicine and benzoic acid combine, equivalent for equivalent, to form populine,—

$$\underset{\text{Benzoic acid.}}{C_{14}H_6O_4} + \underset{\text{Salicine.}}{C_{26}H_{18}O_{14}} = \underset{\text{Crystallised populine.}}{(C_{40}H_{22}O_{16}+2HO)}$$

This occurs when the two substances are dissolved together in alcohol, and the solution made to crystallise; the properties of the artificial compound being precisely identical with those of the natural product. Its peculiar taste—acrid and sweet at the same time, reminding us of the taste of liquorice—is characteristic. With sulphuric acid it takes a red colour, and with bichromate of potash and sulphuric acid it gives, on heating, salicylous acid. In this combination salicine has lost its bitter taste, which renders it probable that populine is a compound of benzoic acid, sugar, and saligenine; for, when boiled with dilute sulphuric acid, it breaks up into benzoic acid, sugar, and saliretine, (saligenine *minus* aqua). The molecule of populine is, therefore, a very complex one; and these kinds of compounds may perhaps be compared to the combinations of two or more salts in mineral chemistry,—for instance, to alum, if we compare the sulphate of alumina, to the benzoic acid, the sulphate of potash to the saligenine, and the twenty-four ounces of water to the sugar.

The author goes on to state that he has obtained similar compounds with tartaric and citric acids.—*Chemical News.*

* By Dr. T. L. Phipson, F. C. S., &c.

THE *London Mining Journal* says that the Oil Wells Company of Canada has been constituted under the most favourable auspices, with a capital 75,000*l*., in shares of 5*l*. each, for assisting in the development of the Canadian native oil trade. The remunerative nature of the business in which the company will engage may readily be judged of from the fact that they will be enabled to secure oil free in the Thames at 8*l*. per ton, the market price of which ranges from 13*l*. to 14*l*. The wells which the company will work are guaranteed to produce 20,000 gallons per day. As the promoters reserve the right of refining either in Canada or England, and, in fact, of availing themselves of every means to render their enterprise profitable and as the directors are all well-known men of business, there seems good ground for the opinion that the undertaking will prove remunerative to the shareholders.

Growth of Corals.

Darwin, on the authority of Lieut. Willstead, R. N., cites the case of a ship stationed in the Persian Gulf, the bottom of which became encrusted with a layer of coral 2ft thick in 20 months. He likewise notices some experiments made by Dr. Allan on the coast of Madagascar, from which it was ascertained that portions of coral weighing 10lb. increased 4ft. in height and several feet in length during the short space of 6 or 7 months.

Effects of Iron Plating.

A communication from Toulon, in the *Messager du Midi* says:—"The laying up of the frigate, "La Gloire," in the Castigneau dock has disclosed three unexpected phenomena; first, that the contact of the copper lining and the submerged iron plates had established a galvanic current, which produced the effect of a voltaic pile, and was completely deteriorating the armour of the frigate in the parts below the water line; secondly, that a species of shell fish, hitherto unknown, was afterwards discovered among the millions of moluscæ by which the hull was covered, apparently produced under the influence of the same galvanic current; and, lastly, in the hold of the vessel 22,000 litres of wine were found to be transformed into vinegar, it is not known by what influence."

New Explosive Powder.

Captain Harvey, R. N., writes to the *Mechanics' Magazine*, that Mr. John Horsely, F.C.S., analyst for the county of Gloucester, discovered, some years since that if chlorate of potassa and nut gall, each reduced to a very fine powder, be well compounded, in proportion of three to one, by weight, the product will be violently explosive.

Some experiments recently made upon a small scale, appeared to shew that powder composed of chlorate of potassa and nut gall is 2½ more violent than the best gunpowder, in small charges; perhaps more so in larger charges.

Horsley's powder explodes at about 450 deg. temperature; it can be exploded by *excessive* friction or by the action of sulphuric acid.

Horsley's powder can be manipulated, it is said, with much greater ease and safety than common gunpowder, and can be stored as common gunpowder. And moreover, if the two ingredients be stored together, *unmixed*, no explosion would ensue if the magazine were fired, although the chlorate of potash would of course give off an abundance of oxygen, which would make the conflagration very violent and brilliant at the spot.

A Telescopic Ladder.

The *Hereford Times* says that a very ingenious and admirable invention, called the telescopic ladder, has just been patented by the inventor, Mr. G. H. Morgan, surveyor and builder, New Market-Street, in that city, This ladder, which might be made to a great length, shuts up like a telescope, the uppermost *floor*, so to speak, shutting up in the next and so on to the bottom; in like manner, the first floor is easily projected, and may be turned against a wall at any angle: then follows the second, third, fourth, &c. The whole series shuts up into a small compass.

Means to Prevent the Rotting of Woods.

In order to prevent wooden posts and piles from rotting while in the ground, the following receipt has been sent to the Societè d'Encouragement, Paris. A certain paint is used which has the hardness of stone, which resists damp, and is very cheap. It has been in use for the last five years—50 parts of resin, 40 parts of finely-powdered chalk, about 300 parts of fine hard sand, 4 parts of linseed oil, 1 part of red oxide of lead, and one part of sulphuric, are mixed together. The resin, chalk, sand, and linseed oil are heated together in an iron boiler; the red lead and the sulphuric acid are then added. They are carefully mixed, and the composition is applied while hot. If it be not found sufficiently fluid, it may be made thinner by adding some linseed oil. This paint, when cold and dry, forms a varnish the hardness of stone.—This varnish may be useful in other ways than by being applied to prevent the rotting of woods. Coal tar serves that purpose admirably. So also would crude petroleum if introduced into the pores of the wood, by proper and well known appliances. Charring the posts or piles is an excellent artifice.

The Atlantic Telegraph.

Periodically, and as if by necessity, the great question of uniting Europe and America by telegraph, surges up and demands a practical solution. And it is quite natural that it should do so. No scientific industry of modern times has been more economically successful than the electric telegraph. There are now at work in the United States of America, 40,000 miles of telegraph, extending from San Francisco, on the Pacific, to Newfoundland, on the verge of the Atlantic Ocean—where it is again proposed to land a cable which shall have its other end at Valentia Bay. There are upwards of 150,000 miles of working telegraph in Europe. A telegraph spanning the Atlantic would unite the the electric wires of America with those of Europe—as those in Europe are now united with many in Asia and Africa. Establish a telegraphic link between Newfoundland and Ireland, and instantly means would be taken to connect our West Indian Colonies and those of other countries with the mainlands of North and South America—thus bringing the whole industrial system of the two Americas into connection with that of nearly all the rest of the world. This question of an Atlantic telegraph is not merely economically and morally interesting to England and the United States, but it involves world-wide results. It would not only be the greatest triumph of science, but it would be the means of bestowing a rich inheritance of blessings on mankind. It is a benefit which the statesman, the capitalist, the economical reformer, the philanthropist, and philosopher, may heartily join hand-in-hand to promote.

It is almost certain that the Atlantic cable failed from controllable causes. It was manufactured and laid down with undue haste.

Out of the total number of 51 different submarine telegraph enterprises, which are all that have been entered upon, 44—comprising 5,133 miles of cable, and 8,906 miles of conducting wire—are at the present moment in perfect working order. Thirty of these 44 successful cables were laid by Glass, Elliot and Co.—*Mec. Mag.*

Aluminum.

Aluminum is now being manufactured on a large scale by Messrs. Bell Brothers (the only licensees in England for Deville's patent). This metal was first discovered by Sir H. Davy, Wöhler obtained it in June, 1827, and of a specific gravity of 2·5 (the same as glass). In 1854, Deville published the properties of aluminium. His process for manufacturing it, which is the same method as Messrs. Bell use, is as follows. Having obtained the chloride, Deville introduces into a wide glass or porcelain tube, 200 or 300 grammes of this salt between two plugs of asbestos, and allows a current of hydrogen to pass from the generator through a dessicating bottle containing sulphuric acid and tubes containing chloride of calcium, and finally th rough the tube containing the chloride, at the same time applying a gentle heat to the chloride, to drive off any free hydro-chloric acid which might be formed by the action of the air on it. He now introduces at the other extremity of the tube a porcelain boat, containing sodium, and when the sodium is fused the chloride of aluminum is heated, until its vapour comes in contact with the fused sodium. A powerful reaction ensues, considerable heat is evolved, and by continuing to pass the vapour of the chloride over the sodium, until the latter is all consumed, a mass is obtained in the boat of the double chloride of aluminum and sodium in which globules of the newly reduced metal are suspended. It is allowed to cool in the hydrogen, and then the mass is treated with water, in which the double chloride is soluble, the aluminum being unacted on. Bell (Brothers) exhibit this metal in the exhibition, and which shows the value of it for ornamental purposes, by the difficult castings exhibited, which run in one piece. Among the different things shown, is a balance, sextant, and other philosophical instruments. Aluminium forms, with copper, a very beautiful alloy named aluminium bronze. In colour and polish this substance resembles the finest gold, and at the same time is not only capable of being cast in moulds but also forged under the hammer like the softest iron, which metal in strength it far surpasses. Reid and Sons, gold and silversmiths, in Newcastle, also manufacture articles of this metal. Availing themselves of the brightness and cheapness, Reid and Sons have taken out a patent for manufacturing watch cases of this metal. These cases can not be distinguished from gold, and are as cheap as silver. From the above, when it is remembered that aluminium is incorrodible, and never blackens even in the most impure atmosphere, there appears every reason to hope that before long it will find extensive employment in the manufacture of our country.—*Artizan.*

Diamonds used for Boring into Hard Rock.

An instrument is now being employed in France, made out of a tube furnished with a circular cutter of rough diamonds. It is caused to revolve, and as it enters into the stone the cutter scoops out a cylinder which is afterwards easily taken out of the tube. Holes in hard granite for blasting purposes, 47 millimetres in diameter, and from 1·10 metres to 1·20 metres deep, are thereby bored in one hour. This would require two days work in the ordinary way. The diamonds, when examined through a magnifying glass, do not seem at all injured.—*Cosmos.*

They do as their Father did.

The most ignorant labourer knows that the raindrops, falling on his dung-heap bring with them silver pieces. He knows that the refuse, sweltering in the ditches of his village, and poisoning the air, would frucitify his corn fields. He nevertheless stands by with indifference, like his father before him, and, for the same reason, because things were the same in the good old time. In the same way (continues Liebig), the municipalities of large cities spend annually immense sums on their sewerage. They put the means of reproducing the bread of millions beyond the reach of the farmer. The farmers look on this with indifference. They however think it a praiseworthy undertaking to fetch the same elements from America, several thousands of miles away.

Worth Knowing.

One pound of green copperas costing seven cents, dissolved in one quart of water, and poured down a privy, will effectually concentrate and destroy the foulest smells. For water closets on board ships and steamboats, about hotels and other public places, there is nothing so nice to clense places, as simple green copperas dissolved under the bed, in anything that will hold water, and thus render a hospital or other place for the sick free from unpleasant smells. For butcher stalls, fish markets. slaughter-houses, sinks and wherever there are offensive, prutrid gases, dissolve copperas and sprinkle it about, and in a few days the smell will pass away. If a cat, rat, or mouse dies about the house and sends forth an offensive gas, place some dissolved copperas in an open vessel near the place where the nuisance is, and it will soon purify the atmosphere.

Manufacture of Saltpetre.

Saltpetre is obtained in the Mammoth Cave, Kentucky, and considerable quantities were obtained from this source during the war of 1812. It is derived chiefly from the excrements of bats, &c. Most all the saltpetre which is employed for the manufacture of our gunpowder comes from India. It is not known whether any saltpetre is now obtained from natural sources in the Southern States. If the Secessionists were deprived of this substance entirely, they could not carry on a war. The nitrate of soda is very abundant in many parts of the world, and were it not so deliquescent, it would answer just as well for making gunpowder as nitrate of potash. The formation of natural saltpetre is a very slow process, requiring about two years to complete. During the French Revolution 2000 tons were made in one year in Paris; and were foreign supplies cut off, twice the quantity could be made in the same space of time in the city of New York with its present number of inhabitants. In Sweden each peasant who owns a house is bound by law to make a certain quantity of saltpetre every year for the use of the State. In Spain, Egypt, Persia, and especially in India, vast quantities of this salt are made annually; and it is not only a source of great profit but of warlike power to Great Britain.—*Scientific American.*

Magnified Photographs.

The *Times*, referring to the closing *Soirée* of the British Association at Cambridge, says that M. Claudet exhibited, by the aid of the oxyhydrogen light, the enlarged images of the solar camera thrown on to a screen. A number of *cartes de visite* were enlarged, showing the great perfection of proportion and the natural expression which may be imparted to portraits when they are taken in a very short sitting. In order to show the working of the solar camera, it was placed in a room adjoining the great hall. M. Claudet exhibited in this manner pictures of persons enlarged to the size of nature, and some considerably larger, from small *cartes de visite.* The effect was very striking and beautiful. He also exhibited some photographs, taken by the Comte de Montizon, of all the most curious animals of the Zoological Gardens, and some views of Java, taken by Messrs. Negretti and Zambra, with instantaneous views of Paris by Ferrier, showing the Boulevards full of carriages and people, as they are in the middle of the day. One of the principal objects of M. Claudet was to explain how it is possible to trace or draw with pencil on canvas those enlarged portraits when they are to be painted, and for this purpose how it is even more advantageous to apply the colours, not on a surface containing the chemical substances of photographic pictures, but on the usual medium employed by artists without the black shadows forming the delineation of photographs.

Purity of Frozen Water.

M. Robinet has made a variety of experiments to ascertain how far water is freed from saline impurities by congelation; and his results go to show that the small amount of lime and magnesian salts in potable waters is forced out in the act of freezing as completely as the more soluble salts present in sea-water. Frozen water, he says, is so far purified that it may, in most cases, be used for chemical purposes in place of distilled water. In reference to this, M. Martens adds, that in his photographic excursions among the Alps he found that he could always use the water from the glaciers instead of distilled water, but that dissolved snow did not answer.

Dr. Rüdorff has also made experiments on the freezing of saline solutions (*Bericht. d. Akad. der Wissensch. zu Berlin*, 1862, *s.* 163). He employed the platino-cyanide of magnesium, the solution of which is colourless; but he found that when the solution was frozen so far that the water left was not enough to hold the salt dissolved, crystals of the well known beautiful appearance were formed. Other curious results were observed with a supersaturated solution of sulphate of soda. When such a solution was cooled below the freezing point and the formation of ice prevented, it was found that a piece of ice dropped in determined the formation of ice, while a crystal of the salt caused the formation of crystals of the salt. A very small piece of the salt dropped in with ice caused the separation of the whole of the salt. He noticed, too, that the lowering of the temperature produced an alteration in the constitution of the solution. For instance, when a solution of the blue salt, $Cu Cl+12HO$, was frozen, the unfrozen water contained the green salt, $CuCl+4HO$. Other curious results will be found in the paper referred to.

Exports of Lumber from Quebec.

	1860.	1861.	1862.
Oak, feet ...	2,485,400 ...	1,725,160 ...	1,463,680
Elm	1,021,560 ...	1,269,320 ...	1,099,200
Ash	88,440 ...	96,560 ...	99,840
Birch	462,160 ...	255,320 ...	165,480
Tamarac....	58,240 ...	50,240 ...	57,120
White pine, sq & waney	18,252,600 ...	19,447,920 ...	15,403,080
Red pine ...	2,502,880 ...	2,855,240 ...	2,491,020

The export of the leading items for the last year falls slightly below the average shipments of the five years from 1853 to 1857. The stock at present in Quebec largely exceeds that of any previous season—that of white pine being 19,000,000 feet, against 14,000,000 feet last year, and against 10,000,000 feet, the average amount for the five years named.

Apparatus for Estimating the Velocity of Cannon Balls.

The apparatus consists of a frame, across which thin copper wires are stretched horizontally in parallel lines, and of a pendulum of which the vibration is measured. The frame is placed a few paces in front of the gun, or the target, according as the initial or impact velocity is required. The wires, which are so close together that the projectile cannot pass between them, are connected with, and act upon the pendulum, by means of an electrical current passing through them. Any one of these wires being broken by the passage of the shot, the pendulum indicates the force of its vibration, and by working out a mathematical formula the velocity of the projectile is ascertained to the 1000th part of a foot per second.

Wonderful Copper Descovery in the Portage Lake District.

Some two weeks ago says the Lake Superior *News and Journal* of Oct. 31st, a huge mass of float copper, weighing at least twenty tons, was discovered on the location of the Mesnard Mine, at Portage Lake. In size it was some *sixteen* feet long, *four* wide, and *one-and-a-half* thick, which is by far the largest *float* mass ever before found upon the Lake. Such being its prodigious weight, it was patent that it came from a vein near by, as it was impossible that any human agency known to exist in the past, could have moved it a great distance. Beneath it, charcoal was found, and also stone hammers, indicating plainly that the ancient miners, whose history is unwritten, and of whom nothing is known except as traces of their workings are thus found, had either taken it from its bed and placed it in fire, in order to burn the rock from it, or finding it upon the spot where it was now discovered, placed it in the fire for the same purpose. We find those who are of the opinion it was never put in the place where it was found by human agency, for the reason that a large amount of the float copper in small mases, weighing from a half pound to fifty, are found scattered immediately around it. Already some two tons have gathered, and whose existence in proximity with the large mass, would iudicate that water and ice may have been the agencies by which they were thus moved and scattered from their original restiug place. The agency, however, by which they were thus placed over the surface, it is not so important to know, as their existence, and the more important fact to which they point, viz; *that they must come from some vein near at hand.* With this conviction, simultaniously with the cutting up of the hugh mass, and the collecting of the smaller ones, the work of a most thorough exploration was begun, in order to find the vein from which they came. What was thus reasonably manifest, seems to have been acomplished, for the work of a few days uncovered, about forty feet distrnt from the hugh float, *a mass of still greater dimentions in the vein itself.* At last accounts. this new wonder had been stripped some five feet in breadth for a length of tweive feet, and three thick, with no indication of growing less at any point. It is opened sufficiently to indicate that it will far exceed the float mass. The vein in which it is found has been known for years. It runs through the Quincy, Pewabic, Franklin, Pontiac, Albany, and Boston, &c., and they all, in the value of their stock, must at least feel the effect of this developement. The vein is of the Epidote character, but from some cause seems to spread and soften at the point of this descovery. We have heard it described as an Amygdaleid belt of the Epidote character. The agent of this fortunate mine, is prosecuting the work of opening the vein with dilligedce, employing all the labour he can obtain. The general impression among the oldest and ablest mining men is that a vein of extraordinary richness has been struck, which will add new interest in this hereto fore wonderful district.

Iron in England.

The total production of pig-iron in the United Kingdom, last year, is estimated at 3,712,390 tons, the county of Durham supylying 312,030 tons.