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THE JOURNAL

OF THE

BOARD OF ARTS AND MANUFACTURES

FOR

UPPER CANADA.

EDITED BY THE SECRETARY OF THE BOARD.

VOLUME IV.

TORONTO:
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BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA,

FOR THE YEAR 1864.

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CORRESPONDENCE:

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

JANUARY, 1864.

THE TORONTO ROLLING MILLS.

With the view of stimulating our infant efforts to larger enterprises, in which Canada, with the exception of her railways, her flour and saw mills, and a few other establishments, varied in character, has all but every thing to learn, the following notice of a great industrial establishment is published. There is a want of public spirit, if not of enterprising men, amongst us, in order that we may become a busy, manufacturing and thriving community.

The Toronto Rolling Mills may, therefore, be held up to our youth as one of those examples, in which capital, when directed with skill and energy, must and does always ensure success.

These mills are situated near the eastern extremity of the city, at the mouth of the river Don, the river of many sad remembrances, and located on a piece of land which, not many years ago, was a portion of a vast swamp—fertile only in malaria and fever—but now from the theodolite and the shovel, and from the blaze of many furnaces, has become in reality a large purifier, and which, along with the gap recently washed through the peninsula, have rendered this and other portions of the city much more healthy than in days gone by.

In describing the operations of the Rolling Mills we must first invite your attention to the train of railway cars, in the northern portion of the premises, now being emptied of their contents, that is of the worn-out rails gathered up along the track of one or other of our railways, and becoming now the raw material of the manufacture—barring the puddle iron, which comes to be explained by and by.

These old rails are delivered at this portion of the premises, as being contiguous to the large shears, by which they are to be cut to the various lengths required. Some of which are cut to a given length, for the top, or head, of the rail, and some to another length for the bottom, or flange, of the rail; those for the top go to the hammer to be shingled, so as to be made more solid and durable in resisting the heavy loads passing over the road; those for the bottoms go to the rolls, and are made into what are called flats, which are not so hard as the tops, but they are tougher, so as to form the broad flange or bottom of the rail.

Railway companies have found from experience that a real good rail, like every other real good article, is always the cheapest in the end; hence the improved system of manufacture in having hammered heads, that is, having the top of the rail of hammered iron.

Suppose we now accompany the old rails from the yard to the shears, and first we find them disposed on a low bed, or platform, side by side. They are taken hold of one at a time, by two men, one at each end, who slide it along the platform until it comes in a line with the blade of the shears, it is here seized by two other men, one of which measures off the lengths and guides the rail in the shears, the pieces of rail snapping and falling from the bite of the ponderous shears, as so many shingle nails from a nail machine; in falling from the shears, those cut for the heads are thrown into one pile, and those for the flanges into another pile.

Having gone from the platform to the shears, we move now from the shears to the furnaces, and suddenly find ourselves in a more complex thoroughfare.

The iron is taken from the respective piles at the shears, already alluded to, by the wheelers, a class of operatives who make themselves heard in the Rolling Mill, and frequently to the actual terror of the lady-visitors, who fancy they are really to be trodden down and buried among railroad iron. Whichever way they turn, they find themselves always in the way of the wheelers, and more especially so at night, as the wheel-barrows are rubbing on them before they are aware. To a stranger the operations at night are much more exciting than during the day; iron, coals and cinders meeting you in the face wherever you go, wheel-barrows here, and wheel-barrows there, and wheel-barrows everywhere. One set of wheelers are taking iron to the hammer-furnaces, and one set to the flat-roll furnaces, and another set to the rail-mill furnaces; long iron, short iron, flat iron, and heads, each being conveyed to its own furnace; the long iron to be heated, and rolled into flats; the short iron to be heated and hammered into heads, and the flats and heads combined in one pile to be heated and rolled into rails.

The Furnaces.—There is no difference in the construction of the furnaces for heating these several kinds of iron; between the heats the same grim darkness surrounds them all; and on visiting the Rolling Mills at night, and should you arrive just at this time, "between heats," from the lull and calm which reigns every where, you would fancy the operations were over, until one or other of the furnace-doors are lifted, revealing a knot of busy workmen, when by and by the cry "buggy up! go a-head!" puts all in life and motion. The ponderous fly-wheel begins to whirl, the furnaces by turns belch forth their almost molten masses, which quickly find their several places of appointment, some to the rolls, some to the hammer, which like a mighty giant raises its huge head, and with a deafening hiss descends in fearful vengeance, blow after blow succeeds each other in quick succession, until at length the hammered slab is borne away among its numerous fellows. Meanwhile the rolls are no less busy, the rail-mill rolls receive its massive pile with thundering as of cannon, then to and fro it swings and rolls until it forms a rail. The flat-mill rolls are also now in motion, and never seem to tire. Sometimes they feed on long thin pieces, at others swallowing blooms of monstrous size, fresh from the puddlers. The flats from these rolls are dragged away in front of a pair of shears, called the hot shears, and the long bars are cut into lengths, suitable for the rail-mill and the hammer operations.

PUDDLE FURNACES.—This is a branch of more than ordinary interest, being that wherein the new iron is made, which is put upon the head of the rail. This process is simply the manufacture of malleable from cast iron, the cast iron being boiled a certain length of time in what is called a puddling-furnace, during the boiling it is stirred about and then formed into balls in the furnace, these balls are withdrawn separately and squeezed in a peculiar kind of a machine, resembling the jaws of an alligator, in which the courser of the cinder and dross is squeezed out and leaves the lump new malleable iron, and being new and strong, it is well adapted for the top of the new rails.

Having gone from the yard to the shears, from the shears to the furnaces, and from the furnaces to the hammer and the rolls, we may now follow the rail from the rolls to its completion and its being sent off on the cars.

Immediately behind the finishing pass of the rolls, the rail is forced along a carriage, and is here taken hold of by two men, and adjusted for the saws, two of which, about three feet in diameter, and running at a great velocity, are placed one at each end of the carriage, and this carriage is moved inwards towards the saws by geering, so as to cut the rail at both ends at the same time and to a uniform length. After being cut it is taken to the straightening-plate, and any unevenness taken out of it by letting it fall several times on the plate; a bend, or curve, is also given to the rail here, sufficient to counteract the unequal cooling, and to have the rail as straight as possible when cold. This part of the process, like many others, can only be properly understood by those engaged in it. After being curved, it is drawn along a large level bed, called the hot-bed, and remains here until it is cold; it is then seized by other two men, who push it forward to the cold-straightener. This operation is performed in a machine which may be termed a mule, having something in common both with the shears and the squeezer. The manipulation of the rails in this process, although apparently simple and easy, requires not a little strength, and some dexterity, to accomplish. Some of the visitors get sadly foiled in the trial. After getting the finishing touch here, so far as straightening is concerned, the rails are placed upon another rack and the rough end dressed; they are then slided along on this rack, preparatory to being punched in the end, for jointing on the track.

PUNCHING.—The punching process is also one of considerable interest, and employs some half dozen men. The punch is a vertical working machine, very powerful, and makes apparently only few depressions in a minute. Between the punch and the rack is a small pivoted frame with two rollers, having grooves for the flange of the rail, and corresponding with the height of the punch, and to provide for the rail laying level in the process of punching. The rail is now moved forward to the first guard and one hole punched, it is then moved forward to the second guard and the second hole punched. The rail is now drawn back until it is balanced on the pivoted frame with rollers and swung round, and the other end punched in a similar manner to the first.

Some of the rails are also notched in the flange. The operation of notching being somewhat similar to that of punching. It is unnecessary to go over it.

After punching, the rails are rolled on to another rack facing the delivery track and the weigh scales, from which they are either put directly on board the cars, or laid away in the yard ready for delivery.

General Remarks.

This establishment is the property of Messrs. Gzowski & Co., and was started in 1860; producing the first season about forty tons per day; the production having increased every season since that time until the present, when it has reached seventy tons per day, English tons. There is steam power amounting to nearly five hundred horses; not more than three hundred and sixty of which is yet required at any one time. There are eight steam boilers in the mill, of the kind called tubular boilers, each of which at the pressure they carry, is equal to sixty horse-power. The steam is produced by the heat evolved from the iron furnaces; consequently no coal is used directly for making steam. The boiler in connection with and especially used for the steam fire pump, is something under twenty horse-power. These boilers are made of the best iron and workmanship, and subjected to a thorough inspection and washing out at the end of every week.

The Large Engine.—This massive motor was manufactured in the States, and is of the kind designated horizontal high-pressure. It is constructed different from any engine in Canada, having separate valves for admission and eduction; and embraces the best arrangement for expansive action. This engine has given every satisfaction; as the engineers say, "it has worked to a charm." The power is about three hundred and fifty horses, but is seldom worked up to this unless from undue resistance, a cold pile in the rolls, or other obstruction. We may remark that so smooth and perfect is the performance of this machine that when pressing your knee upon the iron bed, you cannot tell when it is passing the centres; and so perfect is the expansion gear that it cuts off from *nothing* to seventy-five per cent. of the stroke, according to the load it has to carry; seventy-five being considered a maximum admission for even ordinary constructed engines. This engine is direct action, there being no intervening gearing between the engine-shaft and the rolls. The crank-shaft is coupled to the axle of the middle roll.

The small engines for driving the machinery are two twenty-five horse engines combined. These were also made in the States by a first-class firm, and have given every satisfaction. The combined engine cannot be surpassed for general use. The engineers say, "we consider that we can challenge all Canada for steam engines."

Donkey or Pumping Engines.—There are also in the mill eight donkey-engines for feeding the boilers, one to each boiler, built also in the States, and so finely got up that they run equally well at ten or at two hundred strokes per minute.

Steam Fire Pump.—This is one of the most useful machines in the whole establishment, being always ready for any or every purpose; simple and easily managed; and with the numerous coils of hose beside it, gives the employees a feeling of security when at work, knowing they have ample means at hand to extinguish any thing in the shape of fire; for fear of which they all seem to exercise a very laudable degree of caution.

There are ten heating and two double puddling furnaces, three pairs large shears, two large punches, one straightener, one squeezer, two steam hammers, eleven steam engines, and various sets of rolls. Rails of any pattern can be made, and fish plate for the same.

There is also on the premises a complete machine and blacksmith's shop for doing the repairs, making the rolls, and renewing of the same; a mill for grinding sand, which is used in the furnaces; and numerous other things we are obliged to pass over.

When we state that about eighty tons of coals are used per day, it is unnecessary to say any thing about the quantity on hand, which seems like a coal hill itself; indeed every thing seems to be first-class.

"Waste not: want not." The motto above the late Sir Walter Scott's kitchen door, is one that seems applicable to the Rolling Mills. The enterprising proprietors, Gzowski & Co., may reasonably request that nothing be wasted, since they provide with such a liberal hand.

There are about two hundred and fifty men employed, and probably one thousand six hundred persons depending upon it, under Providence, for their daily bread; some earning large wages, and all paid in cash every month. It would be well for Canada to have more of such men as the proprietors of the Toronto Rolling Mills; and in closing this brief notice, we heartily wish them the full measure of their well-merited success.

Board of Arts and Manufactures
FOR UPPER CANADA.

THE FOURTH VOLUME.

The present number commences the fourth yearly volume of this Journal. From its commencement, its circulation has been slowly but steadily increasing. Its original articles and selections being mostly of a practical character, are not calculated to please the masses; but thinking men —men who take an interest in the world's industrial and scientific progress, will find its pages largely occupied with selections from the best European and American scientific and mechanical periodicals, and with such information on leading practical topics of Canadian interest as we have been able with our limited means to obtain.

In this last department we are always glad to receive information from any and every source able to furnish it. The mechanical and other industrial resources of *this Canada* are to us all important, and he who furnishes for the benefit of the public the most and the best information under these heads—information conducive to the progress of the trade and manufactures of the country—is its best friend.

We solicit a liberal subscription list for this year. The *Journal* will be published on the 15th of each month, as heretofore, at the uniform subscription of 75 cents. per annum, payable in advance.

News and other Agents are authorised to retain 33⅓ per cent. commission on subscriptions collected and remitted by them to the Secretary.

Mechanics' Institutes, and Literary or Agricultural Societies, will be supplied at 50 cents per copy per annum; but Members subscribing otherwise than through the agency of their respective Secretaries, or other proper Officers, will be charged the full rate of 75 cents.

A few bound copies of Vols. I. II. and III. of the *Journal* are for sale, at $1 00—postage free. Remittances of subscriptions in arrear are respectfully urged upon all, as the amounts are too small to send an agent to collect.

ANNUAL MEETING.

Toronto, Jan. 12th, 1864.

The Adjourned Annual Meeting of the Board was held this day, in the Board Rooms, Mechanics' Institute, at two o'clock, P.M.

The members present were, the President of the Board, J. Beaty, Esq., M.D., Delegate Cobourg Mechanics' Institute; E. A. McNaughton, President Newcastle Mechanics' Institute; John Shier, President Whitby Mechanics' Institute; Rev. Professor Hincks and Professor Buckland, University College, Toronto; William Edwards, President, and W. H. Sheppard, R. J. Griffith, Henry E. Clarke, Henry Langley, Walter S. Lee, and C. W. Bunting, Delegates from the Toronto Mechanics' Institute.

The several certificates of appointment by the Mechanics' Institutes represented at the Meeting, were submitted, and names recorded.

The Minutes of last Meeting of the Board were read, and approved of as correct.

The Annual Report of the Sub-Committee for the past year was read by the Secretary; also a full and analyzed statement of the Receipts and Expenditure, as examined with the Vouchers and signed by the Auditors as correct.

On motion of Mr. Sheppard, seconded by Mr. Lee, the Report of the Sub-Committee was received and adopted.

Office-Bearers and Committee for the ensuing year were then balloted for, and the following gentlemen were declared elected:

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

Vice-President:—Rev. Prof. Hincks, University College, Toronto.

Secretary & Treasurer:—Mr. Wm. Edwards, Toronto.

Sub-Committee:—Professor Buckland and Professor Hind, Toronto; John Shier, Whitby; E. A. McNaughton, Cobourg; W. H. Sheppard, R. J. Griffith, H. E. Clarke, Walter S. Lee, and Henry Langley, Toronto.

The Meeting then adjourned.

REPORT.

The Sub-Committee, at the close of their term of office, beg to present to the Board the Seventh Annual Report.

Six Mechanics' Institutes have been represented at the Board during the year: Cobourg and Newcastle Institutes by their respective Presidents, and Hamilton, L'Orignal, Toronto, and Whitby, by their Presidents and Elected Delegates. The Toronto University-College was represented by the Rev. Professor Hincks and Professor Buckland, and Trinity College University by Professor Hind.

During the year, one of the most useful members of the Board and also of the Sub-Committee, has been called to his long home. Your Committee cannot refer to this painful event in more fitting words than are contained in the following notice from page 236 of the *Journal*:

"It becomes our painful duty to record the death of a most valuable and highly respected member of the Executive Committee of this Board, Dr. W. Craigie, of Hamilton, who departed from amongst us on the 9th of the present month, and in the 65th year of his age, after a few weeks' illness.

"On the organization of the Board of Arts and Manufactures, in the year 1857, Dr. Craigie was elected a Delegate by the Hamilton and Gore Mechanics' Institute, and at once took a warm interest in furthering the objects of the Board. At its first general meeting he was elected a member of the Executive Committee, to which position he has been annually re-appointed. He also held the Vice-Presidency of the Board during the past year; and although in attending to his duties he had to travel from his home to this city, he was seldom absent from its meetings. His kindness of manner, and intelligent discussion of all matters brought under his notice, won for him the esteem of all his colleagues. His loss will be severely felt, not only by this Board, but by several scientific and other societies with which he was actively associated."

It would have been a source of gratification to your Committee had they been enabled to report a larger representation of Mechanics' Institutes; but while the trifling Legislative grants formerly made to these institutions, and professedly withdrawn but for a short time, so as to resume them under some more judicious mode of distribution, continues to be withheld, it can scarcely be expected that institutes at any considerable distance from Toronto will manifest such an interest in the affairs of the Board as will induce them, out of their very limited means, to bear the expense of sending Delegates to attend its meetings or take part in its management.

Your Committee can scarcely conceive that the state of the Provincial finances is a sufficient cause for withholding these small grants, nor can it be through want of confidence as to the judicious expenditure of the monies by the respective institutes, if the grants were made on some such conditions as suggested in a memorial from the Board to his Excellency the Governor in Council, in March, 1862, and published in this *Journal* (page 105), for April of the same year.

Finances.

By a careful expenditure of the funds of the Board, your Committee are enabled to report a considerable balance in hand at the close of the year. The Secretary-Treasurer's detailed statement, herewith submitted, shows, total receipts, $3,559 21; expenditure, $2,711 71; balance in hand, $847 50.

On 31st December, 1860, the balance reported was $2,495 84; in 1861, this balance was reduced to $1,636 63; in 1862, the balance was only $1,050 84; and this year, as already stated, shows a still further reduction. In addition, however, to the balance now in hand, there are assets due on account of the *Journal*, for subscriptions and advertisements, amounting to $320 00; which, added to the balance in hand, shows a total in favour of the Board of $1,167 50. Total balance, Dec., 1862, including assets on *Journal* account, $1,463 84 Total balance, Dec., 1863, including assets on *Journal* account, $1,167 50. Reduction of balance since last report, $296 34.

When it is considered that the whole revenue of the Board consists of the annual grant of $2,000 by the Provincial Legislature, and that a loss of upwards of $500 per annum has thus far been sustained in publishing the *Journal* of the Board; and that out of the remainder the charges for rent, salary of Secretary, and incidental expenses, have to be met; and that the rooms now occupied had to be furnished, and a well-selected and expensive collection of books for the Free Library of Reference to be obtained, and to which expensive additions have regularly to be made as new and suitable works are issued; it will be seen that it has been by the strictest economy, and the most prudential management on the part of their predecessors, that your Committee are enabled to report so healthy a state of the finances.

Library of Reference.

Your Committee have great pleasure in reporting the continued success of the Free Library of Reference, both as regards the class of books it contains, and the extent to which it is rendered available to the public. The Library is comfortably furnished, and any assistance required by parties in consulting works on the shelves is cheerfully given by the Secretary. The class of works most generally consulted are those in "Engineering and Mechanics;" "Manufactures and Trades;" "Decoration and Ornament, and Designing;" "Patents of Inventions;" "Chemistry in its application to Manufactures;" and the "Parliamentary Publications of the Province." The constant reference of parties to these works, during each day, and more especially on every Tuesday and Friday evening, when it is open for the benefit of those who cannot attend during the day, shows that the efforts of the Board to furnish a free library of valuable practical works of reference for the artizan, the mechanic, the decorator, and the inventor, are becoming duly appreciated.

The number of books added to the Library during the year is 123. The total number now in the Library is 1,171, of which there are of British, American, and Canadian Specifications and Plates of Patents, 580 vols.; Statutes, Journals, and other Parliamentary publications, 147 vols.; Transactions of Societies, 29 vols.; and of the latest Cyclopædias and standard works on Architecture, Decoration, Designing, Engineering and Mechanics, Manufactures and Trades, and General Science, 415 vols. Of these your Committee acknowledge a donation from the United States Patent Office of 3 vols.; from the Institution of Mechanical Engineers, 1 vol.; from the Smithsonian Institution, 14 vols.; from the Commissioners for the International Exhibition of 1862, (34 pamphlets) 13 vols.; and 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.

Model Room.

But few accessions have been made to the number of models in the room since last annual report; the models of all new patented inventions being sent to the Patent Office at Quebec. Were duplicate models required from inventors before granting their letters patent, one set could be kept in the

Board Rooms in Toronto; and would be a great convenience to inventors in Upper Canada.

Annual Examination.

In accordance with a programme issued by their predecessors in November, 1862, your Committee held an examination of members of Mechanics' Institutes in June last. Seven candidates only, presented themselves for examination, and these were all pupils of classes in the Toronto Mechanics' Institute.

The subjects taken up, and the Examiners therein, were:

English Grammar and Composition—M. C. Howe. LL.D., Toronto Grammar School.
Arithmetic—M. Barrett, M.A., M.D., U. C. Coll.
Book-Keeping—J. H. Mason, Esq., Toronto.
Drawing—W. G. Storm, Esq., Toronto.
Penmanship—W. R. Orr, Esq., Toronto.

The awards were as follows:

Lewis, Richard, aged 16—Grammar and Composition; 1st Class Certificate.
Woodsworth, Richard, aged 16, Clerk—Grammar and Composition; 3rd Class Certificate. Arithmetic; 2nd Class Certificate.
Graham, Wm., aged 24, Carpenter—Arithmetic; 3rd Class Certificate.
Milne, John Alex., aged 24, Salesman—Book-Keeping; 2nd Class Certificate.
Charles, George, aged 18, Wood Carver—Drawing; 3rd Class Certificate.
Rogers, Charles, aged 19, Carver—Drawing; 3rd Class Certificate.

A silver medal was also awarded to Richard Lewis, as the most successful of the candidates passing the examination; and the sum of ten dollars was awarded to the Toronto Mechanics' Institute, being the amount offered "to each Institute establishing, and keeping in operation for not less than three months, a class or classes of not less than ten members, for the study of any of the subjects named in the programme, and submitting at least two members of such class or classes as candidates for examination."

Letters of thanks were communicated to the several gentlemen acting as Examiners, for their valuable and gratuitous services.

Your Committee appropriated the sum of $60 for a design and one hundred lithographed copies of a certificate for candidates, but have to regret not yet obtaining such a design as would be satisfactory to this Board to adopt.

Arrangements have been made for holding the next Annual Examination on the 7th, 8th, 9th and 10th of June, 1864, a programme of which was published in the November number of the *Journal*, page 334.

The "Journal."

The third annual volume is completed, and your Committee congratulate the Board on the satisfaction which it appears to have given to the subscribers, from whom the Secretary has received many flattering commendations, as to the ability with which it has been conducted; nor has it failed to receive high commendations from several of the leading Provincial and other public journals.

In addition to the original matter it contains, relating to Canada, your Committee can with confidence refer to the *Journal* as a valuable record of the various mechanical and scientific improvements of Great Britain and foreign countries, presented to the Canadian public in a cheap and convenient form; in this respect it would, however, be rendered much more valuable did the funds of the Board allow of a larger number of wood-cut illustrations being supplied.

The monthly issue for the past year has been nearly 1250; but at the very low price at which it has been published—50 cents per annum—a loss has accrued to the Board of upwards of $500 for the year. The low rate has also had this additional disadvantage, that no commission could be allowed to agents for collecting the subscriptions due, so that a large amount still remains uncollected. Your Committee have therefore made arrangements for 1864, for a monthly issue of 2,000 copies, and at the uniform subscription of 75 cents per annum; allowing to Agents, Mechanics' Institutes, and Agricultural and Literary Societies, 33⅓ per cent discount. By this arrangement but a trifling loss is anticipated on its publication for 1864.

Free copies of the Journal have from its commencement been sent to all the members of the various branches of the Legislature, to the Mechanics' Institutes of Upper Canada, and to some of the leading Scientific and Literary Institutions and Journals of Great Britain and the United States.

As the Board aims to make the *Journal* the special advocate of the interests of Mechanics' and other similar Institutions throughout the Province, it is desirable that abstracts of their annual reports, and all other proceedings of general interest, should be furnished for publication or notice in its pages; this would create on the part of their members, an interest in the *Journal*, alike beneficial to themselves and the Institutions with which they are connected.

During the past year the *Journal* has contained copious notices of the spirited and beneficial movements of the Directors of the Toronto Mechanics' Institute, to make it what each Mechanics' Institute ought to be—a medium for imparting useful and sound instruction to the industrial classes, and a place for healthful amusement and recreation for all its members; and your Committee are pleased to notice that Institutes in some other localities are making successful efforts, to accomplish similar results. It is desirable that the pages of the *Journal* should conduce as much as possible to that end.

Amendments to Act of Incorporation, and to Patent Laws.

During last year an amended Act for the "Encouragement of Agriculture, Arts and Manufactures," and an amended Patent Law Act, were introduced to Parliament; but owing to the abrupt termination of the session, these Acts have not yet become law. Your Committee believe that, as introduced, they were *both* in accordance with the repeated prayers of this Board to the Government, and trust they may be sanctioned by the Legislature at an early day.

Provincial Agricultural Association.

At the last Annual Meeting of the Association, held in Kingston, on Friday, September 25th, a new code of By-laws, proposed at the previous meeting—a draft of which appeared in the *Journal* of the Board, for October, 1862, page 299—was adopted.

In clause 4 of these By-laws it is provided that "All entries in the Department of Arts and Manu-"factures shall be made with the Secretary of the "Board of Arts and Manufactures." Entries in the Departments of Agriculture and Horticulture to be made with the Secretary of the Board of Agriculture, as heretofore.

Clause 18 also provides that these By-laws "may "be altered or amended at any Annual Meeting of "the Association—notice of the intended alteration "or amendment having been published in the "'*Agriculturist*' and in the '*Journal of the* "*Board of Arts and Manufactures*' for trhee "months prior to the day of Annual Meeting."

Your Committee notice this change in the mode of receiving entries, for the information of those who may intend to exhibit at the show in Hamilton in September next.

School of Design.

One of the objects contemplated in the formation of this Board was the establishment of a school of design. In the year 1858, shortly after its organization, the Board appointed a committee of its members to wait upon the Rev. Chief Superintendent of Education for Upper Canada, with a view of ascertaining if any of the models and casts in the Museum of the Educational Department could be made available for the purpose. Dr. Ryerson informed the committee that he had been for some three or four years making preparations to open such a school in connection with his department, and that he would in a short time have his arrangements completed, and the school opened to pupils, at very moderate charges, for instruction. For some cause unknown to your committee, Dr. Ryerson's project has not to this day been carried out; but that such a school is necessary, and would be of very great advantage to our art-workmen, there can be no doubt.

Your committee regret that the very limited revenue of the Board—barely sufficient to carry out its present operations successfully—will not warrant them in recommending the opening of such a school in connection with the Board; they however venture to express a hope that ere a very long time elapses, means will be placed at their disposal to enable them to carry out this very desirable object.

Conclusion.

In conclusion, your Committee beg to recapitulate the objects which the Board has thus far been enabled to carry out, viz:

1st. The Free Library of Reference of Books and Designs.

2nd. The monthly Journal of Arts and Manufactures.

3rd. The Annual Examination of candidates from the industrial classes in useful studies, and awarding certificates and prizes of merit.

4th. The management of the Arts and Manufactures Department of the Provincial Exhibition of Upper Canada.

The objects which the Board desires to accomplish, but is restrained for want of funds, are—

1st. The establishment of a Museum of Canadian Manufactures, and choice examples of Foreign Manufactures; and also of natural and prepared substances adapted for manufacturing purposes.

2nd. The establishment of a School of Design, and for practical instruction of mechanics and artizans.

3rd. The awarding of prizes for useful discoveries and improvements; and for essays and papers upon industrial subjects of importance to Canadian interests.

All which is respectfully submitted,

John Beatty, Jun., *President.*

William Edwards, *Secretary.*

Toronto, January, 1864.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE.

Shelf No.		
B. 21, 22	Cabinet Maker's Assistant; A Series of Original Designs for Modern Furniture, with descriptions and details of construction; preceded by practical observations on the Materials and Manufacture of Cabinet Work, and instructions in Drawing, adapted to the Trade. 2 vols. folio; 1853	*Blackie & Son.*
D. 45	Carriage Builders' and Harness Makers' Art Journal. 4to.; 1863	
E. 101	"Practical Mechanics' Journal" Record of the Great Exhibition of 1862. The scope of this work, as regards the objects of the Exhibition, is only limited by the exclusion of objects of Fine Art proper. 4to.; 1862	
F. 54	Geological Survey of Canada: Report of Progress from its commencement to 1863; illustrated by 498 wood cuts in the text. 8vo.; 1863	*Sir W. Logan.*
G. 83, 84	Canada, Past, Present and Future; being a Historical, Geographical, Geological and Statistical Account of Canada West. 2 vols., 8vo.	*W. H. Smith.*
H. 55, 56	Explorations in the Interior of the Labrador Peninsula, the country of the Montagnais and Nasquapee Indians, illustrated. 2 vols., 8vo.; 1863.	*H. Y. Hind.*
K. 88	The Artist's Guide and Mechanics' Own Book, embracing Chemistry applicable to Mechanic Arts; Mechanical Exercises in the Various Metals; and a variety of useful Receipts for the various occupations of life. 12 mo.	*J. Pilkington.*
K. 89	Chemistry Applied to Dyeing. 12 mo.; 1853.	*J. Napier, F.C.S.*
L. 86	Views of Canada and the Colonists, embracing the Experience of an Eight Years' Residence. 12 mo.; 1851	*J. B. Brown.*
N. 3	Hand Book for Readers and Students. 24 mo.	*A. Potter.*

RECENT BRITISH PUBLICATIONS.

Allen (C.) Young Mechanic's Instructor, 2nd edit., roy. 12 mo.	0	2	6	*Elliot.*
Apjohn (James) Metalloids, fcap. 8vo	0	7	6	*Longman.*
Cassell's Elementary Handbook, How to Colour a Photograph, new edit., fcap. 8vo.	0	1	0	*Cassell.*
Catechism (A) of Photography, new edit., fcap. 8vo	0	1	0	*Cassell.*
Fresenius (Dr. C. R.) Qualitative Chemical Analysis, 6th edit., 8vo.	0	10	6	*Churchill.*
Hind (Hen. Y.) Explorations in Interior of Labrador Peninsula, 2 vols. 8vo	1	12	0	*Longman.*
Lardner (Dionysius) Animal Physics, Vol. 2, new edit., post 8vo.	0	3	6	*Walton.*
Lepsius (C. R.) Standard Alphabet for reducing Unwritten Languages, 2nd edit. 8vo.	0	3	0	*Williams & N.*
Lowndes (Charles S.) Engineer's Handbook, 2nd edit., post 8vo.	0	5	0	*Longman.*
Molesworth (G. L.) Pocket-Book of Useful Formulæ for Civ. Engi., 4th ed., obg. 32mo	0	4	6	*Spon.*
Rivers (Thos.) Orchard-House; Cultiv. of Fruit-Trees under Glass, 11th ed., fp. 8vo.	0	3	6	*Longman.*
Shelton (E.) Dictionary of Every-Day Difficulties, cr. 8vo., red. to	0	5	0	*Ward & Lock.*
Sherer (John) Desk-Book of English Synonymes, 12 mo	0	3	6	*Groombridge.*
Smiles (Samuel) Industrial Biography, Ironworkers and Toolmakers, sm. cr, 8vo.	0	6	0	*Murray.*
Stereoscopic Magazine (The) 1863, 8vo	2	2	0	*L. Reeve & Co.*
Ward (Hon. Mrs.) Microscope Teachings: Descriptions of Objects, imp. 16mo.	0	7	6	*Groombridge.*
Young (Arthur) Nautical Dictionary, Assisted by James Brisbane, 2nd edit., 8vo.	0	18	0	*Longman.*

RECENT AMERICAN PUBLICATIONS.

Art of Sketching from Nature, by T. Rowbotham, 12 mo., 27 illustrations		*Tilton.*
Air-Breathers of the Coal Period, by Prof. Dawson, plates, 8vo	$1 50	*Dawson Bros.*
Catechism of the Steam Engine, by John Bourne, C.E., 12 mo		*Appleton.*
Hydraulic and other Machines for Raising Water, Ancient and Modern, with Observations on various Mechanic Arts, by Thos. Ewbank; 300 illus., 8vo	5 00	*C. Scribner.*
Mechanical Engineering, comprising Metallurgy, Moulding, Casting, Forging, Tools, Workshop Machinery, Mechanical Manipulation, Manufacture of the Steam Engine, &c., &c., by T. Campin. C.E., &c., &c., 8vo	6 00	*H. C. Baird.*
Practical Draughtsman's Book of Industrial Design, and Machinist's and Engineer's Drawing Companion, by W. Johnson, C.E., 4to.	7 50	*H. C. Baird.*
Year Book of Facts in Science and Art for 1863, 12 mo		*Gould & Lincoln.*

Correspondence.

THE TORONTO MECHANICS' INSTITUTE.

Toronto, 2nd Jan., 1864.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—I have received a letter from a gentleman in St. Catharines, asking for information respecting the nature and objects of our Re-unions, to which I have made the following reply; and thinking that perhaps some other energetic Institute might like to have the same information, I have to beg that you will be kind enough to give the same an insertion in the next number of your Journal.

I am Sir, your obedient servant,

Geo. Longman, *Sec.*

SIR,—I am in the receipt of your letter of the 31st ult., making inquiries respecting our Re-unions and asking for information.

1st. Our Re-union Committee is composed in part of directors, and in part of members, non-directors, with whom all arrangements are left.

2nd. That Committee is divided into three Sub-committees, viz: a Music, Debate, and Reading or Recitation Committee.

3rd. Each Sub-committee prepares its own part of the programme, and submits the same to the full Committee for adoption; but no business is transacted without the consent of the entire Committee.

4th. The Committee borrow (or rent) a Piano.

5th. They appoint a competent person to act as musical conductor, attend to rehearsals, &c., &c.

6th. The Sub-committees give themselves to the work, and secure the services of such as may be competent to take part, either paying them for their services or not, as the circumstances of the case may seem to require.

7th. A Chairman is appointed to preside at each Re-union; no one person being appointed twice in succession.

8th. Our programme generally consists of about fifteen pieces, and is composed of, first, a five minutes address from the Chairman; and then of songs, readings, anecdotes, recitations and debates, alternated in something like the following proportions:

Chairman's Address			5 minutes.
A Debate, 2 speakers.......15 m. each.			30 "
8 Songs (includg. encores) 10 m.	"	1h.	20 "
2 Readings ....10 m.	"		20 "
2 Recitations.................. 5 m.	"		10 "
1 Anecdote .... 5 m.	"		5 "
			2 h. 30 m.

9th. We have on more than one occasion, engaged the Band of the 16th Regiment; and we have reason to believe with good effect.

10th. We charge ten cents admission to all—men, women, and children, members and non-members.

11th. Members' season-tickets, including perhaps ten Re-unions, $1.00, admitting a gentleman and two ladies; by this means members of the Institute introduce two ladies for the same charge, as a non member without them.

12th. This is the only privilege accorded to members at these Re-unions.

This is about all the information I can think of at present. Our Re-unions are well attended, and quite successful; affording healthful recreation, instruction, and amusement to our members and the citizens generally.

The idea in getting them up is not to make money, neither can we make much money by them. They serve one good purpose however, and the St. Catharines' Institute will do well to consider it—they serve to keep the Institute before the public, and to make its existence, its nature, and objects known.

I hope your Institute may be able, successfully, to inaugurate a series this season, and that they may be productive of much good!

(Signed), GEO. LONGMAN, *Sec.*,
Toronto Mechanics' Institute.

S. Sugden, Esq.,
St. Catharines.

Selected Articles.

SMYRNA EMERY & BLACK-LEAD MILLS.

Continuing our wanderings from one to another of the large manufactories which each contribute their important item to make up the endless variety of the grocer's or oilman's stock, we have come upon the well-known mills of Messrs. Johnson, Roffey, and Company, of York-road, Lambeth.

The tradesman who supplies the housekeeper with small packages of such articles as are here manufactured has neither opportunity or leisure to spend a thought upon their origin, mode of production, or the material, wonderful machinery, and dexterous hand labour employed in their production. Being convinced, however, that the acquirement of such information will tend not only to the intellectual improvement of the tradesman, but, indirectly, to his commercial prosperity, we have taken upon ourselves the pleasant task of conducting our readers through the manufacturing processes employed by the above named firm.

Armed with an introduction to Mr. Williams, one of the partners of the firm, we are courteously received by that gentleman, who, relinquishing his morning's occupation in the snug little counting-house, undertakes to conduct us over the premises.

We begin with the square court-yard, three sides of which are occupied by the premises in which the greater portion of the work is carried on. In one corner of the yard we are shown a large heap of dull and decidedly uninteresting looking stones of irregular sizes and shapes. Of course, we are not long in discovering that this is the emery stone in its original state, as imported from Naxos and Smyrna. The stone is so named from Cape Emeri, in the Island of Naxos, from which place large quantities are brought. Its chief constituent is alumina, combined with a small quantity of silica, peroxide of iron, and a little water. The material is also found in smaller quantities in Spain, Asia Minor, and in most of the Greek Islands.

The first step towards reducing these adamantine lumps to a powder is similar in every respect to the familiar process adopted by the honourable associates of some of our most unpopular public institutions, whom our readers have no doubt frequently observed, bending in pursuit of their primitive studies over a rough heap of geological specimens by the country roadside. Pocketing, by permission, a goodly specimen of the crude material, we pass into the midst of a deafening clatter, from which we at first instinctively shrink. Reassured, however, by the apparent equanimity of our guide, we receive from him in brief mouth to ear shouts, the intelligence that here the lumps are undergoing a further and more obvious reduction in size, but, instead of the stone-breaker's hammer first used, we have two series of iron crushers, each series consisting of six pounders, and each ponderous hammer weighing two and a-half hundredweight. Under these, in a kind of trough, are placed the rough lumps of stone, and one by one in quick succession, the crushers are lifted by a powerful iron crank, worked by steam, and dropped upon the mass, causing a noise which, mingling with that produced by other equally noisy contrivances, is enough to deafen the unpractised ear. In front of the trough stands a lad, whose sole duty it is to satisfy the pounding propensities of these hammers; to remove the material which has been sufficiently operated upon, to sift it, and return the larger pieces which have escaped the unrelenting blows of the pounders.

Ascending to the floor above, we find a more extensive series of bins, barrels, and sieves. This is the department in which the emery is divided into the various sizes, according to the mesh of the sieve. When the reader handles a sheet of common emery cloth, it does not occur to him that the sharp particles with which it is surfaced are selected with such minute care by the manufacturer, that were they to be examined by the most powerful microscope no perceptible difference would be found in the size of the grain composing each specimen. A more interesting fact than this is, that by division and repeated subdivision, according to the size of the grain, from twenty to twenty-five distinct sizes of the material are obtained, each destined for a particular purpose. The coarsest, the particles of which are about the size of a pea, goes to the wool carders; the finest to the manufacturers of such substances as knifepowder, and to steel polishers. But there is still a finer quality, not selected by any artificial means, but collected from the beams and rafters of the building. These flying particles, set afloat during the commotion of the sieves, are carefully gathered, and form no small item in business of the firm. The intermediate qualities find their way to opticians, plate-glass manufacturers, and various other consumers in the neighbourhoods of Sheffield and Birmingham.

In the many important manufactories which it has been our pleasure to inspect, we have nowhere seen such an economy of space as is practised here. Not only are the smallest of small rooms filled with busy mechanics, but all the niches and available corners of the place serve as standing or sitting room for at least one workman, of which there are employed in all about forty, in addition to the powerful machinery. The increasing business of the firm, which has been established more than 100 years, has necessitated this economy;* yet we were not a little astonished to hear that the amount of emery stone crushed, pounded, sifted, sorted and sold, amounts to an average of nearly 300 tons per year.

Having been considerably amused and instructed by the examination and comparison of the various sizes and qualities of the powder, we are next taken to one of the rooms used for the making of emery cloth. The apparatus here employed is of a very simple nature, the system reminding us forcibly of that adopted by paper-stainers. Pieces of cloth forty yards in length, manufactured at Manchester expressly for the purpose, are coated as they are unrolled with a mixture of glue and mineral black; the end of this long strip is attached to a cylinder, upon which it is slowly rolled as it receives its coating. A lad standing by, who alternately dusts the sticky surface with emery, and adjusts the cloth as it is wound on to the cylinder. This is next passed to the drying-room, where it receives a superficial coat of very thin, transparent glue, which serves to fix the particles, and to give the approved tone looked upon as an important recommendation by the dealer. The American difficulties have made a considerable difference in the cost of production of this article, for we are informed that the firm now pay 3d. per yard more for the cloth since the reduction in the supply of cotton than previously, and they yet anticipate a further rise in the price. This difference in the cost of coarse cloth makes a serious item, when we consider that the firm often use between 5000 and 6000 yards of cloth per week.

Adjacent to the rooms just described is one containing the machines used for cutting the emery-cloth into the required lengths. These consist of a simple slab and descending blade, very similar in principle to an ordinary straw-cutting machine. In this department, also, the sheets are counted into quires and reams, pressed by hydraulic power, and packed in neat parcels; each separate sheet is, however, first passed through the hands of two dexterous lads, who stand at a counter, and with hand dies make on the back the familiar impression, consisting of the name of the firm in a circle, the centre of which contains a simple letter of the alphabet or number to indicate the sizes. The accuracy with which these young urchins hit their mark is truly surprising, and fully illustrates the old adage, "practice makes perfect."

Following our patient instructor to the stock room, we are shown specimens of the emery-*papers*, the use of which have been, as our readers are no doubt aware, all but superseded by that made on a foundation of cloth.

We next find ourselves in a room where immense quantities of *glass paper* are made by first coating large square sheets of cartridge paper with a surface of thin glue, and then immersing them in a mass of ground flint glass of various sized grains. The green bottle glass is the only description used, being the hardest which can be procured for the purpose.

Passing to the room devoted solely to the storage of this class of goods, we are shown some of a bright red colour, so made to satisfy the prejudice of housekeepers, who, for some unexplained reason, have ever refused to make use of any other description, although the only difference lies in the colour.

We have devoted so much space to the leading department of the business under notice that we are reluctantly compelled to summarise our notes of the black lead manufacture. Commencing a second tour in the noisy room, where two enormous millstones, of the respective weights of three and two tons, are constantly at work in reducing the rough lead to an impalpable powder, we watch with no little interest and amusement the sifting process; forgetting for the moment our own errand as we stand almost impelled, by a forgetful sympathy, to join in the nervous and agitated dance of these dingy utensils. Released, however, for a time from this conglomeration of jigs, polkas, and hornpipes, our attention is directed to a beautiful piece of machinery used for the purpose of compressing the powdered lead into solid blocks. A round iron vessel receives the powder, under the bottomless bottom (if we may so express it,) of which slowly passes, with a rotary motion, a small circular table containing six holes, of the size and shape required in the present instance for quarter pound blocks. The black-lead drops into these holes as they pass underneath the vessel, and, as each hole is filled, the same circular motion brings it directly under ac ammer, which, by a very graceful motion, descends with a pressure of three tons, making the mass more solid and compact than if it had been carved out of the original material. A stamper next takes its turn, and imparts a very clean impression of the trade mark and name of the firm.

Leaving these blocks to the polisher, packer, and labeller, we again cross the yard, and are admitted to an apartment occupied by the packers of the loose lead. Here we receive a striking proof of the good feeling that evidently exists between the employer and employed in this establishment. We are introduced to the head man of the department as not only a faithful and long-tried servant, but an accomplished *artiste* in his calling. Jackson has been twenty-seven years at his post, and so practised has he become during his long service, that he will, with the assistance of two little boys, who paste and stick on the labels, produce in one single day 1792 complete quarter-pound packages, containing a total of four hundredweight of lead. Other instances of long and honourable service distinguish this establishment for the good treatment extended to the hands employed.—*Grocer.*

THE STEAM FIRE-ENGINE.

The steam fire-engine question is, comparatively speaking, a thing of yesterday. Years ago, it is true, such machines had not only been proposed, but called into existence both here and in the United States; yet until the trials of last year brought the subject prominently before the world, very little was known of their requirements or relative efficiency as compared with the hand engines, on which we had before been entirely dependant for the safety of our streets and warehouses. Of the competition at Sydenham last summer, it is not our intention to speak. The subject has received sufficient ventilation. Even admitting every objection which can be urged against it, it yet served an admirable purpose, in that it demonstrated the facility with which thoroughly efficient machinery could be produced by those who devoted their attention to this department of mechanical construction. The three days proceedings at the Crystal Palace were, in addition, the direct cause from which the publication of a considerable amount of valuable information resulted. The detached manner in which this was brought before the public seriously detracted from its usefulness; and the literature of the steam fire-engine is meagre in the extreme. A lucid, comprehensive, and impartial treatise has yet to be written, and if properly prepared, it cannot fail to prove serviceable.

In the steam fire-engine, more particularly when intended for service on land, we have a machine which must satisfy many strictly exceptional requirements. In order that it may be useful and admirable in the fullest sense of the terms, it must not only be extremely light and portable, but of enormous strength as well. Intended to work under the most trying circumstances, and at seasons when the calmest pulses are accelerated, and the coolest heads lose their self-possession, it must be prepared for rough work and much knocking about. Nothing but first-class workmanship and materials can reconcile these incompatabilities. Ere long, we trust to see steel take the place which wrought iron now holds in the fire-engine. It is already partially used, in the form of piston rods and crank shafts; and there is nothing to preclude its employment in the shape of boiler shells, and carriage frames. In cylinders and pumps, the use of homogeneous metal or malleable cast iron, would effect a very considerable reduction of weight, and positively add to their powers of endurance. The principal of annealing articles of cast iron required to sustain great strains, is better understood daily; and a steam cylinder or pump valve, one-fourth of an inch thick, so treated, is stronger than one of twice the weight left as it comes from the moulder's flask. By these means alone, we do not doubt that an important reduction might be effected in the weight of future engines; whilst improvement in the arrangement of the working parts, frames, and trusses, would permit a more equable distribution of the strains to which the machine is exposed, and materially add to its longevity.

The principles involved are simple enough. In their adaptation to the requirements of practice lies the difficulty. Steam gives out its useful effect equally well, whether a piston moves fast or slow, so long as economy of fuel is not an object of desire. Hence, if weight were not a consideration, the speed of the engine would be a matter of slight importance, and that velocity best adapted to the description of pumps employed, could be adopted without hesitation. In order to secure portability, however, in the highest degree, with a pressure kept within reasonable limits, quick-working engines are indispensable. This would of course, entail no difficulty were the motion of water as manageable as that of steam. Unfortunately this is not the case; and, as a consequence, the steam fire-engine requires to be treated more as an hydraulic than as a steam machine. We are, therefore, inclined to prefer that principle of construction which permits a long stroke of the steam, and a short stroke of the water pistons. Such an arrangement is, perhaps, more likely to secure a high co-efficient of useful effect in proportion to the fuel burned and the weight of the machine, than any other. High-speed engines coupled directly to the pumps, are quite capable of doing good service, as our American friends have showed; but we imagine, with a very considerable and unnecessary waste of fuel. Were it not for the effects produced by wear, the rotary pump, as adopted in the "*Manhattan,*" would seem to be best of any; and it is quite possible that this objection may not be found insurmountable. Notwithstanding a bad boiler, the admirable qualities of that machine, in everything concerning the engine and pump, were sufficiently manifest. We believe that excellent results would be obtained from a similar arrangement supplied with steam by a generator, say on Mr. Field's principle, of sufficient power. The rotary pump, however, is condemned for the present by those best acquainted with its capabilities; and it is, therefore, unnecessary to dwell further on its merits or demerits. That the best possible results have yet been obtained from the reciprocating pump is uncertain; and on the relative good qualities of those varieties employed by the three or four firms in whose hands the manufacture of fire-engines rests for the present, it is impossible to decide. We can not separate the efficiency of the engine from that of the pump, as no diagrams have ever been taken from the cylinders of a steam fire-engine. We fancy that the application of a Richards' indicator during the late trials would have produced some singular results, and afforded much valuable information. No careful or accurate estimate can possibly be made of the relative actual horse-power of the various machines exhibited. Everything stated on the subject is, in the absence of the necessary data, vague to a degree; and we are really as much in the dark as ever in all that concerns pumps and engines in their individuality.

As to boilers, that which supplies the greatest quantity of steam with the smallest consumption of fuel is not necessarily the best. The less coal burned, the less the wear and tear of tubes and fire-boxes, of course; but this is a secondary consideration, of little importance if weighed against the facility for getting up steam to high pressures in short spaces of time, and great capabilities for supplying it in quantities. Still a generator of the class required, may possess great steaming powers, and yet not make an excessive demand on the coal supply. It is a mistake to restrict the quantity of water too much. It is true that the number of gallons contained within a boiler, measure pretty accurately the proportionate time required for raising steam in different engines of nearly similar construction and dimensions. But spread it as thinly, and subdivide it as much as we may, the quantity of liquid measures the heating surface as well as the time. A few hundred additional cubic inches of water space may frequently prove of the utmost advantage, while their presence cannot do harm. Too much importance is attached to the question of raising steam quickly. Only in cities and large towns will steam fire-engines ever find a legitimate opening for the display of their powers. Gas can be had at a moderate price all over England—in every town almost which can boast a few thousand inhabitants; and it is certainly injudicious to endanger the durability of boilers which may be severely tried at almost a moment's notice, by a reduction in the quantity of water carried, when a gas jet may be kept burning in the fire-box night and day at a trifling expense. This system has been adopted at Watling-street station for some time past with great advantage; steam being usually maintained steadily at 5 lbs. on the square inch night and day. Messrs. Lee and Larned constructed some steam fire engines at one time which got 30 lbs. steam in 3¼ min. Experience soon showed, however, that there was really no need for such expedition, and the time was extended to 6 min., and finally to 8 min., with a corresponding increase in the good qualities and general efficiency of the machine. Mr. Lee states that one of these 8 min. engines attended 170 fires never being late but once, when the conflagration took place in close proximity to the engine-house; the steam being always raised from cold water while proceeding through the streets. Pressure is always unsteady with a limited water space, rising and falling with the most trifling variations in the state of the fire.

A great difference of opinion exists as to the relative merits of the horizontal and vertical arrangements of steam cylinders and pumps. We attach little importance to the question. It is, after all, merely a matter of constructive convenience, or the reverse. The great objection urged against the verticle system is, that it produces oscillation. This may be true; but engines on the horizontal plan are open to it as well—the vertical pitching motion is exchanged for one fore and aft; and as it is more difficult to scotch wheels effectually, than it is to run down clambing screws on the springs, we think the advocates of the vertical principle have slightly the advantage. Careful balancing will do much to remedy this evil in either case.

The importance of a steady speed, be it fast or slow, in any system of pumps intended to force water under great pressure, is well known. Our fire-engine builders do not appear to attach as much importance to it as they ought. A good governor would secure the desideratum far better than any manual attention. Serious injury is often done by an engine racing suddenly on first opening the regulator, or on the bursting of an hose, or a failure in the water supply. The governor would prove an effectual remedy. If the centrifugal form is deemed objectionable there are many others open to our adoption; a modification of Picher's governor, for instance, might probably be used with great advantage. These are, however, minor matters; and as we have good reason to be satisfied with the progress made in the last few years, we may safely leave this consideration, for the present, to those most interested. The necessity for a fly-wheel and crank-shaft is a more important question, on which great difference of opinion exists. We believe that its adoption simplifies the valve gear, gives steadiness to the motion of the engine, and permits a considerable reduction in the space occupied by the machinery —advantages not to be lightly sacrificed.

ELECTRO-MAGNETIC PHONOGRAPH.

This machine is capable of being attached to piano fortes, organs and other keyed musical instruments, by means of which they are rendered melographic, that is, capable of writing down any music that is played upon them.

So keenly have musicians at all times felt the extreme tediousness of writing music by hand, and the impossibility of preserving the most valuable impromptu pieces in their full and flowing beauty, that immediately on the introduction of the pianoforte into England strenuous efforts were made by men of inventive skill to supply the instrument with the means of registering the music performed upon it. "The first piano-forte seen in England was made by one Father Wood, an English monk at Rome, and by him sold to Samuel Crisp, Esq., who sold it again to Fulke Greville, Esq., for one hundred guineas."* This was about 1757.

The Rev. — Creed would appear to have been one of the first, if not the first, to think of constructing a melographic instrument, and in the year 1774 he sent to the Royal Society a Paper, entitled "A demonstration of the possibility of making a machine that will write extempore voluntaries, or other pieces of music, &c."†

There are also obscure accounts of a machine made in 1770, by a monk named Engramelle.

In a German work of 1774, John Frederick Unger, a counsellor of justice at Berlin, claims priority of invention against Mr. Creed, though it seems most probable that each made a similar invention unknown to the other.

There is no doubt whatever that the Académie of Berlin was presented by Hohlfield—an ingenions mechanic who received some suggestions from Euler—with a machine which, to a limited extent, answered its purpose. It consisted of two cylinders moving paper between them, on which, by means of a crayon, each key made a mark when pressed down in the act of playing. But not only was the action of playing very fatiguing, but the music must have been of a most inconvenient width—that of the key-board—and without any stave, accidentals, &c.; in fact a mere series of dots showing such and such keys were pressed down in the course of the performance, but utterly failing to mark the time, key, or accidentals. The Académie, however, in consideration of the great ingenuity of the contrivance, rewarded the inventor with a handsome gratuity.

In 1827, M. Carreyre made trial, before the Committee of the Fine Arts of the Institute of France, of a melographic piano, which consisted of a clock-work movement, which unwound from one cylinder to another a thin plate of lead, on which were impressed, by the action of the keys of the instrument certain peculiar signs, which might be translated into the ordinary notation by means of an explanatory table.

"After the experiments, the plate of lead was removed, to make the translation, and a commission was appointed to report; but as no report was ever made, it is probable that the translation was not found to be exact. At the same time M. Baudouin read before the Institute a Paper, accompanying it with drawings, concerning another melographic piano; upon the merit of which we do not find that the Institute pronounced." ‡

These accounts prove two important facts; the great efforts made and the small success achieved—this want of success proceeded from the lack of a proper motive power, none having used electro-magnetism—for it must be evident to all acquainted with music that these were as yet nothing more than partially successfully experiments, and produced no further results than stimulating inventors to continual exertions.

The causes of failure were many, the most serious being the oversight of endeavouring to derive the mechanical power from the keys of the piano, whereas some power, which, while depending upon the action of the key for its liberation and manifestation, should at the same time exert its force without strain upon the key, still remained a desideratum. Such a power is electro-magnetism, as the mere motion of a piano key, without any alteration in the touch required—may be made to call forth a force of any magnitude required. Now, in Unger's machine the power was derived from the keys alone, and by direct action, thus rendering the touch of the piano so heavy that no one could perform properly upon it. For this reason it is unnecessary to consider further its defects. M. Carreye's, besides being equally objectionable on the score of its unavoidably heavy touch and arbitrary and unmeaning signs, produced at the best but an indented sheat of lead, a medium for writing music on most inconvenient and unmanageable.

A machine which should register in plain black and white on common paper the music performed, giving the score on the ordinary stave, using the flat, sharp, and natural signs, as in all modern music, accurately registering time, bars, legato and staccato, 8va, alto, and basso passages, and adapted to all keys, still remained a desideratum, for from 1827 to 1863 no further progress was made, though many continued to give their attention to the subject.

But in 1863 Mr. Fenby applied electro-magnetism, and a machine was patented by him, January 13, in that year, which, without altering the touch or appearance of an ordinary piano, is stated to be capable of registering the most complicated music.

Before giving any detailed description of the construction and capabilities of the phonograph, it may be well to point out the obstacles to be overcome in the notation, and thus to separate the possible from the impossible.

The most obvious difficulty, and one which, if not overcome, would render all other excellencies nearly, if not quite, futile—is the means of marking the various durations of the notes from the breve to the demisemiquaver, &c. This was a difficulty inasmuch as the ordinary open, closed, and tailed notes cannot possibly be rendered available in an instrument registering that which is performed upon it.

The following considerations will render this apparent. The longest note is practically but the fusion of a number of shorter notes, from which it follows that on any particular key being depressed, as in playing, its first touch would be the shortest note of the notation, and the machine would immediately print such shortest note, and could not afterwards alter it; for to suppose a piece of machinery to render shorter or longer notes by arbitrary signs, having but a fictitious relation to their duration, is to suppose its possession of a reasoning power, the absurdity of which needs no comment. From these considerations, and others which will readily occur to the mind of the reader, it is manifest that some system is required in which

* Rimbault's History of the "Pianoforte."
† Phil. Trans., vol. xliv., p. 446.
‡ Rimbault.

the duration of sound and the performance of the printing may be co-existent, and thus produce a complete reciprocity of action between the two. In other words, a short note must be capable of becoming a long one in the printing as in the playing.

Bearing these facts in mind will lead to a complete comprehension and appreciation of the system. Each note shows the portion of time occupied in playing it by the length it occupies in the bar, and consists of a horizontal black line proportionate in length to the duration of the note, while the rest of the notation needs no comment, it being in all respects identical with that at present in use.

Having considered the notation, the next thing to which our attention will naturally turn is the mechanical appliances employed to produce this notation. First, then, as to the touch of the piano: this remains, to all intents and purposes, the same as if without the phonograph attached, as the mechanical power is not derived from the motion of the keys, but from a voltaic battery; the only part performed by the key being to bring a small brass stud, on its under side, in contact with a slender spring; this causes an electro-magnet to bring a tracer against the paper which is continually moving at a fixed rate and thus marks the note. When the key is no longer depressed, the tracing ceases, and the rod slides back; this mechanism being capable of registering the slowest or most rapid playing. The accidentals are printed by revolving type, acted on by the same sliding-rod and magnet. The accidentals are adapted for all keys, so that any number of flats or sharps may be correctly registered; the machine being capable of distinguishing accidentals, flats, sharps, and naturals from those which are proper to the key in which the music may be pitched—that is to say, if the key A natural be used, F, C, and G, when played sharp, will have no sharp sign in the body of the music, whereas if the naturals of these notes be struck, or the sharps of any others, suitable accidentals will be printed.

Having now reviewed the notes and signs proper to them, the bars will be considered The barring of the music is performed in a simple manner, precluding the possibility of derangement, and is yet so accurate in adjustment that it correctly follows the accentuation of the most complicated piece of music. When a rallantando movement occurs, the bar or bars through which it runs will be actually lengthened in such a proportion as will accurately denote the character and expression of that part of the music. The same manifest advantages occur in the matter of legato and staccato movements.

The machine requires only blank paper, as it rules the stave and prints the score simultaneously. The inventor furnishes a small battery of convenient and simple form. The charge consists of sulphate of copper and water: one charge lasting for some months. The whole is in a neat drawer at the bottom of the machine, and offers nothing of diffculty or unpleasantness in its management, and requiring to be touched only to supply water to it.

THE GOLD FIELDS OF CANADA AND NOVA SCOTIA.

An interesting paper on the gold fields of Canada was recently read before the Literary and Historical Society of Quebec, by the Rev. James Douglas, son of Dr. Douglas, of the Beauport Lunatic Asylum, who has long had an interest in the Chaudiere gold-producing region. Having narrated the early facts connected with the discovery of gold in Canada, he referred to the operations of the Canada Mining Company, who obtained the right to wash on the flats of the Du Loup. On three-eighths of an acre, in 1851, by the same process as they wash tin in Cornwall, they obtained, from two feet in depth, 2,107 dwts of gold dust, mingled with about a ton of black iron sand. The value of the gold was $1,826; the outlay, $1,643; leaving profit $182. Again, in 1852, on five-eighths of an acre were obtained 2,880 dwts., worth $2,496, of which $307 was dust, mixed with iron sand. Nine of the nuggets found in 1851 weighed together 458 dwts; the largest, 127, and the smallest, 111. Small portions of platinum were found. The washing lasted from 24th May to 30th October, and cost $1,886, leaving a profit of $608. The Canada Company had to abandon their works, owing to a disagreement with the proprietor of adjoining lands. On the same spot the Napanee Company afterwards sunk a shaft through the slate, which process is so profitable in California, but after two years essay they gave it up. Since 1855 the diggings have been abandoned to the depredations of the *habitans*, who are interested in hiding their gains to avoid tribute. The Poulins, five brothers, are the only persevering miners, having been brought up to a bush life and being better able than most to bear the fatigues of the work. It had always been as hard to learn their gains as to find them at work. They would bore subterraneously, leaving no trace but the place of ingress, and thus successfully work a long ledge in their own peculiar way. Their good fortune has not in the least improved their outward condition, though one of them once, when asked to contribute to the gilding of the church altar, said he could give what would gild the whole church. The gold being stolen property, they have ever feared to disclose the extent of their gatherings. Still they probably never struck on any such deposit as that which created the fever of the past autumn. It was too late in the season last summer to do more than ascertain its exceeding richness. During June and July last, about 50 men were constantly working on Roderigue's and Vailleaux's lands. The largest piece known to have been found sold for £22. A party of six, including the two leading Poulins, admitted finding 15 ounces in three days, and another party of six found 6½ ounces in two days. After the unlicensed diggers were driven off, the location was thoroughly washed by Messrs. Parker, Hagens & Co., who have bought a continuation of the lease, working under the superintendence of Mr. Percival, a California, by means of ground sluices. The lower diggings where they were, is at a spot where the stream is crossed by a bar of hard rock, intercepting the gold in its progress, for below nothing of consequence is found, while above the yield is enormous. It was just above this bar that Roderigue and his company of four found such success that they bought the location. In eleven days, with nothing better than a tin pan they found 10 pounds of gold. They afterwards sold out the greater portion of their 150 by 50 feet lots, and at five or six times its cost, and worked the remainder with ground sluices, an instrument which washes more gravel than any other. They then got 1 lb. in one day, and 1 oz. the next. Their largest piece sold for $200. The next weighed nearly a quarter of a pound. Though they kept no accurate record, their earnings were probably not less than 24 lbs. or 6 lbs. each (worth $1,296), or say 80 days, *i.e.* 20 days per month, their wages were $16 a day per man. The conditions under which the alluvial gold is found, varies with the different character of the river beds. A great quantity of gold is said to have been found this last summer about the head waters of the Famine. Gold occurs in the Melgermet, under the same curious circumstances as in the Famine. With regard to the quality and degree of fineness of the Chaudière alluvial gold, the lecturer stated that an assay of a sample, made by Messrs. Thomas & Co., shows it to be 3¾ grains inferior to standard, with 28 dwts. of silver per lb. He remarked that gold was not confined to the Chaudière valley, but will probably be found over the whole extent of the Quebec group of rock, which stretches, with certain undulations, from Mississquoi Bay to Newfoundland. Traces of the precious metal have been discovered at Trois Saumons, on the Magog river, the St. Francis, in Westbury, Dudswell, and at Lake St. Francis. Very beautiful specimens have also been taken from Harvey Hill, Leeds. Most of the gold in the Chaudière was found with the quartz adhering to it, and the lecturer thought that if the rock should be found as richly charged with gold as that of the Lower Provinces, the alluvial diggings would give place to more profitable quartz-mining. The remaining part of the paper he devoted to a consideration of the question as to how gold-mining could be made to contribute to the revenue of the country, and what effect further discoveries would have upon the prosperity of that part of Canada.

In the Nova Scotia *Royal Gazette* we find some interesting details of the result of recent operations in the gold-fields of that Province. They possess the more interest to us from the fact, that the precious metal appears to be found in Nova Scotia under much the same circumstances as those under which it is found in Canada. The *Gazette* contains tables, published by the Chief Gold Commissioner, showing the number of gold mining areas worked, the number of men engaged in mining, the quantities of quartz raised and crushed, with the average yield per ton, and the total returns of gold, in the various districts, for the months of July, August, and September.

The districts to which the returns relate, are Stormont, Wine Harbour, Sherbrooke, Tangier, Montague, Waverly, Oldham, Renfrew, and Ovens. The most productive seem to be Stormont, which in July yielded 256 ounces of gold; Wine Harbour, which yielded 324 ounces; Sherbrooke which yielded 335 ounces, and Waverly which yielded 343 ounces.

The total number of areas worked in the various districts enumerated were, in the month of July, 126; men employed, 994; quartz raised, 1,938 tons; crushed 2,095 tons; total yield of gold, 1,730 oz. 18 dwts. 6 grs. The average yield of gold per ton, exclusive of Waverly district, 1 oz. 4 dwts. 18 grs. There were in all 28 crushers, 20 of which are driven by steam power.

The operations in August and September were much on the same scale, and with similar general results.

In August, in several districts, 130 areas were worked, 1,156 men employed, 1,571 tons quartz crushed; yield of gold 1,625 oz. 16 dwts. 19 grs.

Average yield per ton, exclusive of Waverly district, 1 oz. 10 dwts. 15 grs. One additional crusher was put up at Wine Harbour during August.

In September 122 areas were worked, 750 men employed, 1,624 tons quartz crushed; total yield of gold, 1,253 oz, 7 dwts. 1 gr.; yield per ton, exclusive of Waverly district, 1 oz. 0 dwts. 7 grs.

From the above it appears that the total yield of gold for the quarter ending 30th September, 1863, was 4,620 oz. 2 dwts. 2 grs. The total yield for the half year ending June 30th, 1863, was 5,193 ounces. The average number of men employed for three months ending 30th September was 967. The value of the gold raised in the nine months ending September 30th, 1863, at $20 per ounce, is $196,260. It must be borne in mind that the above statement does not give the entire amount of gold raised; in fact it would be impossible to obtain a knowledge of the exact quantity, because much is secured in nuggets, which with specimens do not pass through the crusher; and as it is from the crusher returns that the table is mainly compiled, it is plain that all the gold obtained is not enumerated.

MANUFACTURE OF BOOTS AND SHOES BY MACHINERY.

A manufactory in which boots and shoes are made upon an extensive scale, by machinery, has been recently established in New York, and is thus described by the *Scientific American*:—

Three large apartments are occupied by the operatives, mechanism, and goods. The skins for the uppers are first spread out, examined, and selected according to the purposes for which they are required. Different cutters then cut out the respective parts according to the size and form required, and these are all arranged and classified. After this, these separate parts are given out in lots to be sewed by machines, and those uppers which are intended for boots are crimped, and the whole made ready for receiving the soles. The more heavy operations of punching, sewing, pegging the soles, and finishing the articles are next executed. The sole leather, in hides, is first steeped in a tank of water to soften it; then it is thoroughly dripped, and afterwards cut by a machine into measured lengths of a certain breadth, according to the size of the sole wanted. After having become sufficiently dry, these cut strips of leather are run between rollers, and also submitted to severe pressure under plates in a press, so as to effect as complete a compression of the fibres as is attained according to the old mode by beating with a hammer upon a lapstone. From these compressed strips, soles of the different sizes are punched out at a single blow by a machine, the cutter of which is of the size and form required, and it turns round so as to cut a right and left sole alternately. Heel-pieces are also cut out by hollow punches at a single blow. The edges of the soles and heels are next smoothed and polished in a small rotating machine; and another machine then makes the channels in the soles for the rows of stitching. After this, the under soles and uppers are fitted upon lasts and made ready for sewing. This operation is executed by Mackay's peculiar machine, adapted for this specific purpose. The waxed thread is wound upon a vertical spool, and is conducted through a guide situated on the top of an elbow secured on a swivel joint capable of turning under the needle, and conducting the thread in the crease around the sole. The needle operates vertically above the sole, and the waxed thread is fed into the interior of the boot or shoe by the guide, the needle descending through the sole, drawing through the thread and forming the stitches, which are pressed down close into the crease by a tracer-foot, upon which great pressure is exerted. In this manner the sole and upper are united firmly and neatly together in a few seconds, without employing a welt. Hand-sewing cannot be compared with such machine-work for accuracy and rapidity. Another machine is employed for putting on double soles with copper pegs. A thin strip of copper is fed in at one side and the holes are punched in the sole, the pegs cut and put into the holes, and then driven down at one continuous operation, with a speed corresponding to that of sewing the soles. The crossing of the half sole at the instep is pegged, and also fastened with a screw at each side by hand, the heels are also pegged down. The edges of the heels are neatly trimmed by a small rotating machine and the soles are also rubbed down by a machine; so that nearly all the operations connected with the manufacture of boots and shoes in this establishment, are performed by machines designed especially for the purpose. The legs of the boots are stretched and the wrinkles removed by new boot-trees secured to benches and are expanded in an instant from the interior by pressing on a treadle with the foot. These boot-trees are altogether superior to the clumsy old wedge kind. The materials used in the manufacture of these articles appear to be of a superior quality, the machines not being adapted for operating on inferior patch leather. Another feature connected with these machines is that they are driven by one of Roper's hot-air engines, illustrated on page 97, Vol. VIII. (new series) of the *Scientific American*. It has been running for several months, requiring but little attention and consuming a very small quantity of fuel. The accurate operations of these machines and the rapidity of their action place them in a highly advantageous position for manufacturing boots and shoes. The price of hand labour had become so high, and workmen so scarce, that such machines became a necessity, and the change effected by their use is equal to four times the quantity of work executed by hand labour—that is, one hundred men will turn out with these machines as much work as four hundred men without them. The saving of labour to the country is therefore immense. About 500 pairs can be turned out daily in this establishment. Perhaps no labour connected with boot-making is so severe as that bestowed upon burnishing the heel with a warm iron. This work is still executed by hand, but a machine is now being set up to accomplish this finishing operation, and it will soon be at work. For centuries no improvement seems to have been made upon the old system of boot and shoe making; when, all at once, as it were—within the space of two short years—the whole art has been revolutionized.

SODA ASH.*

BY MURRAY THOMSON, M.D., F.R.S.E.

Soda Ash, or, as it is sometimes called in commerce, "Alkali," is a preparation of soda largely used by the paper maker, and his use of it has greatly increased since the scarcity of rags has compelled the introduction of new sources of fibre. The process by which an almost unlimited supply of soda ash can be produced we owe to the ingenuity of a Frenchman, M. Leblanc, who published his process about the end of last century. It was first practically applied at St. Denis in 1804. It was proved then to be an eminently successful process, and though it early commanded the esteem of our English manufacturers, yet it was not till the repeal of the salt duty that it was adopted in this country, and one of the first manufacturers to employ it was Muspratt of Liverpool.

Previous to the introduction of Leblanc's process, our only source of alkali was from the ash of seaweed, known under the name of *Barilla*, when it came from Spain, and *Kelp*, when it was made in the western islands of Scotland and in Ireland. Barilla or kelp, was at the best but a limited source, and Leblanc's process was, therefore, a great improvement, when it enabled us to obtain soda from such a plentiful substance as common or sea salt.

We deem it sufficient to indicate in outline only the different stages of Leblanc's process, as a full description of them would hardly prove interesting to our readers.

The first stage consists in converting the chloride of sodium, or common salt, into sulphate of soda, by heating it in a reverberating furnace along with oil of vitriol. Hydrochloric acid is given off during the process. This gas is not allowed to escape into the atmosphere as it once was, but is condensed in an arrangement known as the Coke Tower. The sulphate of soda, which is left in the furnace, is called *salt cake*.

The second stage consists in roasting the salt cake of the last operation along with a mixture of chalk and ground coal in a reverberating furnace until it is completely fused. Carbonic oxide gas is given off abundantly during the process. The fused mass on being withdrawn from the furnace, is now called *ball soda* or *black ash*.

* From *The Paper Trade Review*.

The third stage consists in dissolving out of this black ash the valuable soda salts. This is done by a most ingenious application of tepid water, by means of which a large amount of black ash is thoroughly exhausted of its soda salt by a comparatively small amount of water. What the water does not dissolve is known as soda waste. It consists mainly of oxysulphide of calcium.

The soda liquor or lie, which is thus obtained, is then evaporated to dryness, and once more calcined along with some sawdust or coal dust, the effect of which is to decompose any sulphide of sodium, and convert it into carbonate of soda. It undergoes another purification by being once more dissolved, vaporated, and calcined. The product of this last operation, on being ground under mill-stones, constitutes the soda ash of commerce. It may be regarded as a mixture composed in chief part of carbonate of soda, and in smaller quantity of caustic soda; but, besides these, it may contain such impurities as sulphide of sodium, hyposulphite, and sulphate of soda, particles of sawdust, &c.

If the relative quantities of carbonate of soda and caustic soda remained always the same, in every sample of soda ash, there would be no use for processes for valuing the article; but, as these frequently vary, there has long been in use a method of estimating the exact value of any sample of soda ash. These methods are applicable to pearl ash as well, and are known under the general name of alkalimetry.

An alkalimetrical method is based on the well established fact, that a certain known quantity of an acid, such as sulphuric acid, will always neutralize or combine with a fixed definite quantity of alkali, such as soda or potass; and it is easy to tell, by the use of a little colouring matter, such as litmus, when this neutralizing has been effected. The following details of the most approved method of ascertaining the amount of available alkali in any sample of soda ash, will best illustrate the subject of alkalimetry.

Some ordinary commercial oil of vitriol, which has usually the specific gravity of 1845, water being 1000, is diluted with eight times its bulk of distilled water—if distilled water be difficult to procure, clean rain water will answer. This diluted acid is now tested as to its strength, in the following way: A graduated glass measure, is filled to a point between the division 23 and 24. It is understood of course, that these numbers count from the zero or 0°. the measure is now filled to zero with pure water, covered with the hand, and inverted several times, so as to cause thorough mixture. The diluted acid in every division of the measure ought to neutralise or saturate one grain of pure or uncombined soda. To determine if this is really the case, 100 grains of carbonate of soda, is obtained by heating red hot for some time the common bicarbonate of soda, the heating converts it into carbonate of soda, and 100 grains of this is now dissolved in 3 or 4 fluid ounces of water in a Florence flask, and when the solution has been effected it is filtered if necessary. The filtered solution is now coloured with some infusion of litmus and heated to near boiling. The acid contents of the measure are now added little by little, each addition is followed by brisk effervescence and a partial reddening of the litmus colour, but on again applying heat, so as to boil the solution, this reddening is changed back again to blue, and so with each addition of the acid, until 58·5 measures have been added, when a reddening is produced which boiling fails to restore to blue. This indicates that the soda of the 100 grains of heated bicarbonate is neutralised or saturated. If the 58·5 measures of acid has exactly neutralised the 100 grains of pure carbonate of soda, then the remainder of the diluted oil of vitriol may be put in a stoppered bottle, and kept as a store of standard acid, to be used for testing in the above way any sample of soda ash. If, however, the diluted acid should be so strong that 50 measures of it effected saturation of the above amount of carbonate of soda, then it is clear that these 50 measures should have occupied the bulk of 58·5. A change in accordance with that can easily be effected by adding to every 50 measures of the acid in the measure, 8·5 of pure water, or to every 100 of the acid 17 measures of water. If, on the other hand, more than 58·5 measures of diluted acid be required, this indicates that the standard acid is too weak to bring up its strength, there is no more convenient method than to add of vitriol drop by drop, to the quantity of acid first diluted, and subsequently trying it with fresh carbonate of soda.

With ordinary discrimination, one or two such trials is usually sufficient to restore the acid to its proper strength. When this has been done, the whole of the diluted acid should now be put aside as before, with a label attached, to the effect that the alkalimeter, or graduated measure, when filled to 23·5 with this acid, and then to 0° with water, every division of the alkalimeter is equal to one grain of caustic or pure soda. Enough of this standard acid should now be made to serve for a great number of valuations.

The actual process of valuing any sample of soda ash is now proceeded with in the same way as the 100 grains of carbonate of soda was treated in the foregoing description. The only difference being, that the inference to be drawn in this case is not the strength of the acid from the saturation of the pure carbonate of soda, but the converse; the strength of the sample of soda ash, or real amount of soda it contains, is to be inferred from the amount of acid used to neutralise it, each measure being equal to one grain of pure soda.

LARGE DRIVING WHEELS FOR LOCOMOTIVES.

Few things have been more over-estimated than the importance of high driving wheels for express engines. We may, perhaps, trace back the origin of the idea to Brunel, who designed and caused to be built more than one locomotive with 10 ft. driving wheels, and but 175 square feet of heating surface, or thereabouts. Need we say that these engines were total failures. What between their small power of making steam, and the size and weight of their wheels, they were almost unmanageable, and brought large drivers into disgrace for a time. The very infancy of the railway system, however was distinguished by an intense desire on the part of most engineers for the attainment of speeds, which we, even with our superior facilities for construction, regard as excessive. The principles governing the action of steam were not understood then as well as now; and from fancied difficulties connected with its passage to and from the cylinders, a slow reciprocation of the piston was deemed worth having at any sacrifice. Larger and larger wheels were therefore adopted as soon as the reaction succeeding Brunel's failure had set in, and some years since we arrived at the very general employment of an 8-ft. wheel for express engines. High wheels were early adopted by American builders. In 1849, several engines were placed on the New York and Erie Railroad, with two pairs of 7-ft. drivers; the cylinders, 14 in. diameter, having the enormous stroke of 32 in. Eight-feet drivers are still used on the Camden and Amboy Railway; strangely enough, with good engines. In France, Gouin and Co. built an engine, "l'Aigle" in 1854, with drivers 9 ft. 4 in. in diameter, with outside level cylinders 16½ in. in diameter, and 31½ in. stroke. Several engines with 8-ft. wheels may be met with on many of the French lines. Neither here nor elsewhere, however do these great diameters gain in favour, except for exceptional locomotives of great size; and the engines which prove their superior efficiency by doing most work, seldom have drivers much over 6ft. in diameter. Our friends at the other side of the Atlantic have been so thoroughly convinced, by practical experience, that the adoption of a large wheel is not only unnecessary, but positively injudicious, that the practice of "cropping drivers was at one time almost universal; engines with 7-ft. and 8-ft. drivers having these removed, and replaced by wheels a foot or two less, with manifest advantage.

The size of driver has really very little connection with the speed of an engine. There is no good reason whatever that a pair of pistons should not do their work as well, when moving at 1,100 ft. per minute as at half that speed. It is merely a question of wear and tear; and railway statistics prove that piston speed exercises little if any influence on expenses incurred for repairs. Indeed, it is not easy to see how it can. Some years ago, when locomotive construction was not so well understood as it is now, very considerable difficulty was experienced in keeping pistons fast on their rods. They worked loose continually, and every now and then smashed through a cylinder cover. But this occurred with the pistons of all sorts of locomotives, both slow and fast. Improved methods of valve setting, by providing a moderate amount of compression, quickly obviated the evil, and even had it not done so, we now understand how to forge the piston and rod in one piece, so as to render such a catastrophe impossible. We have ere now pointed out, that the pressure on the piston is no measure whatever of the strain on the crank pin especially in quick-working engines. The proper combination of the expansion of the steam with the momentum of the reciprocating parts, enables us to equalize these strains, reducing the danger of fracture to a minimum. The engine, indeed, if properly balanced, may, from this reason alone, run with less danger of accident at a high speed than at a low one, provided the principle of expansion is properly carried out.

Engines, with high drivers, are notoriously bad at a dead pull. It is urged, indeed, that under any practicable load which we can place on a single pair of drivers, a 17½ in. piston acting on a 12-inch crank, with 120 lbs. steam, will cause them to slip so long as they are under 10 ft. in diameter. We much doubt the truth of the assertion however, provided the rails are clean; and the engineers of express engines know but too well, what it is to struggle up an incline with a slightly abnormal load. The actual tractive power of an engine, with 4 ft. drivers is, *cœteris paribus*, just double that of one with wheels twice the diameter, and the former, will—speeds being the same—develop just half the horse-power of the latter per mile. It is a necessity, in fact, with the engine with high drivers, that it must run at speed to develop power with heavy loads; high wheels preclude speed; hence we find that express trains seldom weigh over 50 or 60 tons. Were smaller drivers employed, the same speeds could be obtained, while inclines, or an extra carriage or two, would present none of the difficulties which they do now.

It is quite possible to overcome this want of tractive force by adopting large cylinders. We question, however, that a recourse to this expedient is advisable. Engineers are well aware that the dimensions of the cylinders are generally a measure of the size of the engine. Although they do not necessarily entail an increase in the capacity of the boiler, still large cylinders require stronger framing, larger valves and heavier connecting rods, &c., than those of smaller diameter. These matters quickly swell the proportions of an engine to something very considerable; and we may, in consequence, determine without much hesitation, that weight in an efficient express locomotive is in direct proportion to the dimensions of the driving wheels. Now it does not require a very profound knowledge of railway matters to demonstrate that small engines are invariably more efficient, proportionally than large ones; and permanent way complains sadly of the usage which it meets with from engines with 12 tons on a single pair of driving wheels.

Speed really depends on boiler power, and the rapid reciprocation of the pistons is no real evil. Theoretically objectionable, practice proves, in the clearest manner, that working expenses are not increased by it to any appreciable extent. Immense driving wheels no longer enjoy the popularity they once did; and we much doubt that any engines are now being built with them. Indicator diagrams taken from an express engine, with 7 ft. 2 in. drivers at a speed of 63 miles per hour, are almost identical with those taken from a nearly similar engine, with drivers a foot higher, at sixty miles per hour. The indicator is after all, the real test of the good qualities of a locomotive as far as the action of steam is concerned; and we regard such a result as pretty conclusive evidence that nothing is to be gained by the use of a wheel much over 6 ft. in diameter. A rapid reciprocation of the pistons permits the use of a large blast-pipe, as the blast in the chimney is equalized, and rendered more effective, while it does not cut up the fire so much as an exhaust at comparatively distant intervals. Regard the matter as we may, we believe that there is no difficulty in proving that the most efficient engines ever built have had driving wheels of moderate diameter; and railway companies will find it good policy to return to their use.—*Mechanics' Magazine.*

Miscellaneous.

THE WONDERFUL PROPERTIES OF FIGURES.

Curious Calculations.

Though figures constitute a universal language among the civilized nations of the earth, and maintain such an exalted character for honesty and truth that it has passed into a proverb that "figures never lie;" yet they are treated as the mere slaves of calculation, without any regard for that respect and consideration to which their peculiar qualities entitle them. To rescue them from the degradation of being looked upon as mere convenience, let us see if they are not possessed of certain intrinsic properties which shall excite our wonder and admiration.

"A million of dollars," which we hear expressed on every side, wherever the cost of this "cruel war" is under discussion. Let us make a very simple mental calculation, and see if we are not astonished at the result. Mr. Longworth, who recently died at Cincinnati, was said to be worth fifteen millions of dollars, How many days would it take to count that sum at the rate of fifty dollars a minute, working steadily ten hours each day? While some are guessing four or five days, another a week, another two weeks or a month, the operation may be carried on mentally by saying fifteen millions between guessing and thinking.

The powers of human understanding are limited. The increase of figures has no limits. Our knowledge of numbers, therefore, must necessarily be limited. But like every other subject, the more we study and think about it the more we shall know.

The child who has learned to count as far as three, has an idea of that number; but the number thirteen is quite beyond his comprehension. The savage gets along very well with his arithmetic so long as he is not required to go beyond the numeration of his fingers and toes; but any greater number quite bewilders his imagination, and, in despair, he refers to the hairs of the head, the leaves of the forest, or the sands on the sea-shore, to express his overwhelming sense of its magnitude. Every young student of history has laughed at the extreme simplicity and ignorance of the Indian whom Powhattan sent to England to see the country and find out how many people where there. As soon as the shores of England were reached, the "poor Indian" procured a long stick and commenced to cut a notch on it for every one he saw. Of course he was soon obliged to stop.

On his return, Powhattan, among many questions, asked how many people he had seen? "Count the stars in the sky," was the reply, "the leaves on the trees, or the sands on the shore, for such is the number of the English." Perhaps this untutored child of the forest was not so far astray after all; for the stars in both hemispheres visible to the naked eye do not exceed the number of ten thousand. The hairs of the head and the leaves of the trees may be easily counted, and the sands on the sea-shore are by no means innumerable.

The enlightened man may have a clear understanding of thousands, and even millions, but much beyond that he can form no distinct idea. A simple example, and one easily solved, will illustrate the observation. If all the vast bodies of water that cover nearly three fourths of the whole surface of the globe were emptied, drop by drop, into one grand reservoir, the whole number of drops could be written by the two words "eighteen septillions," and expressed in figures by annexing twenty-four cyphers to the number 18. (18,000,000,000,000,000,000,000,000.) Man might as well attempt to explore the bounds of eternity as to form any rational idea of the units embodied in the expression above; for although the aggregate of drops is indicated by figures in the space of only one inch and a half of ordinary print, yet if each particular drop were noted by a separate stroke like the figure 1, it would form a line of marks sufficiently long to wind round the sun six thousand billions of times!

Now observe, if you please, the marvellous power or value which the cyphers or "naughts"—insignificant by themselves—give to the significant figures 18. The young reader will be surprised to learn that the use of the cypher to determine the value of any particular figure, which is now practised by every school-boy, was unknown to the ancients. Therefore, among the Greek and Romans, and other nations of antiquity, arithmetical operations were exceedingly tedious and difficult. They had to reckon with little pebbles, shells, or beads, used as counters, to transact the ordinary business of life. Even the great Cicero, in his oration for Roscius, the actor, in order to express 300,000, had to make use of the very awkward and cumbrous notations (cccɪↄↄↄ cccɪↄↄↄ cccɪↄↄↄ), which may admit of the very liberal translation: Three c's one ɪ, three inverted c's; three c's, one ɪ, three c's inverted; three c's one ɪ, three c's upside down. How very odd this looks in the year of our Lord MDCCCLXIII—1863!

Many very curious and interesting things might be said concerning the history of numerical characters used in ancient and modern times; but, not to prolong this article, they must be reserved for some future occasion.

The simple interest of *one cent*, at 6 per cent. per annum, from the commencement of the Christian era to the close of the present year 1863, would be but the trifling sum of 11 dollars, 17 cents, and 8 mills, but if the same principal, at the same rate and time, had been allowed to accumulate at compound interest, it would require the enormous number of 84,840 billions of globes of solid gold, each equal to the earth in magnitude, to pay the interest; and if the sum were equally divided among the inhabitants of the earth, now estimated to be one thousand millions, every man, woman and child would receive 84,840 golden worlds for an inheritance. Were all these globes placed side by side in a direct line, it would take lightning itself, that can girdle the earth in the wink of an eye, 73,000 years to travel from end to end. And, if a Parrott gun were discharged at one extremity while a man was stationed at the other—light travelling 192,000 miles in a second; the initial velocity of a cannon ball being about 1,500 feet per second, and in this case supposed to continue at the same rate; and sound moving through the atmosphere 1,120 feet in a second—he would see the flash after waiting 110,000 years; the ball would reach him in 74 billions of years; but he would not hear the report till the end of one thousand million of centuries. Again, if all these masses of gold were fused into one prodigious ball, having the sun for its centre, it would reach out into space in all directions, one thousand seven hundred and thirty-two millions of miles, almost reaching the orbit of Herschel or Uranus; and, if the interest were continued till the end of the present century, it would entirely fill up the solar system, and even encroach five hundred millions of miles on the domains of the void beyond the planet of Neptune, whose orbit, at the distance of two thousand eight hundred and fifty million of miles from the sun, encircles our whole system of worlds.

The present system of figures is called the Arabic method, but it should be more properly termed the Indian method, because it had its origin among the Hindoos of India, from whom the Arabs learned it; and they, in turn, carried the art into Spain, where they practised it during their long occupation of that country.

The publication of their astronomical tables in the form of almanacs was the principal means of gradually spreading it abroad among the surrounding nations; but so slow was the progress that it was not generally established until about the middle of the sixteenth century.—*N. Y. E. Post.*

Ventilation.

The best specimen of ventilation on a large scale is perhaps in the Houses of Parliament, under the direction of Sir Goldsworthy Gurney, and is partly effected downwards through the floor of the Houses of both Lords and Commons, and partly upwards above the roof. The floors are of cast-iron, full of holes, like a honey-comb, and covered with a hair-cloth, or porous carpet, so that the air can pass freely through it. Below the floor there is a special air-shaft reaching to the carpet about 10 by 20 feet, through which the foul air is extracted; this descending shaft extends all the way from the floor of the Houses down to the extracting air-courses communicating with the Clock and Victoria Towers.

A square shaft in each of the towers is now made an upcast, by means of a coke fire burning at the bottom; so that the vitiated air is thus carried away.

Through the other portion of the floor, not connected with the ventilating shaft, fresh air is supplied, and this balance of interchange is so nicely contrived that the effect is perfectly imperceptible.

The Houses, during ventilation, are kept at a uniform temperature of about 64°. In cold weather the air is warmed by passing over hot water pipes, and in very hot weather the air is cooled by passing over blocks of ice before its entrance into the House.

The external air, both on the terrace next the river, in the courts, and the roof, is in a balance with the air of the House,—" a feather balance;" a feather suspended moves in the House neither up nor down, nor will smoke (introduced by way of experiment) after it becomes of the same temperature as the air of the House itself.

It is evident that rooms intended to hold a large assembly of persons might be ventilated in a similar manner, and even the apartments of houses might be similarly dealt with, by having a square perforated opening in some part of the room communicating with a downcast shaft terminating in the kitchen chimney. The kitchen fire in this case would create a sufficient draught for carrying away the vitiated air of the apartment; or the downcast shaft in this case might be made in such a manner that the foul air from the apartment above would be made to pass through the kitchen fire. The opening in the upper room could be easily concealed by a suitable piece of furniture. For admitting fresh air into the apartment, another grated opening would be required in the floor, which could be concealed like the former one. There ought also to be perforations in the cornice of the apartment for carrying off the ascending heated air; for in an apartment containing a number of persons, the lower stratum of air is of a greater specific gravity than the air above, consequently the lower portion is drawn off by the downcast ventilating shaft, whilst the upper portion passes off as already explained. To ventilate rooms in this manner would not be difficult if the ventilating passages were contrived during the erection of a building; and in many mansions already built it would be desirable that such a mode of ventilation should be adopted. Many churches containing large congregations, and public assemblies, are so badly supplied with a change of air, that the air, especially in the galleries, is almost insupportable, and, consequently, detrimental to health. Some of our theatres are, likewise, labouring under a similar inconvenience. Every person who has been in a crowded theatre must have experienced the relief which is afforded by a supply of air when the curtain or drop is drawn up. The chandelier, it is true carries off a large quantity of heated air, but the heavier stratum below is not so easily removed.

The Royal Italian Opera, Covent Garden, appears to be the best ventilated theatre in London, care having been taken to give sufficiency of space, and to provide for the egress and ingress of air.

The ventilation of small dwellings might be effected by inserting perforated zinc plates in the skirting board of the several rooms, by which the air could be admitted from the hall or passages, which plates might be painted uniformly with the skirting board of the room, whilst similar perforated plates, or ventilating holes, should be placed in the upper part of the room to carry off the deteriorated air, and there might also be placed a ventilator of a similar kind in the chimney shaft above the fireplace. All such openings may be easily concealed in building a house; but our builders, nay even our architects, seem entirely to consider ventilation a matter of no moment whatsoever. Witness, for instance, the Houses of Parliament, the ventilation of which was an afterthought carried out at an enormous expense.—*Sanitary Reporter.*

Rowland's Soap.

This is soap mixed with some liquid hydrocarbon, as turpentine, coal tar, naphtha, camphine, &c., whereby the detergence of the soap is said to be greatly increased. It is prepared by dissolving 3lbs. of soap in 1lb. of water with the aid of heat; adding to another pound of water 2 oz. of farina, flour, dextrin, starch, oatmeal, or other analogous substance, mixing and boiling to the consistence of a paste, adding this paste to the dissolved soap, and stirring till a perfect incorporation of the materials is effected; or the whole of the water may be mixed with the flour, and converted into a pasty soap by boiling, and the soap may be dissolved therein instead of being melted separately. The mixture when well incorporated is to be removed from the fire and stirred till it has cooled to about 140° F., when 8 oz. of turpentine, mineral naphtha, camphine, benzol, or some other equivalent substance must be added, together with a saturated solution of carbonate of ammonia. The whole must then be again well stirred, and the mixture run off into suitable vessels, closed air-tight. About half an ounce of the liquor ammoniæ of the London Pharmacopæia may be added to every four ounces of the saturated solution of the carbonate. In place of the dextrin, flour and other farinaceous substances above mentioned, an equivalent quantity of gelatine, glue, or other mucilaginous or gelatinous substance may sometimes be used. For making a detergent composition for common use, common mineral or coal tar naphtha, or turpentine, may be the hydrocarbon used, and a larger quantity of caustic ammonia may then be advantageously added; but, for a detergent preparation for toilet purposes, or for washing or cleansing body linen, it is preferable to use the best rectified camphine, or some analogous material of more agreeable odour. The carbonate of ammonia may also be added to the pasty saponaceous mixture in the dry pulverised state, in the proportion of a quarter of an ounce to every pound of soap. When it is to be used for washing linen, about four ounces of the mixture should be added to about twelve gallons of water, and stirred till quite dissolved. The clothes may be put in and stirred with a stick, after which they may be boiled for a few minutes and then rinsed in fresh warm water.—*Chemical Technology*, by Richardson and Watts.

The Bathoreometre.

M. J. Giordano has described to the French Academy of Sciences an instrument, called by him a *bathoreometre* (depending, as to principle, on the closing of an electrical circuit by means of a substance interposed between the electrodes), whereby he is able to determine, with great exactitude, the thickness of very thin substances. A single thread of the silkworm was found to have a thickness of C 014 of a millimetre; that of a spider (such as is used to divide the field of the telescopes), 0·037 mm. Hair from an infant's head is 0 009 mm., that of an adult averages 0 047 mm., in thickness. French gold-leaf has a thickness of 0·009 mm. A film of mica was obtained so wonderfully thin as 0·003 of a millimetre, or about twelve-millionths of an inch.

The Tobacco Question.

The London *Athenæum* thus puts out the pipe of a clergyman who has written a love story entitled "What Put my Pipe Out?" and in it gives eight reasons for the disuse of tobacco:—"Unless we are mistaken his eight reasons (we may remark, by the by, that six is the right number of reasons to go to the enlightened public with) will not leave much weight with those who love the gentle weed. Let us put them before our readers, editing each with a brief note: '1. It is a practice borrowed from savages' So also are other usages, such as personal decoration, and the habit of distinguishing men of rank by clothing them with authority—usages not branded as odious because of their origin. '2 It is a practice which generally begin with us in youth, when the reason is not matured.' At the same period men begin to indulge in manly sports, strengthening themselves in the habit of speaking the truth, and mark out for themselves careers of noble enterprise. The fact that the habit began in youth can scarcely be accepted as proof that a man's habitual industry is injurious to him. '3. It is an offence against the natural instincts of society, especially against ladies, who have not been vitiated by its use. The natural instincts of society surely cannot be offended by a usage 'borrowed from savages, living in that degree of civilization which borders most closely on what is vaguely termed 'a state of nature;' moreover, what right has the non-smoker to assume that ladies who do not object to smoking are vitiate? '4. Disinterested medical men say it is productive of many physical and mental diseases.' On the other hand, disinterested medical men say that moderate indulgence in tobacco is either harmless or beneficial. '5. The growth of it uses up valuable land for its cultivation which might be better employed for corn.' Might it be better employed? The author settles the question by assumption, not proof. Teetotallers offer a similar objection to the culture of the vine, and vegetarians in the same way denounce the system which allots so much of the earth's surface to graziers. '6. Our natural tastes, which are usually good judges in such cases, reject it at first, until overcome by habit.' Until it has been educated to enjoy them, the pallate rejects the most exquisite as well as nutritious dishes. '7. Many philanthropists say smoking leads to drinking.' On the other side, many philanthropists know the reverse. Smoking has become more and more fashionable in English society just in proportion as deep drinking has fallen into disfavor. '8. Tobacco costs money.' Dogmatic treatises against a usage countenanced by a large number of the wisest and best of our race, cost their readers time and temper, as well as money.

Lighting Cities.

An ingenious Frenchman has discovered a most economical way of lighting cities, and proposes to apply it to Paris. Balloons, from the cars of which are to emanate an electric light, are to be fixed at certain stations, and hover over the city, at the proportion of one balloon to 80,000 persons; the city would be lighter at night than it often is in winter by day.

Flax Cotton.

A flax cotton mill is fitted up at East Toledo, Ohio, which is expected to consume 4,000 pounds daily of raw material, and produce 2,000 pounds of cottonized flax. Eastern satinet manufacturers have agreed to take it all.

Trial of Armor Plates, Steel Guns, &c., at St. Petersburgh.

Further trials at St. Petersburgh with the experimental 19-inch rifled cast-steel gun. The London *Times* states that this gun is of solid cast-steel, made by Krupp, and throws a 300-pound shell or a 450-pound solid shot. The results of previous experiments with this gun led the Russian Government to order 50 of them, which are now in course of delivery. The principal objects of the experiments on the 7th inst. were to ascertain the best description of shell, and to test the quality of armor plates supplied by Messrs. John Brown & Co., of Sheffield.

First a series of cast-iron shells, 300 pounds each were fired at different ranges, and then shells made by Krupp were fired at the 4½ inch armor plates.

The first shell was 22½ inches long (two and a half diameters), with a flat end 4 inches in diameter. Fired with 50 pounds of powder at 700 feet distance, it passed through the plate, oak and teak backing, and broke into many pieces, although filled with sand only. The second and third shells were also of Krupp's steel, the same length but with 6½ inch ends. These shells pierced plates, wood &c, and also went to pieces, although only filled with sand. The fourth shell was made by M. Poteleff of puddled steel, on Aboukoff's system, the same dimensions as the second and third, and went through iron, teak, &c., but was only bulged up from 8 inches to 12 inches and the end flattened; not a single crack being visible in the shell. The fifth the same as the fourth, passed through iron, teak and the second target, and went at least a mile beyond. The sixth and seventh were from Krupp, and were charged with powder; they were quite flat-ended, 9 inches in diameter. One exploded in the plate the other in the wood. The eighth and ninth shells were of cast iron, and, although they passed through the plates, were of course destroyed. Evening prevented further trials, which will yet be made on the same plate.

The results on the plate were highly satisfactory. In a space of 4 feet 6 inches, eight holes were made without any crack of the slightest description; and the marine officers present were highly satisfied, because they are obtaining 4,000 tons of plates from Messrs. John Brown & Co. for their different ships.

Cast-steel guns are decidedly before any yet produced in England of any other metal. The 9-inch gun of Krupp has been fired with 300-pound shells and 50 pounds of powder, about 70 times, without any flaw; and the Russian Government will shortly be in a position to obtain in St. Petersburgh a a large supply of cast-steel guns, made from Russian iron, by Russians, on Aboukoff's system, which is very nearly the same as Krupp's—*London Engineer.*

To Prevent the Transmission of Sound through A Plate glass Partition.

Have two plates with an air-space betwixt. An ordinary window may be glazed with double "sheets" or "squares" of glass; and if an air-space of a quarter of an inch is left betwixt each sheet or square of glass, sound will be deadened and heat be retained. Mr. Bridges Adams has proposed double-windows, as described; that is ordinary window sashes, with double glass, having one eighth of an inch or one quarter of an inch air-space betwixt each square of glass. Ordinary windows in offices or street-fronts will be warmer, and deaden the sound, if they be so glazed.

Lake Superior Copper Workings.

A paper by Charles Whittlesey, Esq., on Ancient Mining on the shores of Lake Superior, 'has been published in the Smithsonian contributions to knowledge. The author has devoted much attention to this subject, and maps of the country, with engravings of old mines and the relics found in them, are contained in this publication. We here learn that evidences of ancient mining operations were first brought to public notice in the winter of 1847-8. The Jesuit Fathers who first visited that region announced the presence of native copper in large masses; and boulders of copper had been found many years scattered among the drift gravel from Lake Superior to Rocky river, in Ohio; but no ancient workings were known till the period mentioned above. In casting the eye over a map of Lake Superior, a remarkable projection, in the form of an immense horn, is observed jutting out from the south shore and curving eastward. This is Keweenaw Point, which is about eighty miles in length and forty in width. Through the whole of this extent of projection, a belt of metalliferous formation extends; and within this all the copper mining operations — ancient and modern—have been confined. The most remarkable feature of this metalliferous region is the character of its products, which occur, not as an ore of copper, but in masses, veins, and rounded nodules of the metal itself.

The first actual mining operations here were commenced in 1761 by Alexander Henry, but they proved abortive. In 1841, Dr. Houghton made a report to the Legislature of Michigan, conveying very definite information respecting the existence of native copper in Lake Superior, and shortly after this fresh mining operations were commenced, and speculators flocked in from all quarters. In 1848, Mr. S. O. Knapp, Agent of the Minnesota mine, made the first public announcement respecting the discovery of ancient mines and the relics of an ancient mining population. This created a sensation far and near, and subsequent explorations have led to the discovery of very many ancient pits. Most of the ancient diggings have been found in dense forests, and outwardly consist of irregular shallow hollows, which had been previously noticed without thought of their real character. There are three groups of ancient mines corresponding with the modern mines in this region. In these old pits, hard stone mauls and hammers have been discovered; also copper hammers, spear heads, gads, arrow heads and knives; and wooden shovels, levers, and a ladder. During the past summer, several of these old mines were discovered in the Onianagon district, and from one a bag of untanned leather in a perfect state of preservation was taken, and has been considered one of the greatest of ancient curiosities. Who those olden miners were, is a puzzle to antiquarians. But providentially they have done great service to us for our practical modern copper miners regard the old pits as pretty sure guides to valuable copper lodes. When an old pit is found it is cleared out and explored, and generally the miners are rewarded by finding rich masses in the excavation. Those ancient miners seem to have possessed quite as accurate a knowledge of the copper veins as the most skilful and intelligent modern mineralogists and miners. In a certain sense they were our mining pioneers. They do not seem to have been acquainted with the art of smelting copper, and were unacquainted with the use of iron; therefore their efforts at mining were rude; still they have left evidences of being an ingenious and skillful people. Mr. Whittlesey entertains the opinion that these ancient miners were not of the present Indian race. As yet no remains of cities, no graves, no domiciles or ancient highways have been found in the copper region. These old miners appear to have been further advanced in civilization than those whom we call Aborigines. Trees standing upon the old pits are three hundred years old, and beneath these lie the rotten trunks of a earlier period. When the ancient miners lived is unknown, but these mines must have been abandoned at least from five to six hundred years preceding the present age. Who they were, where they came from, and whither they went, in all likelihood will never be known.

British Liberty.

Governor Seymour, of New York, made a great speech at Syracuse the other day. In the course of an argument upon the tyrannical encroachments of the Federal Government he made the following handsome acknowledgment of the true spirit of liberty that exists under British institutions:—"The proudest Government that exists upon the face of the earth is that of Great Britain, and its proudest statesman, when he would tell of Britain's crowning glory, did not speak of its wide-spread dominions, upon which the sun never sets; did not say, as he might have done, that the beat of its morning drum made a continuous strain of music round the world. He did not speak of martial achievements, of glorious battle-fields, and of splendid naval conflicts; but he said, with swelling breast and kindling eye, that the poorest man of Great Britain in his cottage might bid defiance to all the forces of the crown. It might be frail, its roof might shake, the wind might blow through it, the storm might enter, the rain might enter; but the King of England could not enter it. All his powers did not dare to cross the threshold of that ruined tenement. (Great cheering.)"

Preservation of Grapes and other Fruits.

BY M. LE DOCTEUR RAUCH.

Various means, more or less successful have been suggested for preserving grapes,—a fruit most delicious and wholesome, but very difficult to keep.

One of the simplest ways is to dip the ends—the stalks of the bunches—in sealing-wax, and to suspend them from poles or cords in a cellar or cool room, where they will not be exposed to frost. By carefully removing any berries that may decay, grapes in this way may be preserved till the end of December. They generally preserve their freshness longer in a cellar than in a room, where the air is dryer; and this applies to nearly all other fruit. For this reason plums may be preserved for months in vessels filled with sand, hermetically sealed, and buried in the ground; exclusion of the air having the same effect in each case.

In the south of Russia there is another way of preserving grapes. They are gathered before they are quite ripe, put into large pots, and so filled with millet that each fruit is separate, and the pots are covered so as to render them air-tight. They are sent in this way to the markets of St. Petersburg. After remaining thus for a whole year, they are still very sweet, all their sugar being developed by the ripening process in the pots.

Recent experiments show that cotton possesses the useful property of preserving various substances. Meat-broth in a bottle, lightly closed with cotton, has been found to keep unaltered for more than a year. After this it was a natural course to try its preservative effect on various other substances, and in America cotton has long been successfully used for preserving grapes in the following manner:—

The branches are left on the vine-stalk as long as possible, even to the early frosts, provided they are but slight. The bunches are then cut with a sharp knife, all the damaged fruit removed with scissors, and then left for several days in a cool room. They are then put between layers of ordinary cotton, handling them very carefully, and placed in vessels such as tin boxes, or glass preserve pots, taking care not to put too many layers, so as to crush the lowermost. The receptacles are then carefully covered and sealed. The latter precaution is certainly of use, though American farmers generally discharge it, and nevertheless have good grapes often as late as April. The fruit is kept in a cool place, but out of the reach of frosts.

Apples and pears are still more easily preserved in cotton, though it retards their ripening, which wool, on the contrary, accelerates. American farmers therefore, a few days before they wish to eat the fruit, wrap it in wool, when it ought to take a beautiful golden colour; and pears ripened in this way are sold for almost double the price of those still a little unripe.

The most recent method was invented by a Frenchman, M. Charmeux, whose grapes, exhibited at several exhibitions, excited considerable attention. His method I have tried, and found it succeed very well. He attaches great importance to the maintenance of a certain degree of humidity. His directions are as follows:—

Leave the fruit on the vine as long as the season allows, cut off the bunches so as to leave a piece of the branch adhering to the stalk, comprising about two nodules above and three or four below. Carefully cement the upper end of the branch, and place the lower end in a phial filled with water, containing a little powdered charcoal, to prevent decomposition. Close the phial with wax, place the grapes in straw or cotton, in a cool room, but screened from frost. It might be better to hang them up, which could easily be done if the phials are well sealed. In this way, and by occasionally picking out any decayed grapes, I succeeded in preserving from the autumn of 1859 to the beginning of April, 1860, and then I found the fruit excellent. They might, no doubt, be kept longer in a cellar, or in some place where the temperature is constantly at the same low degree, and darkness would probably be favourable to their preservation.—*Moniteur Scientifique*, v., 74.

Canadian Timber and the Great Exhibition.

From "Lloyd's Register of British and Foreign Shipping" for 1863 and 1864, just laid before us, we find that several important Canadian woods for ship-building have been added to their lists, and others have been raised to a higher standard than they have hitherto occupied, as compared with woods from other countries. These important results have been brought about by the admirable display of Canadian woods at the late International Exhibition. In the jurors' report it is stated that "at no previous exhibition in this or any other country has so splendid and valuable a display of the products of the forests and plantations been exhibited, not only when we consider the magnitude of the various collections sent from almost every country, but also in regard to the admirable care shown in the preparation of the specimens."

Science and commercial enterprise have indeed gone hand in hand, so much so that the jurors further add that "in point of size of specimens, excellent selection, and information given, the Upper Canada collection of woods is undoubtedly the finest in the exhibition building." The Lower Canada collection also received high praise, but was stated to be "small compared with the Upper Canada." The Canadian black walnut, hickory, black birch, white and red cedar, are added to the list of timbers for vessels classed A. Black elm, hickory, white oak, beech, chesnut, red cedar, tamarac, and birch pine are allowed the highest place for the outside planking from the keel to the first buttock heads in ships of twelve years in class A. Table A of the register will show the important uses made of Canadian timbers in every part of the ship, inside and out, and which secure the highest standard in their registration.

We are glad to perceive also that an increased demand has arisen on the continent for Canadian timbers. Anything that will give additional value to the woods of the vast Canadian forests must be of the greatest importance to that country, where now so many of their magnificent trees are cut down and burned as fuel. Of course, the first object of the settler is to clear and prepare his land for agricultural purposes, but in doing this, those trees which have a sufficient commercial value might be preserved, and this could be done by arrangement with the Bureau of Agriculture without much difficulty. The Canadian forests are rapidly yielding to the woodman's axe, and when too late, it may be found that not only have valuable timbers over extensive areas been ruthlessly destroyed, but even the climate unfavourably effected, as is unquestionably the case with some countries of this hemisphere, in the deficiency of rain during the agricultural months. If, however, Canada should in other ways have been benefited by the International Exhibition, she will be abundantly rewarded by the increased demand for her valuable woods.

Dr. Hurlburt, the Commissioner who had charge of the woods exhibited in the Canadian department of the last Exhibition, has nobly exerted himself in bringing under the notice of the proper authorities the valuable advantages possessed by these woods, and to his labours we may, we believe, attribute the high opinion the committee of Lloyd's now entertain of them for shipbuilding purposes. Dr. Hurlburt has well earned the thanks of all Canadians for his perseverance in attaching public attention in this country to one of the most valuable products of the Province.—*London Canadian News, October 22nd.*

The United States Crops of 1863.

The answers returned to the circulars for September, of the Agricultural Department, asking information of the condition of the crops, are given in tenths, above or below the crop of 1862. During the summer the department made an estimate of the amount of the crops of 1862. This estimate was based on the census returns of 1860. As the crop of 1859, which was taken by the census, was below the average, and that of 1862 much above, allowance was made for this difference, varying in its amount according as the agriculture of each State required. The general per cent. increase of each State was added. One-fourth of the amount given in the census was struck off from the returns for Missouri and Kentucky on account of the war. Thus calculated, the crops of 1862 were made the basis for estimating those of 1863, according to the tenths, increase or decrease of each State, as reported by the correspondents of the department.

The summer crops, wheat, rye, barley, and oats, for 1862 and 1863, were as follows:—

	Wheat.	Rye.	Barley.	Oats.
Total 1863...bush.	191,068,239	20,798,287	16.769.597	174,858,167
Total 1862... "	189,993,500	21,254,956	17,781,464	172,520,997
	*1,074.739	†456,669	*1.020,867	†2,327,170

The fall crops of corn, buckwheat, and potatoes, for 1862 and 1863, were as follows:—

	Corn.	Buckwh't.	Potatoes.
Total 1862....................bush.	586,704.474	17.822.995	113,533,118
Total 1863 .... "	449,163,894	17,193,233	97.870,035
Decrease	137,540,580	1,629,762	15,663,083

The monthly report of the department for September shows that the amount of wheat and flour exported to all countries for the year ending September 1, 1863, is 40,686,308 bushels, and of corn 11,680,343 bushels. The domestic consumption, then, is as follows:

	Bushels.		Bushels.
Wh't crop for 1862...	189,993,500	Corn crop for 1862.	586,704,474
Exported..............	40,686,308	Exported..............	11,680,342
Domestic consu'n.	149,307,192	Domestic consu'n.	575,024,132

These exports and domestic consumption exhibit the relative magnitude of the foreign and domestic markets.

The report examines the probable foreign demand for breadstuffs during 1864, and shows that the principal portion of our exports of breadstuffs are purchased in the English markets; that the average annual importations of all grains with Great Britain and Ireland are 94,278,949 American bushels; but in 1860 the importation was 135,386,434 bushels, and in 1861, 142,529,106 bushels; that it was as great a crop in 1862, but not so large in 1863; that from the present condition of the crops in England, the demand for 1864 would return to the general average, rather than to the great amount since 1860;

* Increase. † Decrease.

that the home demand for 1864 would be at least equal to that for 1863, and that the condition of the currency would remain as favorable as it now is; that hence the amounts of wheat and corn for 1864 would be as follows:

	Bushels.		Bushels.
Wheat crop for '63...	194,068,239	Corn crop for 1863...	449,163,894
Domestic consum'n.	149,307,192	Domestic consum'n.	575,024,132
Leaving for exp,t.	41,761,047	Leaving a defi'y of	125,860,238

—which must be provided for by greater economy in feeding, and a greater proportional consumption of wheat.

The number of stock hogs is about the same as in 1862, and about five per cent. below a general average in condition. These were early turned on the frosted corn.

The buckwheat crop is not as much injured as was generally supposed, because most of it is produced in the States of New York, New Jersey, and Pennsylvania, where the frosts of August 30, and September 18, did not injure the crops materially.

The tobacco crop of 1863 is larger than that of last year by nearly 50,000,000 lbs., although the frosts in the Western States were very injurious to it. But about one-half of the crop there had been gathered before the frost of September 18, and seventy-five per cent more ground had been planted than in 1862.

The hay crop of 1862 is estimated at 21,603,645 tons, that of 1863 at 19,980,482 tons—a decrease of 1,623,163 tons. Its quality is good.

The Golden Parallels.

In a late number of the *Edinburgh Review* there is a notice of several publications on the subject of gold fields and gold miners. A mass of facts is collected relative to the Australian, Californian, and Columbian gold diggings, and several important conclusions are arrived at. In the first place we are reminded that the great gold fields already discovered are all included within two regions. The gold fields of New South Wales and Victoria extend without any interruption along the slopes of the great mountain range which separates the eastern seaboard Australia from the interior of the continent, and the gold fields of California and British Columbia occur without interruption along the western slopes of the Rocky Mountains. Thus, there are presented two great gold-bearing regions extending along two widely distant elevations, and probably "owing their auriferous character to some influence connected with their upheaval." The possibility of establishing a connection between these two gold-bearing regions will be understood after a little consideration of their characteristics. The American gold-fields, under various names, run along the eastern seaboard of the Pacific, almost from pole to pole—from Behring's Straits in the north to Cape Horn in the south. Throughout this vast region large quantities of the precious metal are found. "From Chili, in the south, to the British Possessions, in the north, its slopes, spurs, and subordinate ranges are now yielding gold. From Chili we mount through Bolivia, Peru, Equador, New Granada, all still continuing to yield the precious metal, after some three centuries of gold mining. Thence after we pass the Isthmus, we find the gold miner at work through Mexico, California, Oregon, Washington, till at length we come to the British Possessions, stretching to the shores of the Arctic Ocean." Such is a brief description of the great gold-bearing system of America. Turning now to that of Australia, there i found a coast range running from the extreme northern point of the continent to the extreme southern point. But this range neither begins nor terminates in Australia. It extends across Bass's Straits, on the one hand, and beyond Cape York on the other; in which direction the chain of rocks forms at intervals numerous islands, such as New Guinea, the Carolines, the Ladrones, and others, until Japan, with its gold bearing rocks, is reached. Thus, in accordance with this theory, the basin of the Pacific has on each side a continuous elevation of volcanic origin. At intervals on both sides gold is now found, from Behring's Straits to New Zealand; and it is stated that at the "beach diggings" in California, a bluish sand, not unlike the pipe clay of Ballarat, is frequently thrown up by the waves, and is found to contain gold in considerable quantities.

The conclusion arrived at by this reasoning is that the great gold fields of the world, as at present known, are included in the vast system of volcanic rocks which surround the Pacific. This chain, though broken here and there, is said to be traceable between Australia and America, and to be easy of identification on both sides of the ocean. Such a continuous and well marked line of volcanic elevations has often received the attention of geologists. Humboldt's view, which is the one generally accepted on the subject, is that the bed of the Pacific attained its presentdepth at a comparatively late period; that its unbroken crust, pressed down on the molten mass underneath, caused a quantity of it to rush towards the line of fracture at the edges, and that this disturbed matter found vent in the elevations which are now connected with the gold-fields of America and Australia. So far these considerations, as bearing on the science of geology, are highly important; but it has to be shown in what way gold is to be connected with volcanic shocks in some places and not in others. On this point it is laid down by Sir Roderic Murchison that the rocks which are the most auriferous are of the Silurian age, and that a certain geological zone only in the crust of the globe is auriferous at all. Gold, he states, has never been found in any stratified formations composed of secondary or tertiary deposits, but only in crystaline and palæozoic rocks, or in the drift from those rocks. The most usual original position of the metal is in quartrose veinstones that traverse altered Silurian slates, frequently near their junction with eruptive rocks. Sometimes, however, it is partially diffused through the body of rocks of igneous origin. From this it appears that volcanic eruptions, in connection with Silurian rocks, are to be regarded as the origin of gold formations.

It will have been seen that, according to the volcanic basin theory as described above, the auriferous rocks which surround the Pacific leave Victoria and plunge into the sea to appear again on the other side of Bass's Straits. This would, of course, leave South Australia out of the reach of these gold-bearing ranges. But singularly enough, the reviewer, after remarking upon this termination of the Victorian rocks, refers to the geological work of Mr. Julian Woods in order to show a curious extension of the volcanic action which is to be "traced in South Australia." On referring to the extract, however, it appears that Mr. Wood's reference is not to South Australia, although it relates to the country close upon its border. Mr. Woods says :—" At about fifty miles east of Mount Gambier, on the Victorian side of the boundary, there commences an immense volcanic district, which may be traced with very little interruption to Geelong by immense masses of trap-rock and extinct craters of large dimension. This kind of country extends considerably to the north of the line, and it is underneath the trap rocks there found at the junction of the Silurian slates and ancient granites that the extensive Australian gold-fields are worked." Another extract is given from Mr. Woods' book, embodying a statement similar to that which has been already quoted from Sir Roderick Murchison, namely, that trap rock and other indications of volcanic eruption are no guide to the presence of gold, unless in the neighbourhood of Silurian rocks.

A Novel Apparatus.

At the last sitting of the Academy of Sciences M. Galibert described an apparatus for securing free and complete breathing to persons obliged to stay some time under water, or to penetrate into places filled with deleterious gases or smoke. This apparatus consists of a piece of wood having the form and dimensions of the human mouth when open. To this piece of wood two india-rubber tubes are fixed of any length, according to the exigencies of the case. The man engaged in the operation is further provided with a nose pincher, or instrument for compressing the nostrils, so as to prevent the introduction of deleterious gas or water, as the case may be. The operator puts the piece of wood in his mouth, and puts on the nose pincher, he stops up one of the orifices with his tongue, and inhales pure air from the other; after which he shifts his tongue to the other orifice, and exhales his breath through the other. He continues thus regularly shifting his tongue from one orifice to the other in the order of the inspirations and expirations; but even a mistake would be of little consequence. A man easily learns the use of the apparatus by a few minutes' exercise. This contrivance has the merit of requiring no preparation, and thus offering a speedy means of affording assistance in the case of fires or suffocation by water or gases. It might also be used in medicine for the complete immersion of patients in a bath, which might sometimes be advisable,

Boat Worked by the Pendulum.

Lately, a small paddle boat has been plying on the Humber at a rapid rate. We understand it is worked by the pendulum, instead of oars, and it is the invention of a gentleman who is well known in London and Hull for his numerous inventions. It is also applicable to drive carriages on the high roads, and if constructed for the rail would go at the rate of 20 miles the hour. A carriage holding two gentlemen has several times been driving about Hull, then working its way to Beverly, and over the Ferriby Hills. It is the intention of the patentee to propel ships and life-boats by the pendulum, which may be applied to either screw or paddle.

The apparatus is fixed in the boat, and is ready for use at any moment. In case of emergency this system must be of admirable service. The boat, which is a ship's jolly boat, was tried from Hull to Paull, with four workers, and ran the distance in 27 minutes. The same distance a six-oared race-boat takes at least 25 minutes, the men pulling at the top of their strength. Whilst in the pendulum boat not a coat was taken off. Were the apparatus transferred from the jolly-boat to the race-boat, the inventor asserts that the same distance would be run in 15 minutes. The pendulum boat can be worked with half the ease of an oared boat, and any one unaccustomed to pulling can work the pendulum in two minutes, and continue to do so for 20 or 30 miles without fatigue. Any common boat can be fitted with the apparatus. The York papers state that the inventor intends making further experiments on or about the 23rd inst. on the Humber.

How to Foretel the Direction of the Wind.

It is one of the general rules concerning the force and direction of the wind, that the wind will always be in an easterly direction when localities situated to the northward of some place of observation have a high reading of the barometer; and, on the contrary, the wind will be in a westerly direction when the reading of the barometer is higher in localities situated to the southward of the same place of observation. In the first instance, the wind, without exception, is between south-east and east-north-east, whereas the westerly direction is again almost without exception between south-west and north-west. If it so happens that at the same time there is a difference of the reading of the barometer between localities situated in an easterly and westerly direction from each other, the wind in the first case will partake more of the northerly, in the other case more of the southerly direction.

The future direction of wind, therefore, may be determined by the following rule:—When one has the lowest reading of the barometer to one's left hand, the back is turned to the region whence the wind will blow. As for hurricanes, one has always towards one's left hand that locality where the wind will blow most vehemently; regard being, however, taken to the direction of the wind. The reading of the barometer in places towards the south from us is on the average higher, since westerly winds predominate; but as westerly winds are on an average more violent than easterly, one may pretty safely infer that an ordinary difference north above south is less to be apprehended than an equally large difference of south above north. When the barometer reads higher in the north than in the south, the force of the wind is certainly as much greater as the difference of the readings of the barometer is greater; it may even be as large as six millimetres, without there being any just apprehension of a gale of wind. The greater the difference, the more sure one may be that the wind will turn towards the east, and keep to that quarter for some days. It only occurs once in a hundred times that during the blowing of a westerly wind the barometer reads a couple of millimetres higher in the more northerly places; such occurrence invariably indicates a great disturbance of the atmospheric equilibrium; and a heavy fall of the barometer in the north, or a rise in the south, commonly even ensues the very same day, while even on that day, or a day or so later, a gale of wind from the westward begins to blow. When, on the contrary, the south reads four or more millimetres above the north, one ought to be on one's guard. If the reading of the north is above that of the south, and an easterly wind does not then quickly succeed, that rise of the barometer must not be considerd as being due to a regular division of pressure of the atmosphere, but only to the temporary abiding of an atmospheric wave, and a strong westerly wind may be expected next day. According to accurate observations, we find that 40 times in 118 a gale of wind will ensue when the south reads higher, and I repeat, therefore, here what was already observed before—a gale of wind is always announced, but with the announcement the gale does not always follow. A danger known before it is really present ceases to be so, or at least loses a good deal of its power; and whether the gale does occur or not, one has been warned, and can be guarded. Science incessantly proceeds, and the day is not, perhaps, very far distant when in this department also very important truths will be brought to light. I ought not to neglect to observe that the gale does not always break out within the first twenty-four hours; the difference in the readings of the barometers is often again the same on the next and even on the third day; but the wind becomes heavier and heavier, and at last a violent gale breaks out. A ship, therefore, having left port on the first day, would not have fallen in with the gale of wind on that day, but only on the next ensuing. The repeated warnings are to be considered as one, which renders the whole more important.—*Chemical News.*

New Method of Engraving.

MM. Delouche and Fellman, an artist and an engraver, have introduced a new method of engraving, which presents many features of interest. They take a plate of polished zinc, which they cover with a coating of whiting analogous to, but not indentical with, that employed by wood-engravers; upon this the design is drawn with a peculiar ink. The plate is then suspended in a bath of sulphate of copper from the negative pole of an ordinary galvanic battery, where the inked portions of the drawing become coated with a deposit of copper. When this is considered sufficiently thick, the plate is removed, and having been washed, is suspended from the positive pole of the same battery in a bath of acidulated water. The acid eats into the plate where it is not covered with copper, or the white part of the drawing. A few hours terminate an operation which supplies a plate from which ordinary engravings may be taken in the usual way.

Printing Without Ink.

We learn from the *Typographical Advertiser* that a gentleman, a large capitalist, and one of the most successful inventors of the day, has succeeded in chemically treating the pulp, during the process of manufacturing printing paper, in such a manner that when the paper is impressed upon the uninked types the chemical particles are crushed, and a perfect black impression is the result. The advantage sought to be obtained is the discarding of ink and rollers; and, by revolutionizing printing machinery, and printing from a continuous roll of paper, it is calculated that time occupied in impressing large quantities of paper will be nominal in comparison to the requirements of the present day. Cleanliness in the printing office would thus become proverbial, and the time now wasted in making and distributing the rollers obviated.

A Receipt for a Deep Black Neutral Ink.

Take 42 ounces of powdered galls, 15 ounces powdered Senegal gum, 18 quarts of distilled or rain water, 18 ounces of green vitriol free from copper, 3 drachms of liquor ammonia, and 24 ounces of spirit of wine; mix these in an open vessel, and allow them to stand, stirring frequently, until the ink attains the desired blackness. This ink will not corrode steel pens.—*Elsner's Chem.-Technische, Mittheilungen,* xi. s. 139.

Numerous Languages.

At the recent annual meeting of the British Association, held at Newcastle, in the north of England, Mr. Crawfurd, who read a paper on Sir Charles Lyell's "Antiquity of man," challenges the statement that no language lasts as a living tongue, above a thousand years. He said: "As the authentic history of man is not above three times that length, and, as in some quarters of the world, the vicissitudes of language have been unquestionably great, it would, no doubt, be difficult to produce examples of a much longer duration. The Arabic, however, may be cited as a language which has had a somewhat longer duration, for the Koran is good Arabic at the present day, after the lapse of 1,240 years; and when the stationary state of society which belongs to the East, and the peculiar physical geography of the native country of the Arabs are considered, I see no reason why it may not have been of twice, or even of three or four times the duration assigned to language by Sir Charles Lyell. I am told by competent judges that, saving the loss of its dual number and middle voice, modern Greek does not materially differ from ancient; and if such be the case, the Greek language, dating only from the time of Homer (and even then it was a copious tongue), has lasted some 2,600 years. Circumstances peculiar to it, no doubt, contributed to this duration." Mr. Crawfurd added that "all the languages of the world had been reckoned by some at 4,000 and by others at 6,000; but it was certain the real number was unknown. As a general rule, languages were numerous in proportion as men were barbarous—that is, in proportion as we get nearer to the time when each primordial horde, or tribe, framed its own independent tongue."

Slacking of Quick Lime.

Dr. Davy recently read a paper on the above subject before the British Association. In some experiments which he had made on the slacking of lime—as its conversion into a hydrate is commonly called—he had noticed certain results new to him, and of which he gave a brief account. It is well known that as soon as water is added to, and absorbed by, well-burnt lime fresh from the kiln, and immediate union takes place, the mass becoming broken up and falling into powder, with the production of much heat and steam; but if the lime has been kept exposed to the air two or three days, during which time it absorbs a small quantity of water, without at all disintegrating, the same rapid union is not witnessed, without the addition of water sufficient to form a hydrate. On the contrary, some minutes will elapse before the combination takes place, and the Doctor finds there is a similar retardation of action from other causes. The result of the experiments which had been made, he maintained, warranted the conclusion that lime is capable of uniting feebly with less water than is required to form the hydrate, that consisting of one proportion of each, the weaker compound containing probably about two proportions of lime. Considering the high temperature produced in the act of union with water and lime, and the quantity of steam that may be generated, the idea could hardly fail to occur that the formation of the hydrate may be applied to some useful purpose, such as the blasting of rocks, and, if successful, might be especially useful in collieries as a substitute for gunpowder, which has so often occasioned, by the ignition of gas, terrible accidents with loss of life. The few trials he had instituted with a view to this application had not answered his expectations. His experiments, however, had been made on sandstone, and as coal was not nearly so resisting as that material, and as its burning was easily effected, he expressed a hope that the experiments might be repeated in a colliery.

Hints as to Health and Comfort.

A correspondent writes as follows:—"Beware of drinking water drawn from the cistern from which a water closet is supplied. Sulphuretted hydrogen gas finds its way up into the cistern every time the closet is used, and the water then holds the filthy flavour from the organic matter. Most of the houses in London, indeed, almost all of which the rent happens to be from £25 to £150 per annum. have no distinct and separate cistern for drinking, cooking, and toilet water. In such cases the water is unwholesome for drinking, unless it be previously filtered through charcoal, that valuable material which appropriates the offensive matter, the organic matter. Look well to your "stink traps" which lead your refuse water into the drains and sewers. They should always be provided with a flat stone as a "sealing" of the syphon trap. Neither black nor Norway rats will dive, so they cannot enter your house from the drains, but by gnawing away the piece of plank which is commonly used instead and to save the expense of the flat stone just mentioned. Though rats are highly to be respected as cleansers of our sewers, they are a great offence in the houses.

Coal Beds in America.

Heath's mine, in Virginia, is represented to contain a coal bed 50 feet in thickness; a coal bed near Wilkesbarre, Pa., is said to be 25 feet thick; at Munch Chunk is a coal bed 40 to 50 feet deep, and in the basin of the Schuylkill are fifty alternate seams of coal, twenty-five of which are three feet in thickness.

Hunting for Cedar Timber.

In New Jersey there are men who make it their business to dig the cedar trees buried for centuries in the swamps, and cut them into shingles of, it is said, extraordinary excellence. A correspondent of the New York *Post* thus describes the timber, and the process of "getting it out":—"These swamps are very valuable, an acre of such timber commanding from five hundred to a thousand dollars. A peculiar feature of the swamps is that the soil is of purely vegetable growth, often twenty feet or more in depth. This peaty earth is constantly accumulating: from the fall of leaves and boughs, and trees are found buried in it at all depths, quite down to solid ground. The timber so buried retains its buoyancy and colour, and it is considered so valuable that large numbers of workmen are constantly employed in raising and splitting the logs into rails and shingles. In searching for these logs the workmen use an iron rod, which he thrusts into the soil, and by repeated trials ascertains the size and length of the wood he strikes, and, then by digging down obtains a chip, by the smell he can determine whether it is worth removal. The number of shingles produced from the wood of these submerged forests is very great; from the little town of Dennisville, in this county, as many as eight hundred thousand, valued at twelve thousand dollars, have been sent to market in a year. From the same place thousands of dollars' worth of white cedar rails are annually sent out. The deposit of timber at this point extends to an indefinite depth, and although, from the growth above it, believed to be two thousand years old, is all entirely sound, and will supply, for years to come, the draft upon it."

Photography on Stone.

A curious communication was sent in to the Academy of Sciences by M. Morvan, in which he describes a method of his for obtaining direct photographic impression upon stone, and which he can afterwards print off. He first gives the stone a coating, which he applies in the dark, of a varnish composed of albumen and bi-chromate of ammonia. Upon this he lays the right side of the image to be reproduced, whether it be on glass, canvass, or paper, provided it be somewhat transparent. This done, he exposes the whole to the action of light, for a space of time, varying between thirty seconds and three minutes if in the sun, and between ten and twenty-five minutes if in the shade. He then takes off the original image, and washes his stone, first with soap and water, and then with pure water only, and immediately after inks it with the usual inking roller. The image is already fixed, for it begins to show itself in black on a white ground. He now applies gum water, lets the stone dry, which is done in a few minutes, and the operation is complete. Copies may at once be struck off by the common lithographic process.

Locking-up Forms of Types.

The following improvements in printers' chases have been recently patented by Mr. Robert Ward, of Newcastle-on-Tyne. The invention has for its object improvements in locking-up or fastening forms of type or other printing surfaces. For these purposes, in place of employing loose wooden wedges acting on side-sticks or foot-sticks, as heretofore, a long wedge of any suitable material, by preference in one piece, but this is not essential, is placed between two foot-sticks or two side-sticks, and such wedge is set up by a screw, which is formed with a head having holes therein by which it can be readily turned whilst in the chase in which the "form" of type or printing surfaces is required to be locked-up or fastened. The head or outer end of the screw rests against a block, whilst the screw itself enters a female screw formed in the larger end of the wedge: hence, when the screw is turned, it will force the wedge more and more in between the two foot-sticks so as to cause them to separate, and thus lock-up or fasten the "form" in the chase.

Prussian Order of Merit.

The King of Prussia' who lately conferred his Order of Merit in Science and Arts upon Sir Charles Lyell, on account of his volume on "The Antiquity of Man," has lately appointed the Rev. Edward Hincks, D. D., Rector of Killyleah in the north of Ireland, a Chevalier of the same Order. Dr. Hincks is son of the late Rev. Dr. Thomas Dix Hincks, formerly Professor of Hebrew in the Belfast Institution, and is brother of the Hon. Francis Hincks, formerly Premier of Canada, lately Governor-General of the Windward Islands, and now Governor of British Guinea. He is uncle of Mr. William Hincks, one of the Congressional Reporters at Washington. Dr. Edward Hincks, formerly a Fellow of Trinity College, Dublin, is one of the most profound Oriental scholars in Europe. The Prussian Order of Merit consists of only thirty Germans and thirty foreigners, selected for their superior acquirements.

Exports of Petroleum from New York.

Up to 26th Sept. the total exports of petroleum were 14,528,022 galls. The quantity for the corresponding period of last year being 4,233,488 galls.

Greek Fire—Shell and Shot.

The statements which have been published respecting some incendiary shells stated to have been thrown into Charleston by General Gillmore, seem to have set the whole country in a blaze of excitement. According to a very common mode of romancing adopted by letter-writers these shells have been denominated "Greek Fire;" but there is no resemblance whatever between them and the genuine Greek Fire of ancient times. It is related that the former was discovered in 660, by a Greek engineer named Callinacus, who in that year destroyed a large fleet of Saracen vessels with it; and it afterwards became a terror to the whole Mahommedan races. It is described to have consisted of resin, saltpetre, sulphur, pitch and camphor, mixed with turpentine, and made into balls with flax. It was ignited, then fired from arrows, or thrown by javelins on board of the Saracen vessels, when they were engaged with the Greeks in the hand to hand contests of those days. The compound was very inflammable, but its chief danger consisted in being capable of burning in water. Tradition conveys exaggerated ideas respecting its destructive effects. It would not produce much fear, nor very formidable results, on board of modern war vessels. The incendiary shells now called Greek Fire were first brought to public notice during the Crimean war, by J. Macintosh, who made experiments with them at Shoeburyness, England, and set inflammable materials on fire at a distance of 800 yards. A patent was secured for the invention in 1855, and the composition is described in the specification as follows:—"I fill diaphragm shells with naptha, mixed with phosphorus and bisulphide of carbon, having a bursting charge sufficient to open the shell. When fired, the bursting of these shells scatters the contents in all directions, and the shower of inflammable material falling among troops ignites spontaneously, causing their immediate disorganization. Fired into shipping, these shells bursting on the deck below, scatter the inflammable material, and the spontaneous combustion which results causes injury to the crew, who are driven overboard, and the vessel itself is speedily consumed. Fired into harbors, dockyards and towns, the result is alike destructive and decisive."

A little volume forwarded to us by Captain J. Norton, from Rosherville, England, 1860, contains the following description of his incendiary shell for infantry:—"A leaden rifle shell is first nearly filled with bisulphide of carbon, then small bits of phosphorus are dropped into it, and the mouth of the shell is then closed with a cork projecting like that of a bottle. A leaden shell thus charged and adapted to the military rifle, will continue to burn for ten minutes, with an intense flame which cannot be extinguished with water." Such are the descriptions of the modern incendiary shells called by some persons "Greek Fire." As phosphorus was unknown to the ancient Greeks, of course it is sheer nonsense to credit them with the invention of this fire. Thus far, such incendiary shells seem to have produced but little mischief. An officer of the United States artillery lately informed us that he had made experiments and found them of no utility, owing to the inflammable liquid being so much scattered when the shells burst. He believed that if a considerable quantity of the inflammable liquid could be held together and thrown into one place it would prove destructive, but this could not be effected with any of the incendiary shells which he had tried. For producing destructive results by setting wooden vessels, buildings, and other combustible materials on fire, red-hot shot is more to be depended upon than liquid fire-shells. The modern method of producing such shot, is to fill shells with molten iron, then fire them from the guns. A small cupola has been put up on one of the English iron-clads for melting pig iron, thus to fill shells; but against armor-clad vessels of course such shot would be useless, as they would spatter against iron plates like balls of clay.—*Scientific American.*

Adulterations.

Beer and ale, since the duty has been taken off hops, can be made, and are made, without either malt or hops, and the excise are fearing that this will be the cause of a diminution in the receipts as regards the tax upon malt. We have just seen that the Berlin Faculty of Medicine are opposing the drinking of Bavarian beer, which they declare to be the cause of innumerable cases of apoplexy.

Bavarian beer, which was not known in Prussia 20 years ago, is now largely consumed in that country. Wine is made and sold which neither contains the juice of the grape nor that of any other fruit.—*Sanitary Reformer.*

Bleaching Powder.

Since 1838 the method pursued in the manufacture of bleaching powder has entirely changed, and the quantity made has far more than doubled. At that time it was made by the decomposition of manganese and common salt with sulphuric acid, which was a rather costly process, and the price was about 28*l.* per ton. It is now manufactured from what was at one time the waste muriatic acid referred to above, and the price has been reduced to one-third. During the last few years the demand for bleaching powder has been increased, partly on account of the extensive use of esparto grass from Spain in the manufacture of paper, which has been found to require a large quantity of chemicals to bleach it, and nearly all the Spanish grass imported to this country is shipped to the Tyne. The quantity of bleaching powder now made is 11,200 tons annually.

Resin Size.

This article is manufactured according to a patent obtained by Mr. W. S. Losh, and is intended to produce a size suitable for paper-makers, and to supersede the old size in ordinary use, which consists of alum, resin, and soda ash. Its manufacture has, however, been only partially developed, and not more than 100 tons yearly is produced; but a new and cheap size, which can be prepared ready for the use of the paper trade, is, we think, a step in the right direction, and the theory of the sizing of paper is a field still open to chemists.

Value of London Sewage.

The following is taken out of a letter from Baron Liebig recently published:—"From exact calculation of the liquid and solid voidings of London (the detail of which would be out of place here) we may conclude that 42 tons of ammonia, 10 tons of phosphoric acid, and 7½ tons of potash find their way into the London sewers daily. These 42 tons of ammonia are contained in 247 tons of guano; the ten tons of phosphoric acid in 83.3 tons of guano thus 163·7 tons remain in which the phosphoric acid is wanting; or, what is the same thing, if, to the sewerage obtained daily from London, 100 tons of superphosphate of lime (at 20 per cent. of phosphoric acid) be added, the value of the daily voidings of the metropolis, or the sewage of London, is made equivalent to 247 tons Peruvian guano; or, by the addition yearly of 36,500 tons of superphosphate, we may acquire the value of 90,155 tons guano, at 13*l.* 12s. 6d.=1,228,364*l.* Deduct the price of 36,500 tons of superphosphate, at 5*l.* 5s. = 191,628*l.*, and we have 1,036,736*l.* as the money value of the sewage. To this should still be added the worth of the potash in the sewer water. Potash is the manure which the farmer obtains with the most difficulty; it is that element, too, which renders his stable dung (the amount of phosphoric acid and ammonia being the same) of greater value and efficacy. In 247 tons of guano, about 1½ ton of potash are contained; but every day 7½ tons are obtained in the sewer water, which gives a surplus of 6 tons, corresponding to 11 tons of sulphate of potash, giving yearly 4,015 tons, which, at 18*l.* per ton, shows a money value of 72,270*l.* Add this to the sum above given, and we have as real annual money value of the London sewerage 1,109,006*l.*"

The Shipping Trade of Quebec.

During the past season 1,332 sea-going vessels, of an average tonnage of 520 tons, making a total of 692,640 tons, have been cleared at this port, against 895 vessels, of about the same average, making a total of 465,400 tons during last year, thus showing an increase in favour of 1863 of 437 vessels, and 227,240 tons.—*Gazette.*

A Flax Mill at St. Catharines.

The Novelty Iron Works, at the east end of the town, has been leased by Mr. Walter Arnold, and will be converted into a flax mill, the necessary change of machinery being now made.

A Traveller's Opinion of the Japanese.

They are bold, courageous, proud, and eager after every kind of knowledge. A friend of mine gave a workman a Bramah lock to put on a box; it was not discovered until some time afterwards, and only then by the absence of the name, that the lock had been imitated, and, as the workmen confessed, the original kept as a pattern. I have been on board a steamer (paddle), which used three years ago to run between Nagasaki and Jeddo, 600 miles, whose engines and boilers, and every part of her machinery, were made of copper. She was built by a doctor in Jeddo, whose only guide was a Dutch description of a steam engine translated into Japanese. An American gunnery officer was sent over in 1859, in the Powhattan, to teach them gunnery. He was courteously received, and then taken over the arsenal at Jeddo. He returned to the ship saying "he had been taught a lesson instead of having to teach." In many of the arts and manufactures they excel us; their beautiful castings in bronze would puzzle the most experienced European workmen. I have shown specimens to clever workmen who have confessed they could not imitate them. Though they do not know how to blow glass, I have seen samples which would rival in brillancy any made in England. The French Minister had a large ball, so clear, and of such perfect colour, that he believed it to be a gigantic sapphire, and bought it for a good round sum. Their paper imitations of leather are perfect; their paper waterproof coats are bought by the captains of ships for their exposed boats' crews; their own clocks are good, and they have imitated our watches; they walk about with "pedometres" attached to their belts and they are not backward in copper-plate engraving and perspective. Their china is far superior to the Chinese. The country abounds with coal, though they only use that found close to the surface; but even that, a sort of bituminous shale, is good. In gold and silver I believe they could rival Mexico and Australia; iron, copper, and tin are found in profusion. A friend of mine at Yokohama gave a Japanese a piece of English cotton shirting; in a few days the man brought back two pieces, and my friend had much difficulty in saying which was his, so closely had it been imitated. In fact, they are a people who want for nothing but teachers.

Tables Relating to Locomotive Engines.

The following useful tables from the *American Railway Times*, should find a place in the engineer's note book:—

The tractive power required to move any load upon a level railway is found by dividing the square of the speed in miles per hour by 171, and to the quotient adding 8, and multiplying the sum by the load in tons.

Speed in Miles per hour.	Tractive power needed, load being 50 tons.	75 tons.	100 tons.	250 tons.
12	442	663	884	2210
15	465	691	931	2328
20	517	773	1034	2585
25	582	874	1165	2912
30	663	994	1326	3315

Table showing the tractive power required to overcome grades with different loads.

Grade in feet per mile.	Load in tons. 1.	50.	75.	100.	250.
20	8	424	636	848	2122
40	16	848	1272	1696	4244
60	26	1272	1910	2546	6340
80	33	1697	2545	3393	8489

To find the tractive power needed to overcome any grade, we multiply the load by the rise per mile, and divide the product by 5280, the number of feet in a mile.

Table of factors which multiplied by the total piston pressure give the tractive power of the engine in lbs.

Diameter of Driver.	Stroke in inches. 18.	20.	22.	24.
4	2386	2652	2918	3182
4¼	2250	2500	2750	3000
4½	2151	2390	2593	2830
4¾	2012	2235	2459	2682
5	1910	2122	2334	2546
5½	1736	1929	2122	2315
6	1591	1768	1945	2122

The above are all decimals, and are got by dividing the double stroke by the wheel circumference, both in inches.

Table of piston pressures for different cylinders, and different steam pressures.

Diameter of Cylinder.	Area of Piston.	Whole pressures on both pistons, at 100 lbs.	110 lbs.	120 lbs.	130 lbs.
16	201	40,220	44,242	48.264	52,062
18	254	50,900	55,990	61,080	66,170
20	314	62,840	69,124	75,408	81,692

Relative volumes of steam under different pressures.

Steam pressure.	Relative volume.	Steam pressure.	Relative volume.
80	359	120	240
90	323	130	231
100	293	140	216
110	269	150	203

That is, at a pressure of 100 lbs. per inch, each cubic foot of water will make 293 cubic feet of steam.

Table giving the amount of surface obtained by 100 *tubes, of different dimensions.*

Length of tube. in feet.	Square feet of surface in 100 tubes, diameter of tubes in inches being 1½.	1¾.	2.	2¼.	2½.
10.0	392	457	524	589	655
10.5	411	480	549	618	687
11.0	431	503	576	647	720
11.5	451	526	602	677	753
12.0	471	549	628	705	786

Table showing the mean pressure in the cylinder, for different percentages of admission, and different initial pressures.

Initial pressure in lbs.	Mean cylinder pressure cutting off at ¼.	⅓.	½.	⅔.	¾.
100	54	65	83	93	95
110	60	72	91	102	105
120	66	79	99	112	114
130	72	86	108	121	124

That is, if we cut off the steam at 50 per cent., which has a pressure at entering of 120 lbs. per inch, the mean pressure throughout the stroke will be 99 lbs.

On Refining Petroleum.

The methods practiced by persons engaged in refining the American Petroleums are as different as those in use for the purification of the oils distilled from coals. Some employ acids and alkalies, others use alkalies alone, and steam is applied at various degrees of heat. Some of the oils produced by those means are of good quality, others are inferior and do not ascend the wick of the lamp in sufficient quantities to afford a constant light. In others, the illuminating principle, by some change effected on the carbon, is partially destroyed, and in almost all the odor is disagreeable. The oils from some of the wells contain traces of chloride of sodium, other carbonate of soda in quantities, sufficient to effect their treatment. The denser oils, or those which contain too much carbon to admit of being consumed in lamps without smoke are excellent lubricators, either mixed or unmixed with animal oils.

It will be perceived by the foregoing statement that it would be a difficult task to prescribe a mode of purification to meet the requirments of the oil refiners. Neither the petroleums nor the oils distilled from them contain creosote, or cabolic acid, and other impurities which contaminate the oils distilled from coals and coal shales; their purification therefore, is simple and comparatively cheap.

When the proof of the oil is not below 38° Fah., distillation with water, or by the use of steam, will most frequently render the lamp oil of good color, and its illuminating properties will be of the highest order. Before the heavy oils, or those below proof 38° Fah., are submitted to any treatment, it is necessary to give them a preliminary distillation, by the aid of common or superheated steam, and the distillate should be separated into two parts, all below proof 38° Fah., being set aside to be treated for lubricating oil, a further portion to be added to the illuminating oil. Washing the lighter part of the charge with a solution of caustic potash or soda, is useful. A final distillation over a weak solution of either of those alkalies will generally render the oil pure. The heavy parts of the oil may require agitation with equal parts of sulphuric acid and water, followed by an alkaline wash and then distillation. It is only the most impure oils, and those from the wells of certain localities that require tho use of acids, which, like the strong alkalies, when used in excess, greatly impair the illuminating properties of these hydro-carbons. The lighter the oils the lighter will be their color. At proof 45° Fah. they are colorless. At proof 42° Fah., colouring matter begins to appear in the distillate, and continues to increase until the charge is exhausted. In order to present the lamp oil of a light color, some refiners have sent it to the market at proof 45° Fah.; but it should be understood that such oils are much more inflammable and liable to explode than those at proof 46° Fah. Color, in this instance, should be sacrificed to safety.—A valuable property of all the before mentioned oils consists in the fact that they never become rancid or ferment. Indeed they become improved by age, and gradually lose their unpleasant odor.

Natural Barometers.

Chick-weed is an excellent barometer. When the flower expands fully, we are not to expect rain for several hours; should it continue in that state, no rain will disturb the summer's day. When it half conceals its minature flower the day is generally showery; but if it entirely shuts up, or veils the white flower, with its green mantle, let the traveller put on his great coat. The different species of trefoil always contract their leaves at the approach of a storm; so certainly does this take place, that these plants acquire the name of the husbandman's barometer. The tulip, and several of the compound yellow flowers, all close before rain.

An Ancient Tree.

A tree has recently been cut down in California, the circumference of which was 90 ft., and its height 325 ft. The bark was in some places 4 ft thick. The tree contained 250,000 ft. of solid timber. Its age was 3,100 years. The wood was sound and solid. The age of a tree is ascertained by counting the number of rings which are exhibted in its trans verse section, each ring representing one year's growth.

Centrifugal Force of Revolving Shafts.

To ascertain the bursting or centrifugal force on the rim of a fly-wheel, multiply the square of the number of the revolutions per minute by the diameter of the circle in feet and divide the product by 5,780. The quotient is the centrifugal force in terms of the weight of the body.—*Scientific American.*

Preservative Properties of Coal-Tar.

M. Rottier has placed a paper before the Royal Academy of Belgium, upon the preservation of wood by the heavy oil of coal-tar, in which he states that, after reviewing the number of compounds this complex product contains, the volatile hydrocarbons, aniline, phenic acid, and napthaline, do not possess any preservative properties; but that a green oil, which is produced in the distillation of coal-tar at a temperature of about 572° Fahrenheit, is the substance alone that resists the decay of wood.

The Guano Supply.

The measurements of the guano beds on the coast of Peru has shown the Macabi Islands to contain about 1,500,000 tons, the Guanape group 2,500,000, the Lobos Islands 4,000,000.

The Virtues of Borax.

The washerwomen of Holland and Belgium, so proverbially clean, and who get up their linen so beautifully white, use refined borax as a washing powder instead of soda, in the proportion of a large handful of borax powder to about ten gallons of boiling water; they save in soap nearly half. All the large washing establishments adopt the same mode. For laces, cambrics, &c., an extra quantity of the powder is used, and for crinolines (required to be made stiff) a strong solution is necessary.

Borax, being a neutral salt, does not injure the texture of the linen; its effect is to soften the hardest water, and therefore it should be kept on every toilet table. To the taste it is rather sweet, it is used for cleaning the hair, and is excellent dentrifice.

Artificial Marble.

Sir James Hall upon one occasion produced crystalline marble by subjecting chalk to a high heat in a close vessel. Professor Rose, of Berlin, Prussia, tried the experiment, and failing to produce such a result, denied the correctness of Sir James Hall's statements. Being assured that crystalline marble had thus been produced, and that the specimens could be seen in London, he entered upon a second experiment, and in a recent communication to the Berlin Academy of Sciences, Professor Rose states that marble can be produced by exposing massive carbonate of lime to a high temperature under great pressure. His experiments were made with aragonite from Blin, in Bohemia, and with lithographic limestone. In one case the mineral was heated in a wrought iron cylinder, and in the other in a porcelain bottle, the vessels being air-tight. They were exposed to a white heat for half an hour, and on cooling, both the aragonite and the lithographic limestone were found converted into crystalline limestone; the former resembling Carrara marble, and the latter a grey granular limestone. The change was effected without material decomposition; the resulting marble containing a trifle less carbonic acid than the lithographic limestone, from which it was produced.

New Patent.

A Frenchman has patented an invention for pulverizing the refuse of slate, and mixing with it some substance which produces a most durable material, and which answers the same purposes as some kinds of our most valuable stone.

ERRATA.

In the Journal for December, 1863, the following *Errata* occurred at page 357, in the article on "Heat and Motion:" first column, 18th line from the top, for *winter* read *water*, and, in 20th line, for *water* read *air*.