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TO NUMBERS FOR JANUARY AND FEBRUARY, 1868.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR ONTARIO.

JANUARY, 1868.

PATENTS LAWS FOR THE DOMINION.

His Excellency the Governor General, in his speech at the opening of the first parliament of the Dominion of Canada, included in the measures to be submitted, one "for the introduction of uniform Laws respecting patents of Invention and Discovery." It is understood that this measure will be taken up on the re-assembling of the Legislature.

The present patent laws of Canada extend only to the Provinces of Ontario and Quebec, and are very arbitrary in their restrictions, as to who may obtain patents. The Province of New Brunswick is more liberal, and grants patents to foreigners on the same terms as to her own citizens. The laws of Nova Scotia, we believe, are also very restrictive. This is contrary to the spirit of the age, and the interests of these Provinces; and, apart from the necessity for assimilating the patent laws of the different sections of the Dominion, require immediate revision.

We have received from C. Legge & Co., Solicitors of Patents, Montreal, a pamphlet* on this subject. It is, as it professes to be, made up principally of suggestions of their clients. Their first proposition is to admit British subjects and foreigners to equal rights with our own, in obtaining letters patent—patents to be granted for fourteen years, and absolutely not renewable. Fees to be increased in amount, and rights granted and fees to be paid at the commencement of each of three terms, of three, seven and fourteen years respectively, as is the practice in Great Britain—patent rights already granted in each Province, to be extended to the whole of the Confederation—the privilege of filing *caveats* for six months, so as to give time to perfect inventions. These are the principal suggestions made.

On turning to our article in the number of the *Journal* for March, 1864, we notice that it discusses the leading objections to the present law, and suggests amendments which we still think desirable. As the article referred to is not in the hands of many of our present subscribers, we re-produce the main portion, viz:—

"The principal objections to the present law are, 1st, That a patent right cannot be obtained by any but a British subject, nor by a British subject unless an actual resident of Canada. 2nd, That no efficient examination is made as to the novelty or utility of the inventions, thus allowing so many useless articles to be patented. 3rd, That the specifications and drawings of patented articles are not published by the Department, so as to be available to the public for reference. 4th, That the law being prohibitory as to Americans obtaining patent rights in Canada, Canadians can only obtain patent rights in the United States by payment of the sum of $500, which in many cases is tantamount to a prohibition.

"As to the first of these objections, it must certainly appear very ungenerous to our fellow-subjects coming from other portions of the Queen's dominions with a valuable invention or discovery, to find that by our provincial law he is excluded from obtaining any protection; and, to the American most inconsistent for us, who are continually declaiming against American publishers for pirating the works of English authors, to refuse him a patent right on payment of suitable fees—the avowed purpose being to use and benefit by his invention, without affording him any remuneration therefor.

"The second objection we do not esteem as of much weight, the loss accruing from patenting useless articles falling principally upon the inventors themselves. Could an efficient examination, however, be established, it would prevent the re-patenting of any invention or discovery, and thus prevent an injustice being done to the original patentee.

"As to the third objection, it would greatly increase the value both to the inventor and the public if the specifications and drawings were freely published, and placed in the libraries of the Boards of Arts and Manufactures, and of all Mechanics' and similar institutions, for reference. It would also afford information to inventors of what had already been patented, and save them time and expense in perfecting machines already discovered and patented by others.

"A gentleman of this city devoted some years study to what he considered a new mode of propelling steamers, an improvement on the ordinary side paddle-wheels now in use, and went to the expense of having models prepared preparatory to applying for a patent. When his models were nearly completed he consulted the British Patent Office publications in the Free Library of this Board, and at once discovered that an invention exactly similar had been patented in England

* Suggestions with reference to the proposed new Act respecting Letters Patent for Invention, in the Dominion of Canada.

some years previously. Another gentleman from the city of Hamilton, who had for a long time been studying an improvement on the screw propeller, and was about to apply for a British patent, found, on reference to the same library, a description of an exactly similar invention. By these means they were saved further trouble and expense, and had they only consulted these works sooner, they would no doubt have been saved much disappointment also.

"The provisions of the present law referred to in the fourth objection is undoubtedly the most detrimental of any to the interests of Canadian inventors, and also to the public, whose interests are identical with theirs. A number of inventions are now waiting the alteration of our law so as to secure reciprocity with the United States. The reasons given by the inventors for withholding their discoveries from the public are, that a patent for Canada only secures the monopoly of a very limited market, and they cannot afford to pay the sum of five hundred dollars required from every Canadian citizen for a patent in the United States, consequent upon our prohibitory law; and therefore prefer to wait, hoping that our legislature will make such amendments thereto as will enable us to take advantage of the law passed by the United States Congress, March 2nd, 1861, section 10, 'That all laws now in force fixing the rates of the Patent Office to be paid, and discriminating between the inhabitants of the United States and those of other countries, which shall not discriminate against the inhabitants of the United States are hereby repealed,' and establishing uniform rates of fees of $35 for all, on the conditions recited in the foregoing extract.

"It will thus be seen that so soon as our law ceases to discriminate against the inhabitants of the United States, a reciprocity in patents will take place; and surely no one can for a moment doubt but the advantage of securing the American market to our inventors, will be a boon far more valuable than we can confer on American citizens by throwing our market open to them.

"A fear is sometimes expressed that by granting patent rights to Americans, they will neither manufacture their inventions here or sell rights to others to do so; but this may be guarded against by providing that unless the manufacture of the article patented is commenced in the province within say twelve months after the issue of the patent, all exclusive rights therein shall be forfeited by the patentee or his assignee.

"The immorality which the present law leads to is also another important consideration. A large number of patents taken out in Canada are the inventions of American citizens, who, on finding that patent rights cannot be obtained in their own name, on account of their being aliens, secure the service of some weak or immoral minded Canadian, who for a *consideration* makes the affirmation that the invention or discovery is his, and thus secures the patent. We also suggested that a six months "Provisional protection" should be provided, so as to allow inventors to experiment on their machines with a view to perfecting them before depositing a complete specification. The absence of this provision in the present law causes the greatest dissatisfaction, and accounts to a great extent for the many crude machines patented in the Province, as the inventors dare not put their utility and completeness to a practical test for fear of others witnessing and pirating their ideas, and, as has been done in too many cases, taking out patents before the real inventors are fully prepared.

"In the United States the inventor is allowed to file a caveat which protects him for twelve months, unless another person applies for a protection for a similar invention, when notice thereof is given the person filing the caveat, and he is required within three months of the date of such notice to file his complete specification, model, &c., and make his final application for the patent. In Great Britain the inventor is allowed to file a "provisional specification" which protects him for six months, on payment of a small fee; and if he proposes to proceed with his application for a patent, having satisfied himself of the novelty and utility of his invention or discovery, notice thereof must be given to the Commissioner not less than eight weeks before the expiration of the term of provisional protection; and at least eight days before the expiration of such provisional protection, he is required to file his complete specification, and make application for the issue of the letters patent. We strongly urge the introduction of somewhat similar provisions in any amended Act that may be passed in this Province.

To the above we would add, that the fees should be so raised as to cover the expense of printing the specifications in full, with wood-cut illustrations when necessary; and that this should be done within a given number of days, say one month, after the issue of letters patent; and that copies of such specifications should be sent to the Libraries of the Boards of Arts, and Agriculture, and Mechanics' and similar institutions, for public reference.

The advantage of such publicity to inventors, would far more than compensate them for the additional fees paid; and intending applicants for patents would thus be able to ascertain the nature

of previously patented inventions, and in many cases save the expense and annoyance of making fruitless applications for patents. The public would also be promptly informed of the nature of all inventions and discoveries patented, and would have an opportunity of examining and judging for themselves as to their utility.

It would also tend to prevent the setting up of false "claims" by patentees, and be of great assistance to inventors, if the issue of letters patent were announced monthly in the *Canada Gazette*, with a short "claim" registered by each patentee, in the same manner as these are published in the United States, and of which we give two examples for illustration :—

41,141.— Machine for making Horse-shoe Nails.— Daniel Dodge, Keeseville, N.Y. :

I claim, first, the employment in a machine for making forged nails, of cutters so constructed, arranged and operating as to serve the purpose of cutting metal from the side to reduce the thickness and produce the desired form of the point of a nail, substantially as herein specified.

Second, the finger, f, or its equivalent operating in combination with the upper cutter, b, and with a fixed guide or gage, substantially as and for the purpose herein set forth.

41,142.— Washing Machine.— Samuel Davis, Providence, R. I. :

I claim the combination and arrangement of the dasher, B, and upright, C, with the deflector, D, lever, E, standard, I, rest, e, and shelf, f, substantially as described.

There are numerous anomalies and uncertainties in the legal construction of the present law, which will no doubt be remedied in the framing of the new Bill.

THE GRAMMAR SCHOOLS OF ONTARIO.

Our correspondent, WORKER, on the subject of Grammar School Education, in this number of the Journal, clearly demonstrates their primary object to be the imparting of a high standard of "practical English and commercial education;" and in which provision is also intended to be made for the thorough instruction of pupils intending to follow engineering or mechanical pursuits; and that the character given these schools by those to whom the duty of controlling them has been entrusted, in making them mere classical institutions, as preparatory to the admission to the Universities and the professions, is, that "the interests of 90 boys are sacrificed to the interests of 10," or, in other words, that the grammar school funds are perverted, or misapplied, and an injustice is done to the people who contribute them, and to nine-tenths of the pupils who avail themselves of them.

WORKER is undoubtedly right, when he says that grammar schools "could easily be made to supply nearly all that is required" in the matter of technical education; and were the grammar school means of instruction supplemented by provisions for evening class instruction for adults, and the "brushing" up of those who had previously passed through the grammar schools, all appliances requisite for a high standard of technical education would be provided, short of the actual workshop for practical operations. The subject demands the attention of the school authorities, and especially of trustees of grammar schools.

By the way, the impression is abroad that no boy can be admitted as a pupil in any of our grammar schools, unless he enters for one or both of the Latin and Greek classics, or can pass a much higher grade of examination than what is required for entering the classical course. If this is the case, it is plainly contrary to the spirit and intentions of the statute; as a "practical English and commercial education" may certainly be imparted distinct from a study of Latin and Greek, or the course of studies laid down as preparatory to the surveying or civil engineering professions.

If there is any doubt as to the intention of the statute, our view of it is certainly sustained by the circular of instruction to the head masters of grammar schools, dated 1st December, 1865, in which the chief superintendent, the Rev. Dr. Ryerson, in reference to the comprehensive objects of the grammar school law, says, first, it is "to make the grammar schools the high schools of their respective localities;" and after naming the other objects contemplated, such as preparatory schools for the Universities and the professions, concludes by remarking that they are intended "to impart the higher branches of an English and commercial education to those youths whose parents do not wish them to study Greek or Latin." This leaves no room for doubt, as to the primary and most important objects for which these schools have been organized.

THE PAST AND THE FUTURE OF THE JOURNAL.

This number commences the Eighth Yearly Volume of the *Journal*. We look back with some degree of satisfaction at its past history, which shows no *mean* record of the best and most useful inventions and discoveries, and improved industrial processes, of Great Britain and the other nations of Europe, and the United States of America.

We have neither the time nor the ability to write elaborate original articles on technical subjects; nor has the Board the means necessary to enable it to employ an editorial staff in that department. We do, however, in the midst of a

multiplicity of other duties, exercise great care, and we flatter ourselves a fair amount of judgment, in making selections for the pages of the *Journal* from the best of the British and American Scientific and Mechanical publications; such selections as, if studied by our Artisans and Engineers, cannot but afford them a vast amount of information; and which, if practically applied, would be of great benefit both to themselves and to the Province. We shall endeavour to use as much care during the year now commencing; and trust that at its termination we may have earned as flattering encomiums as we *have* received on our past labours, in this matter. If we succeed in this, we shall be abundantly satisfied; and will also have met the requirements of the Statute in this respect, which provides that the Board "shall, from time to time, publish, in such manner and form as to secure the widest circulation among the Mechanics' Institutes, and among mechanics, artizans and manufacturers generally, all such Reports, Essays, Lectures and other literary compositions, conveying useful information, as the said Boards are respectively able to procure."

At the close of the sixth volume we gave a short summary of its contents: it may not be amiss to do so in regard to that just closed. Volume VII. contains some twenty Original Articles, besides interesting Correspondence; several papers on Technical or Industrial Education; upwards of two hundred useful Receipts, and Tables and other Practical Memoranda; thirteen articles on Steam-engines, Boilers, &c.; nine on Petroleum as Steam-fuel, and seventeen others on Petroleum; twenty-six articles and notices on Photography; thirty on the manufacture of or manipulations in Iron and Steel; fifty Statistical tables and notices; proceedings of Mechanics' and other Institutions; lists of Canadian Patents and Trade Marks; several articles on the important subject of Disinfectants; lists of recent British and American publications, and Books added to the Board Free Library; Prize Lists and Awards, and various notices of the Paris and Provincial Exhibitions; the most complete Classified Catalogue yet published of Canadian Birds; upwards of one hundred papers and notices of Machinery and Manufactures; and large number of clippings on Miscellaneous but useful subjects.

The seven *bound* volumes of the *Journal* constitute one of the most valuable works of Reference for the Library shelves of the mechanic.

We repeat what we have said before, that it "is not published for profit, but at a considerable loss; the object of the Board being simply to furnish useful and practical information, at such a small cost that no one need be without it.

We shall be happy to continue our accquaintance with present subscribers, and to make many new accquaintances, also, in new subscribers to the eight volume."

Old subscribers receiving this number and not wishing to continue their subscriptions, will please *remail* to the Board.

CANADIAN PATENTED INVENTIONS OF THE PAST YEAR.

Canada is too young and its population too sparse to constitute a very remunerative field for Inventors and Discoverers, or for the introduction of many of the leading manufactures of older and denser populated countries. We have a goodly number of patented inventions recorded; but *few* ever realize the expectations of the patentees—the bulk of them pass quietly into oblivion, or are heard of *only* in the pages of the *Canada Gazette*, the *Canadian Almanac*, or this *Journal*.

We have no list made public of Patents issued since June 30th, 1867; but to that date, from July 1st, 1866, they numbered 297. A complete analysis of these would occupy too much space; but the following classification will show in what direction the inventive talent of the country mostly runs.

Of the 297 inventions patented, 57 were for Machinery, principally for manufacturing purposes, and tools; 36 for heating and illuminating — the *medium* for the majority of these being petroleum or its products: 29 were for Agricultural Machines and Implements; 28 for Domestic Implements and conveniences; 27 for new articles of Manufacture, or improvements in old ones; 20 for Chemical preparations or processes; 15 for machines to operate on, or to be operated upon by liquids; 14 for improvements in vehicles; 14 for railway stock and appliances; 14 inventions or improvements relating to doors, gates and fences; 9 relating to steam engines and boilers; 7 to fire-arms and projectiles; 5 to household furniture; 4 to Sewing Machines; 3 to Musical Instruments; and 6 of a miscellaneous character, not easily classified.

As we have already remarked, but few of the patentees realize any benefit from their inventions. This, in many cases, is owing not so much to the absence of merit or utility in the articles invented, as to the fact of their not being made known to the public. If an invention is worth patenting, it is surely worth the expense of a woodcut illustration and a written description. These we have all

along offered to publish in the Journal free of charge, if sent to us for the purpose.

The mere announcement that Mr. *so* and *so* has received a patent for *such* and *such* an invention, is not sufficient in itself to interest the public in it. An illustrative picture at once arrests the attention; and if there is *anything in it*, it will thus most likely be discovered, and a practical use be made of it. The hint is again thrown out for those most interested.

GRAMMAR SCHOOL TEACHER WANTED.

WANTED, a Teacher, for the classical department of the——— Place Union Grammar and Common School; salary $500. Applications will be received till 31st inst.

Ho! ye graduates of Universities, who have spent probably the best portion of your days, wearying yourselves it may be over the midnight lamp, and undermining your health in obtaining academic honours, now is your reward nigh at hand. What if, as the sons of poor but ambitious Farmers, Mechanics or Labourers, some of you have been enabled to maintain your position until graduating at the age of from 20 to 25 years, without having had any returns for time and capital expended in your education? That time has passed by, and your future labours in "teaching the young idea how to shoot" shall be abundantly recognized. $500 salary per annum as classical teacher in the ——— Union Grammar and Common School! What liberality!. Had your parents educated you to some mechanical business, and you had become equally skilled in it as you now are in Latin and Greek, you might indeed have been more liberally paid; or had you been fortunate enough to have secured the position of porter in some good mercantile house, it might have been far better both as to your health and your pecuniary reward; but as a classical scholar, who has honourably won distinctions in the chief educational establishments of the land, be *content* with "salary $500" per annum—it might be much worse. If you give entire satisfaction to everybody, especially to the trustees of the school and the parents of the pupils, you may yet attain the honourable position offered to some *one* aspirant candidate, in the following clipping from the *Globe* of the same date:—

WANTED, for the ——— Union School, a Grammar School Teacher, to commence after the Christmas holidays.
Applications with Testimonials, will be received until the 25th instant.
Personal applications preferable.
Salary—$600 per annum.

Only think of it—the privilege granted of making a personal application; and should you fail to obtain such a desirable advancement as $600 annual salary would give, you need not retain or go back to your $500 position—that is, if you are of stout build, 5 ft. 10 in. or upwards in height, and of good moral character—the Toronto City Police Force is open to you, in which you would be equally well remunerated.

We advise you not to refuse to accept appointments in the schools to which the above advertisements refer, if you can secure them; for only one gentleman can possibly attain the $750 a year salary offered in the next slip, also cut from the *Globe* of the same date. Here it is:—

APPLICATIONS will be received by the undersigned for a Teacher for the Port ——— Grammar School up to the 28th inst., salary—$750. Testimonials, &c., to accompany application.

Should we notice in the daily press any offers of salaries in advance of $750, we will call attention to it on the first opportunity.

Seriously—these offers are insults to capable men, and a disgrace to our Province.

OUR EXCHANGES.

The Trade Review.

We beg to call attention to the advertisement of this ably conducted Trade Journal. Its valuable statistics, trade circulars, reports and well written articles on almost all matters pertaining to the business of this Dominion, stamps it as a work that should be in the counting room of every business man.

Another of our valued exchanges is

The Grocer—

a weekly *Trade* Journal, which circulates extensively amongst Grocers, Oil and Colormen, Provision Merchants, Manufacturers, and General Merchants throughout the world. It contains Prices Current, Latest Market Reports, &c., &c. In the Advertisement pages are Price Lists of many of the principal Wholesale Houses and Manufacturers, and other important information.

The Oil Trade Review

is also presented to the subscribers to *the Grocer*, once a month. It is wholly devoted to the Trade which it represents: petroleum and other oils. Articles are also given describing the various modes of Manufacturing and Refining; the Current Trade News, Prices Current, Patents, &c. Subscription to the two papers is 20*s*. sterling per annum, or the *Oil Review* alone 5*s*. It is published by H. S. Simpson, Monument Yard, London, England.

Morgan's Trade Review

is a monthly publication devoted exclusively to the interests of Merchants and Traders resident out of England. It contains current values of the various exports in the home markets, together with market values, descriptions and prices of articles adapted

for export, &c., &c. Its subscription price is 20*s.* sterling per annum—Morgan Brothers, Bow Lane, London, England, publishers.

The Journal of Gas Lighting, and the American Gas Light Journal,

are both excellent semi-monthly publications, and afford a large amount of information on all matters of *lighting*, *water supply* and *sanitary* improvements. The former is published at 11 Bolt Court, Fleet St., London, at 15*s.* stg. per annum; and the latter at 22 Pine St., New York, at $3 per annum, American funds.

The American Artizan

advertisement, on the third page of our cover, correctly describes the character of that journal. We know of no more useful publication on this continent, for the mechanic and practical man.

The American Agriculturist

was noticed in the November number of the Journal —now is the time to subscribe for it.

The American Farmer,

published at Rochester, at $1 per annum, U. S. funds; and

The Gardeners' Monthly,

published at Philadelphia, at $2 per annum, are both excellent publications. We also regularly receive

The Canadian Farmer,

The Journal of Education

For both Ontario and Quebec.

The Canadian Agriculturist,

The Canadian Naturalist,

AND

The Canadian Journal.

These publications are well known here, and need no further recommendation from us. The British

Commisioner of Patents Journal

is issued twice a week, and contains lists of all "applications for patents," "notices to proceed," "patents sealed," &c., &c.

The Photographic Journal

is published monthly, at 6*d.* a number, by the Photograph Society of London: it contains a large number of valuable papers, and information on photographic subjects.

The last we shall mention at present is

Willis' Price Current of Literature.

This is a monthly list, of some 36 8vo., pages, of second-hand books; and also a list of new current works, on sale by Messrs. Willis & Sotheran, of 136, Strand, London. Books ancient and modern, rare and valuable, may be selected any month from these lists. An excellent work for curators of public libraries. Subscription 3*d.* per number.

Board of Arts and Manufactures
FOR ONTARIO.

ANNUAL MEETING OF THE BOARD.

According to the Statute, the Annual Meeting of the Board should be held on the first Tuesday in the month of January; but as previous to last year that has also been one of the days of the Municipal Elections, and is now the day after, it has always been impossible to obtain a quorum; and the meeting has consequently had to be adjourned. The same course will doubtless have to be taken this year, of which adjournment due notice will be given. The Meeting will, no doubt, be held on Tuesday, the 21st instant.

By an amended act, recently passed, the time for electing Delegates by Mechanic's Institutes and Boards of Trade has been changed from the first meeting of each Society in the month of January, to the last meeting in the preceding year. By an oversight we neglected to mention this in the December number; but if the appointments have not yet been made, it will be quite legal to make them during this month.

ODD NUMBERS WANTED.

Any of our readers having duplicates of the following numbers of this Journal, or copies that they do not intend to file, would confer a favor by mailing them to this office. Full value will be allowed for them :—

1862.—January, February, November & December.
1863.—March, September and November.

ARREARS DUE THE JOURNAL.

Subscribers in arrears for this Journal, either for the past or previous years, are requested to remit the amount due, in postage stamps or otherwise.

W. Edwards, *Secretary.*

The expansion of the rails of a railroad 500 miles long amounts in a hot summer's day to nearly a quarter of a mile from the point of the extreme contraction in winter. Of course this expansion is all taken up by the joints.

The amount of capital expended on the Suez canal, last year was $10,600,000. The estimated amount still required to be expended before the work will be completed, is said to be $29,600,000.

The total weight of the Enfield and its sixty rounds of ammunition, is 14lbs. 6oz. and 11drms.

Practice and persistance are the elements of the mechanic's success.

Correspondence.

TECHNICAL EDUCATION—THE FOREIGNER AND THE BRITON.

(NO. III.)

Provision required for Education.

The provision which Britain and Canada equally require, is that which shall be most efficient for the development of the abilities of their people, placing the highest culture and noblest places within the reach of all, high and low, rich and poor, who have brains capable of attaining to the one, and ability befitting the other. Such a system was in existence in Scotland, when the parish school afforded to the humblest peasants, who had good sense and ambition enough to wish to see their "laddies" become great and good men, and filling the highest and most honoured positions in a nation, the means of giving them that education which is the very best aid and incentive to rising in the world. To the disgrace of the nation, and the unmitigated discredit of the quackery that presides at Kensington and Whitehall, and rules the Educational Department, this excellent condition of things, which did so much to raise Scotchmen to fill important positions in every region of the globe, is fast disappearing and giving place to schemes which have neither reason nor common sense to defend them, nor any better recommendation than the sheer assertions of a peculiar clique. The parochial schools of Britain and the common schools of Canada, ought to place the preparatory education which the University requires within the reach of the humblest citizen who wishes and is willing to strive to obtain it for their children. (As to getting it without striving or paying for it, no one has a right to expect it.) The Mechanics' Institutes ought to provide for the man with brains and inclination a means of acquiring every information *out of working hours*, which may tend to make him a wiser or better man, or more efficient workman; while a central university, by the mere exercise of examining power, should put the highest literary and scientific degrees and distinctions within the reach of all of every station who have ability and perseverance sufficient to reach them, the regular attendance at its classes putting the opportunity of obtaining the polish a residence alone can afford, also within the reach of all, thus enabling the humblest to fit himself, if he have the ability, for taking his place in those distinguished circles where gentlemanly bearing is as much a requisite as extensive learning. All this may be done, and done effectively, with less trouble and expense than would be required to establish and support the quackery of polytechnicalities as a cure for artistic backsliding, and which must one day take its place among national follies.

For this purpose it is only necessary that parochial or common schools should be provided—not so much with trained teachers as educated men (though both would be best), men of virtue and good sense, and fitted by a knowledge of the principles on which their success as educators depends to discharge wisely and well the high and holy calling of enlivening constitutional dulness and developing latent talent, of preparing at a distance the virtues of other years, and training up, in conjunction with mothers, the youthhood of the land—not in reading, writing and arithmetic merely, but mainly and chiefly in the ability which elevates and the virtues which adorn high positions.

Having such teachers, pay them well, honour them for their excellencies and their vocation, and leave them to exercise their own judgment and discretion, in their laborious and important work, without the supervision of inspectors, lay or clerical; but at liberty like medical men, clergymen and lawyers, to attain eminence and distinction, conferring benefits on the public and bringing credit to themselves, without being "cribbed, cabined and confined" by pothouse politicians, or even by the wisest and best of their own or other professions. If they are not fit for their important task, inspection will never make them so: if they are not to be trusted for faithfully doing their duty to the best of their ability, the most consummate scoundrel will have little difficulty in making the best appearance on inspection day. It is only bunglers, those who are only half up in their work, who fail to know and provide for inspectorial idiosyncrasies and contingencies; while in nine cases out of ten the conscientious and able teacher, who will not *stoop* to humour the one or care for the other, comes off second best.

Provide mechanics' institutes in the same way with the very best instructors, and colleges with the very best professors; pay all well, leaving plenty of scope for and inducements to attain distinction, and you have provided all that any nation requires for the highest development of the abilities, and, with an efficient clergy, for fostering the virtues, of its people. Aids of course may be found in giving virtue and ability preference in positions of trust, emolument and eminence; but these must be to a large extent local and exceptional—the great and essential outlines are as I have stated; they are all that is absolutely necessary—they are amply sufficient: neither of which can be predicated rightly of any existing continental plan,

or portion of a plan, and they require only slight modification of and additions to the machinery already existing, and will add little or nothing to the present expenditure for the same population, in either the old country or the new.

The principal impediment to the full development of this scheme is the want of any system of true philosophy, as to the science and art of education. In this, the most important by far of all in the science and art department, our operatives are more without trustworthy information than were the mechanics of three centuries ago, when Nature's abhorrence of a vacuum and the principles of lightness were among their principal scientific formulæ; and earth, air, fire and water, made up the number of the chemical elements. In the preparation of a sound philosophy on this subject, there is a field for our Educational Department acquiring in the future laurels to which those they at present wear will be but summer flowers, and of conferring a boon on the nations such as no name in the catalogue of benefactors can claim.

S. R.

P.S.—I have already trespassed greatly on your patience and space, but must solicit the favor of one other letter, to take up the glove you have thrown down, in your addenda to my last (and which in your usual succinct pertinence gives an unmistakable issue); and show that while the educational appliances of Britain are not all they should be, yet they are such as to leave most workers without excuse for ignorance or inability —leaving to the admirers of the continental provision (with which of course they are familiar) to do the same for it, and you and your readers to judge when both sides are before you whether there is any ground for the allegation that foreign workers are surpassing British, owing to the superiority of their educational advantages.

GRAMMAR SCHOOLS AND TECHNICAL EDUCATION.

(No. III.)

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

In the Grammar School Act of 1853 occurs the following; "In each County Grammar School provision shall be made to give instruction, by a teacher or teachers of competent ability and good moral character, in the higher branches of a practical English and Commercial education, including the elements of Natural Philosophy and Mechanics, and also in the Greek and Latin Languages, and Mathematics, so far as to prepare students for the University College, or for any College affiliated with the University of Toronto, according to a programme of studies, and general rules and regulations to be prescribed by the Council of Public Instruction."

There was another Act passed in 1865 called "The Grammar School Improvement Act," to which I may have to refer hereafter.

Under these two Acts there are in operation in the Province of Ontario 104 Grammar Schools, concerning which I gather the following facts:

Government Grant for 1865	.....	$53,205
Municipal " " "	.....	14,963
Fees "	.....	18,542
Other sources "	.....	13,943
Total receipts for "	.....	$100,653

of which there was expended $94,240.

The number of masters in those Grammar Schools for the same year was 149: and of pupils 5754.

Government Grant for 1866	.....	$51,816
Municipal " " "	.....	33,908
Fees "	.....	15,871
Other sources "	.....	12,939
		$114,534

To which if we add the balance from last year, and a small sum for maps, will give a total receipt for the year 1866 of $123,268.

Of this sum $113,887 was expended for the year 1866. The number of masters for the same year was 151, and of pupils 5179. Any person reading the Act of 1853, which I have placed at the beginning of this article, would without hesitation say that the primary object of Grammar Schools, is, to impart a practical English and Commercial education, including the elements of Natural Philosophy and Mechanics; and in regard to the second part —about the Greek and Latin—that it is quite subsidiary to the first part. Furthermore, would he not also conclude that what is said about preparing students for University College, &c., is said not as setting forth the object for which Grammar Schools were established, but rather the standard to which these schools were to bring their pupils. From the same extract, he would expect that if a parent brought his child to a Grammar School master, and signified his desire that his child might be prepared to pass the entrance examinations at any of the Colleges in the Province, that the school would be so equipped as to enable the pupil to pass the examinations with credit; and, on the other hand, he would at least equally expect, if another parent made a request that his child was to receive a practical English and Commercial Education, without being placed at a disadvantage either as to entrance or to encouragement while

attending the school, that this request also could be complied with. I direct attention to the last programme issued by the Council of Public Instruction, and which is now in use in the Grammar Schools of Ontario, viz.—

3. Pupils in order to be admitted to the Grammar School, must be able, 1. To read intelligibly a passage from any common reading book. 2. To spell correctly the words of an ordinary sentence. 3. To work questions in the four simple rules of arithmetic.

5. Must know the rudiments of English Grammar, so as to be able to parse an easy sentence.

4. To afford every possible facility for learning French, girls may, at the option of the Trustees, be admitted to any Grammar School on passing the preliminary and final entrance examinations required for the admission of boys. Girls thus admitted will take French (and not Latin or Greek) and the English subjects of the classical course for boys; but they are not to be returned or recognized as pupils pursuing either of the prescribed Programmes of Studies for the Grammar Schools.

SECTION III.—PROGRAMME OF STUDIES FOR CLASSICAL PUPILS IN THE GRAMMAR SCHOOLS OF UPPER CANADA.

CLASS.	I. LATIN.	II. GREEK.	III. FRENCH.	IV. ENGLISH.	V. ARITHMETIC AND MATHEMATICS.	VI. GEOGRAPHY AND HISTORY.	VII. PHYSICAL SCIENCE.	VIII. MISCELLANEOUS
FIRST, OR LOWEST.	Latin Grammar commenced. Arnold's 1st Latin Book.	None.	None.	Elements of English Grammar, Reading and Spelling.	Arithmetic. Revise the four simple rules. Reduction and Decimal Currency. Begin Simple Proportion.	Outlines of Geography.	None.	Writing Drawing. Vocal Music.
SECOND.	Latin Grammar continued. Arnold's 2nd Latin Book. Cæsar commenced.	Greek Grammar commenced. Harkness' Arnold	None.		Arithmetic. Revise previous work. Simple Proportion. Vulgar and Decimal Fractions. Algebra. First four rules.	English History. Modern and Ancient Geography.	None.	Writing. Drawing. Vocal Music.
THIRD.	Cæsar continued. Virgil. Æneid, B. II. commenced. Latin Prose Composition. Prosody comm'ncd	Greek Grammar continued. Harkness cont'd. Lucian. Charon.	Grammar and Exercises (De Fivas').	Grammar. Elements of Composition.	Arithmetic continued. Algebra. Fractions. Greatest Common Measure & Least Common Multiple. Simple Equations. Euclid, B. I.	English History continued. Ancient History. Modern and Ancient Geography.	Elements of Natural History.	Drawing. Vocal Music.
FOURTH.	Virgil. Æneid, B. II. completed. Livy. B. II., ch. 1 to 15 inclusive. Latin Prose Composition. Prosody continued.	Lucian. Life. Xenophon, Anabasis, B. 1, ch. 7, 8. Homer. Iliad, B. I.	Grammar & Exercises cont'd. Voltaire. Charles XII., B. I., II., III.	Grammar, Composition, Christian Morals and Elements of Civil Government.	Algebra. Involution and Evolution. Theory of Indices & Surds. Equations, Simple, Quadratic & Indeterminate. Euclid. Bb. I., II.	English History continued. History of Canada. Ancient Geography and History.	Elements of Natural Philosophy and History.	Drawing. Vocal Music. Book-keeping, including a knowledge of Commercial Transactions.
FIFTH.	Cicero (for the Manilian law. Ovid. Heroides I. and XIII. Horace. Odes, B. I. Composition in Prose and Verse.	Xenophon. Anabasis, B. 1, ch. 9, 10. Homer. Odyssey, B. IX. Previous subjects reviewed.	Corneille. Horace, Act IV. Review of previous subjects.		Algebra. Progression and Proportion, with revisal of previous work. Euclid, Bb. III., IV.	Previous subjects reviewed.	Elements of Physiology & Chemistry.	Drawing. Vocal Music. Telegraphy

SECTION IV.—ENTRANCE EXAMINATION AND PROGRAMME OF STUDIES FOR PUPILS NOT INTENDING TO STUDY GREEK OR LATIN.

1. Pupils desiring to become Surveyors, or to study for matriculation in the University of Toronto as students of Civil Engineering, or to study the higher English branches and French without taking Greek or Latin, must have obtained, before entering the Grammar School, such an acquaintance with the English branches as may be got in good Common Schools. Such pupils, before admission to the Grammar School, must pass an entrance examination in the following subjects:—

Arithmetic.—Proportion, with Vulgar and Decimal Fractions. (To be thoroughly understood.)

Geography.—An accurate knowledge of General Geography.

English Grammar.—The analysis and parsing of ordinary sentences.

2. The preliminary entrance examination to be conducted in the same way as that prescribed for other Grammar School pupils, and to have only a temporary force until the candidates for entrance are examined and finally admitted by the Inspector.

3. The course of study for pupils of the above classes to be as follows:

First Year.

Arithmetic, from Fractions to end of the book.

Algebra, to the end of Simple Equations.

Euclid, Books I., II., III., IV., with definitions of Book V.

Elements of Natural History (including Botany) and Physiology.

French Grammar and Exercises.

Voltaire's Histoire de Charles XII., Books I., II.

Outlines of British History to the present time.

English Grammar and Composition.

Drawing from Copy.
Book-keeping, including a knowledge of Commercial Transactions. Telegraphy (if desired).

Second Year.

Algebra continued.
Euclid, Book VI.
Elements of Chemistry and Natural Philosophy.
*Nature and use of Logarithms.
*Plane Trigonometry, as far as the solution of Plane Triangles.
French Grammar and Exercises, continued.
Voltaire's Histoire de Charles XII., Book III.
Corneille's Horace, Act IV.
Geography reviewed, and Map Drawing on the Black-board.
History of Canada, and of other British North American Provinces.
English Composition.
Christian Morals, and Elements of Civil Government

From the above it will be noticed that there are two programmes, one for pupils taking the classical course, the other for pupils intending to become surveyors or civil engineers; and that the last mentioned take English and French — not Greek or Latin. There is still another class for which there is no programme given, viz., those who do not take the classical course, and do not wish to become either surveyors or civil engineers, but who desire to obtain the higher branches of an English education. What they are to do, the Council has not yet said. On comparing the entrance examinations for the two courses, it will be observed that the one for the surveyors, &c., is considerably higher than that for the classics: I say nothing as to the former being too high or the latter too low, or both; but why the difference? and that difference against him who intends to become a surveyor or civil engineer.

Again, as to the studies while the pupil attends the school; in the classical course, the studies are pretty fairly graduated, rising gradually from class to class, with the single exception of classics; the standard being placed rather too high in these for the different classes, excepting the first. But for the surveyor or civil engineer, look at the subjects put down for the first year. Just fancy a pupil—say of 14 years of age—coming to a grammar school, intending to become a surveyor: he is shown by the master what is expected of him during the first year, in mathematics, for instance; that he is to know of Euclid Books I. II. III. IV. and definitions of V. You will be surprised when I tell you that the University of Toronto asks only the same of its first year men, together with a few propositions out of 6th Book. Surely the Council of Public Instruction entertains a very high opinion of the mathematical power of those young men who desire to become surveyors or civil engineers. This is a decided discouragement to enter on this course of study. Still further, in the Grammar School Improvement Act it is enacted, that, unless a grammar school has at least an average of ten pupils studying Greek or Latin, excepting times of sickness, such a school is not entitled to share in the Grammar School Fund. Why take the Greek or Latin alone? unless to over estimate their value as means of education; and by consequence to depreciate the other branches which are at least of equal value educationally, and, in the estimation of many, of more practical importance. It is from such indications as these that a person is able to gather what the intention of the Council of Public Instruction is, in regard to the Grammar Schools, viz: to make them classical schools merely; there by falling into the very error so much deplored at the present time in England, and in regard to which Mr. Lowe, M.P. spoke so strongly lately in Edinburgh.

Let us take the results of the two years 1865 and 1866, and see how many pupils went from all these schools to colleges and professions, as far as reported. There were 5,754 pupils attending the Grammar Schools for the year 1865. Of this number 87 entered some University or College, or passed the Law Society, *i. e.*, not 2 for every 100 who attended these schools; in 1866, 5,179 pupils attended, and 83 entered some University or College, or passed the Law Society; the same as in the previous year, less than 2 for every 100. I may be told that many of those pupils were girls, and as they do not enter Universities or Colleges, or become members of the Law Society, therefore my result is not correct. Granted: let us, then, take it in another way. I have collected statistics from one of the oldest Grammar Schools in the Province of Ontario, for the last ten years, and where no girls are admitted. Surely this will meet the case. What is the result? This: that of five hundred boys who have passed through this school for the time mentioned, only ten for every hundred entered either the Ministry, Law, Medicine, or some one of the Universities.

Reflect for a little what these statements involve, even in the most favourable case. Is it not out of the question that the interests of 90 boys are to be sacrificed to the interests of ten, even if it is for boys who take Greek and Latin? This young and rising Province is worse off in this respect than England, where many have much wealth and leisure to devote to the acquirement of such branches of learning as the Greek and Latin

* These subjects to be optional in the case of boys not preparing for Surveying, or for matriculation in the University in Civil Engineering.

classics. One of the classical masters of Harrow, England, after an experience of thirteen years, has arrived at the conclusion that of every 100 boys who enter their large schools, only 25 go to the Universities; or, in other words, that the interests of 75 are sacrificed to those of 25; but we are worse, for in our case it is 90 to 10.

I wish not to be misunderstood on this point: I do not wish to be understood as not valuing highly the importance of the ancient languages of Greece and Rome, both for their own sake and for their value as educational agents; but I would be understood as most decidedly maintaining that they are not superior to some other branches of knowledge in developing the mental powers, and inferior as regards the ordinary business of life; of greatest importance to those who intend to enter the Ministry or legal profession; and, therefore, though these languages ought to be taught in our Grammar Schools, yet this is not their sole or even their chief object.

From the programmes given above, Mr. Editor, and from the few remarks made, you will see that the Grammar Schools have a very important bearing on the subject of Technical Education, and could easily be made to supply nearly all that is required on that head. You have Geometry, Algebra and Trigonometry taught in those schools already; then, from the Act of 1853, you observe that a knowledge of Mechanics and Natural Philosophy is to be communicated; and hence, all the requisite acquaintance in Chemistry, Geology and Mineralogy, may be obtained, to make an intelligent and even an accomplished artisan. My excuse for this article being so long is, that I deem the subject of much importance, especially to those who do not intend their sons for professions, but yet are very anxious that their children should obtain a sound and rather extensive education, fitting them to discharge their duties, as citizens of this Dominion, with ease and intelligence.

WORKER.

Selected Articles.

THE GLASGOW COOKING DEPOT.

Some writer, we don't know who, has lately very fully described these Institutions through the Public Press. We cull the leading points in his article. He says:—

Passing down Jamaica Street my attention was directed to a sign on the lamp—"The Great Western Cooking Depot." A large number of persons were passing up and down a wide staircase, to rooms, or "flats" the Exterior of which from the street presented quite an inviting aspect. Three rows of handsome plate glass windows, and an ornamental iron front, gave lightness and attractiveness. The three stories all bore the same sign, and at the door were small placards which made the following announcement:—

These premises have been opened for the working classes and have accommodations for dining comfortably four hundred persons at one time.

Prices.

Bowl of Broth	One Penny
Bowl of Soup	One Penny
Bowl of Porridge	One Penny
Plate of Potatoes	One Penny
Cup of Coffee	One Penny
Cup of Tea	One Penny
Bread and Butter	One Penny
Bread and Cheese	One Penny
Boiled Egg	One Penny
Lemonade	One Penny
Soda Water	One Penny
Ginger Beer	One Penny

All of the best quality and always ready

Another bill made the following announcement: The Upper Hall of this Branch will be specially set apart for a Public Breakfast every day from a quarter to nine till a quarter past ten, consisting of the following dishes: Bowl of Porridge, Bowl of Milk, Cup of Coffee, Roll and Butter—fixed charge, three pence.

The Hall will also be specially reserved for a Public Dinner every day, from one till four o'clock, consisting of the following dishes: Bowl of Broth or Soup; Plate of Beef—hot or Cold; Plate of Potatoes; Plum Pudding—fixed charge, 4½d.

N. B.—Prices of each Article at all other hours, and in all other parts of the Establishment, same as usual.

Still another Bill gave a list of various similar places in other quarters of the city, stating that in each there was a separate room for females, and that all the daily papers were to be found in their establishments, open to the free use of the public.

Mr. Corbet, long familiarized with the necessities and requirements of the labouring poor, put into operation a plan which he had long before conceived of opening a place where the workmen could obtain good food at small rates. While the motive on Mr. Corbet's part was purely benevolence, there was nothing in the conception at war with the principles of business. It had not escaped the observation of so shrewd a social economist that food purchased and cooked on a large scale, at first cost, and with all the appliances for the time and labour which capital could command, could be readily sold at prices very much lower than the usual rates, and of a much better quality.

The money necessary to establish this first and succeeding depots Mr. Corbet considered as money lent to a business enterprize on good security; and for the use of this Mr. Corbet asks an interest of five per cent.

Though these establishment are called "cooking depots," the term does not fairly express their character. They are dining rooms or restaurants on a large scale. The Bromielaw Depot was at an early day a complete success, and by the close of 1862, there were thirteen branches—being one established for every two months. At the present time

there are twenty five of these dining rooms, in addition to the central depot, which I visited first. Many of these are much larger establishments than the original one, being capable of accommodating at one time from 300 to 500 persons, while others again are smaller, according to locality. Mr. Corbet, in 1862, when the success of his movement was beyond a doubt, thought that twenty establishments opened in the different districts of the city would be ample for its wants. It is now estimated that from thirty to forty will be required.

Everything connected with the enterprise is conducted on uniformity of operations. The rooms are all furnished in the same way. Cash is paid for everything. The best articles are purchased and at first hand. The best wages are paid for all the labour needed, and the comfort of those employed is made a prime consideration.

I fully satisfied myself by personal observations and by the statements of unprejudiced persons, there is nothing whatever in the conduct of the establishments, either in the manner of employees, in attempts to establish rules, in the articles supplied so far as the *cuisine* goes or in the manner in which they are served, to offend the most fastidious habits.

In the earlier days of the enterprise the various establishments conducted the necessary cooking, each by itself. It was soon evident that great saving might be effected by establishing a central depot, which should be essentially for cooking purposes. To make this a success it would be necessary to perfect a system of rapid distribution, supplemented of course by providing at each dining room means of keeping warm and palatable the viands thus prepared. The central depot has been in operation about two years, and is highly successful. It was built for the purposes, and cost for the building, &c. about £2,000, and with the ground about £5,000. It is in a central and accessible part of the city.

In the twenty-six establishments or depots now in operation, about two hundred and twenty persons are employed, of whom twelve or fifteen are at work in the central establishment. There is a superintendent, to whose energy and ability much of its success is due. The bookeepers assist him. Six light spring waggons are kept in constant use. There are three bakers, an engineer and a chief cook, with a number of female assistants. In the dining room none but females are employed. About one hundred are thus engaged. At the cooking depot are cooked the joints, the soup, Scotch broth, collops, bread pastry and the puddings sold in dining rooms. The soup, &c., is taken to them in large cans (the vehicles being so hung as to prevent slopping as much as possible), the meat is placed in hot closets, and with the bread, &c., all is taken in the covered vans. At each dining room is a kitchen, wherein the vegetables, tea and coffee used are cooked, and in the halls themselves are stoves, steam tables, urns, and &c., on and in which everything is kept in proper condition. Take, for instance, that peculiarily Scotch dish, whose praises Burns sung so affectionately, as

"The halesome parritch, chief of Scotia's food."

it is only to be obtained in the highest perfection when cooked in large quantities. It is commonly used for breakfast, and the depots do not undertake to furnish it of prime quality after half-past ten in the morning. The same rule applies as forcibly to the preparation of soup, the excellent broth, another Scotch dish, or the collop, a sort of hash, I believe, which is also peculiarly national, and to the bakery and preparation of the joints. It is also quite apparent that the amount of waste is reduced by this system to the minimum. In the central kitchen there are thirteen boilers, each capable of holding one hundred gallons, which is about what is used daily. Seven hundred pounds of meat is daily consumed in the preparation of these soups and the joints used. About three thousand small rolls or half-penny loaves, from sixty to eighty quartern (four pound) loaves, and several hundred great pies of apple and other fruits are daily baked at this depot. The average number of customers daily at the different dining halls is from ten thousand to twelve thousand. The amount spent by each will average about three pence, or in our currency six cents. That will give a daily receipt of about £132.

The rent paid for the buildings used is about £2,700 annually. The wages disbursed in the same period will be about £3,000. The employees all receive food, of course, and about one-third of the females are lodged in one of the depots also,—it being a rule of Mr. Corbet that they shall either live there or live at homes of their own. The average annual wages of the women will be about £15. Add to this their food and lodgings, with the fact that the money will buy at least one-half of wearing apparel more than the same amount in America, and we shall see that the average wages paid will not be less than a dollar a day. Each establishment is under the general control of a matron, the chief woman in charge of different "flats," the cashier and counter woman, the waiters and the kitchen girls, each receive compensation adequately graded, and each receives—what to any one who knows the circumstances which surround female labour in all great cities is a great desideratum—an abundance of good food. All are paid monthly.

The monthly expenditures of this great enterprise amount to about £2,700. The monthly receipts amount to about £3,500. The books are made up and balanced at the end of each month. There is a regular pay day, on which all accounts are required to be presented and are then settled. These figures show an increasing profit. The endeavour is constantly made to obtain new appliances for economy without deterioration of quality. The superintendent is now endeavouring to hire or purchase a farm at some convenient locality, on which the vegetables can be raised and the dairy be maintained. It now takes the milk of one hundred and fifty cows daily to supply the establishments.

It is evident from the foregoing figures that the enterprise of Mr. Corbet returns a handsome profit. All such returns (not counting the beforementioned five per cent on capital expended) is used for charitable purposes. The enterprise has been in operation for precisely seven years, and has returned a profit of about four thousand pounds (£4,000) of which already $3,500 have been distributed to various charitable objects.

Mr. Corbet considers that he has succeeded completely in the object at which he aimed. There is

no part of the City of Glasgow where the working man, or any one else who may desire to, cannot obtain the maximium of food, well cooked and comfortably served, at the very minimum price possible. The large number of depots enables the benefits achieved to be distributed among all who choose to use the establishments. There has been a constant addition in the middle class of customers. Whatever prejudices may have existed, if any, have long since passed away. In fact, these dining halls are pleasant, comfortable and cheap restaurants, in which any sensible man would be pleased to sit and be served.

Of course I visited the dining halls, and, at a later hour, I had the satisfaction of sitting down to a repast in the largest establishment, the quantity of which, had it all been eaten, would have sufficed for two persons, and the cost of which was but one shilling. Of course the regular habitues vary according to locality. Near the shipping you will find the depot frequented by the dock labourers, mechanics, clerks and sailors. In the foundry district, the mechanics are most frequent. In another place the majority of the customers are clerks and other persons employed in the prominent shops, &c. In still other establishments the custom is very largely transient. This is owing to locality or the prominent character of the building used. One of the most useful of these establishments is located near the ancient Glasgow University buildings and is the resort of the students.

The first one visited by me was that which attracted my attention on my arrival. Jamaica street is a very busy thoroughfare. Three large floors or "flats" are used, one room being set apart for women. The first thing that strikes you on entering is the lightness and cleanliness of the whole. It was just before the dinner hour, and the great counters were arranged with a most tempting display of the smaller dishes. The floor was uncovered but perfectly white and clean. The plate glass windows were spotless, and each window-seat had a flowering plant in it, these being the property of the employees. The furniture is simple but perfect for its purpose. A large number of plain tables about five feet long by two wide, covered with dark cloth, with a clear and sparkling water carafe in the middle of each, flanked by as clean tumblers and the necessary cruets, and a sufficiency of light easy benches, formed equipments. A few pictures on the walls, a pier glass over the mantle, perhaps a couple of vases and a Franklin stove in the fireplace, made up the furnishing. The girls were nicely and cleanly dressed, each wearing a spotless white bodice or jacket. In this establishment, consisting of three flats, about four hundred persons could be accommodated at once. The average run of customers is about fifteen hundred daily. During the two visits I made there I could see nothing different in the class of customers from those who are to be seen in the restaurants of Boston and New York. About three-fifths of the customers take dinners. Of the rest more than half take breakfast, and the remainder supper. It is the rule of all these depots to sell after five p. m. all soup and other articles, which otherwise must be thrown away, at half price. Large quantities are thus carried away, as well as consumed on the premises. Of course, meat, vegetables, bread, etc., are entirely available, and are used for soup, &c.

In another establishment I visited I also dined. It is situated in Mitchell-Lane, but a step off Buchanan street, the Regent street of this city, and is frequented by the clerks and shop-women who are employed near by, as well as by many of a superior class. The ware in use is of a neat pattern and not coarse or common looking. My dinner consisted of a basin of good and most nutritious soup, very palatable, with a small roll and bun of light and digestible bread; a large plate of good roast beef, with an abundant supply of potatoes, bread, butter, a cup of fair coffee, and a large piece of excellent apple pie, in which the fruit was made more palatable by rich milk. The pastry was good, the bread excellent, the beef tender and well cooked. The soup alone, with bread, would have made a capital luncheon, and when the meat was added, the meal was far more than sufficient. As I said, the cost was a shilling —soup, bread, butter, potatoes, coffee, one penny each; pie two-pence, and the beef three-pence, I believe. There was some little addition which I have forgotten, amounting to two-pence more. I could have obtained a good dinner for an English sixpence, or about twelve cents. Sufficient to sustain nature could be got for little more than half that, while the matron informed me that it was very seldom that the female customers averaged more than two-pence-half-penny per head.

ARTIFICIAL STONE FOR BUILDINGS, GRINDSTONES, &c.

London *Engineering* gives a very interesting account of the progress made by Mr. Ransome, of England, in the production of artificial stone, its manufacture, &c. We give the following extract:—

"If Mr. Ransome has not found the philosopher's stone, he has at least produced a stone worthy a philosopher, and which promises to become the stone of the ages. For it appears to have the elements of great durability, and it certainly possesses every other quality desirable in building stone, whether for structure or ornament. Although five years are not five centuries, chemistry has analyzed even the tooth of time, and can produce, within the period of a comparatively brief experiment, results identical with those of ages of atmospheric corrosion and disintegration. Mr. Ransome's stone has been boiled, and roasted and frozen, and pickled in acids, and fumigated with foul gases, with no more effect than if it had been a boulder of granite or a chip of the blarney stone. It has been boiled and immediately placed on ice, so as to freeze whatever water might have been absorbed, and it has been also roasted to redness, and then plunged in ice water, but without any sign of cracking or softening, superficially or otherwise. Nor does its durability rest alone upon such evidence as this, for it is of the simplest chemical composition; and chemistry and geology alike testify to the durability, if not the indestructibility, of a stone which is nearly all silica, like flint, and onyx, and agate, and jasper. It has no oxydizable constituent; for silica, or silicic acid, is already oxydized, and thus it is unalterable in air; and as the new stone is

almost impermeable, it will suffer little, if any, injury from moisture or frost. We may, then, as the lawyers say, "admit" the durability—and if we insist upon further evidence, only posterity, say in the twentieth and twenty-first centuries—can have the benefit of it, and no doubt Mr. Ransome will bequeath plenty of test blocks for their satisfaction—and the stone is everything else that can be desired of a building stone, or of a stone for external ornament, excepting, of course, that it does not polish.

And how marvellous, for its simplicity and beauty, is the process by which this stone is made! Some toiling mason or other hewing in the quarry or in the builder's yard, must have wished, before now, that stone, like iron, might be melted, and run in molds, even though his own occupation were thus at an end. Did he ever, when by the sea shore, or by a sand pit, think of cementing indissolubly together the countless millions of grains into solid rock? Mr. Ransome, no mason, however, unless he be, as he may be for anything we know, a member of the mystic brotherhood, did think of this. And he tried every cement he could lay his hands to, and did not succeed. The sand became little else than mortar by such sticking as he could effect. But he found out, at last—and we are speaking of a time more than twenty years ago—that the best sandstones were held together by silicate of lime. And so he set himself to work to produce this substance, indirectly from flints, of which plenty could be found for the purpose. But the flints had to be liquefied first, and how could this be done? Not by heat, nor would caustic soda touch them, so the chemists said. Flints might be boiled in a caustic solution for a week together, so long as the boiler was an open one, and lose very little by the operation. But by-and-by, Frederick Ransome made one of the most unexpected discoveries in chemistry, viz., that when boiled in a caustic solution, under pressure, flints would melt almost like tallow before the fire. But we are not about to give the long history of the invention. With flint soup, or silicate of soda as a liquid, the question was what other liquid would, in mixing with it, turn both into an enduring solid? What other liquid would turn both into silicate of lime—the substance he was seeking? When he found that chloride of calcium (in solution) would, when mixed with silicate of soda, turn both into flint, or something very much like it, the road was clear, and the manufacture of stone from sand was as simple and beautiful a process as the making of Bessemer steel from pig iron by blowing air through it when in a melted state. Chloride of calcium had been chemically considered a very respectable married couple, known as Ca and Cl. There was a little bigamy attaching to silicate of soda, but the principal parties to the marriage were silicium and natrium, or Si and Na. But, as has happened before now with organic bodies, those inorganic couples, on their introduction to each other, at once ran away with each other's husbands and wives. Si, although still keeping his wife O, took Ca and became silicate of lime, while Cl and Na were, like Lot's wife, turned into salt, or chloride of sodium, for their wickedness.

The sand, a clean-grained, slightly brownish sort, just such as a dishonest grocer might select for increasing the gravity specific or otherwise, of his sugar, comes from near Maidstone. There is no end to the quantity of it, and we believe it costs less than 3s. a ton in the Thames. There are flints, enough for a hundred years to come, brought up from the chalk pits at Charlton; and the caustic soda and the chlorine of calcium, the latter a waste product of the soda manufacture, are bought of the wholesale chemists. The silicate of soda is made from the flints and caustic soda as follows:—The flints are heaped upon iron gratings within a series of cylindrical digesters, of the material, size, and form, of small steam boilers. A solution of caustic soda is then added; the digester is then closed steam tight, and the contents are boiled by steam of 70lb., taken from a neighbouring boiler, and led through the solution in a coil of iron pipes. The solution of caustic soda is prepared of a specific gravity of about 1,200°. The flints are dissolved into "soluble glass," and are drawn off in that state, as a clear though imperfectly liquid substance, which is afterward evaporated to a treacly consistency and colour, and of a specific gravity of 1,700°.

The sand is completely dried at the rate of two tons an hour, within a revolving cylinder, through which hot air is forced by a centrifugal fan. A small portion of finely ground carbonate of lime, say Kentish rag, or even chalk, is mixed with the sand, the more closely to fill the interstices; and each bushel of the mixture is then worked up in a loam mill, along with a gallon of the silicate of soda. Thoroughly mixed with this substance, the sand has a sticky coherence, sufficient to enable it to be molded to any form, and, when well rammed, to retain its shape, if very carefully handled. In this condition—molded, of course, and any thing that can be done in founder's loam may be done in this sand, sticky with silicate of soda—in this condition it is ready for the solution of chloride of calcium. The instant this is poured upon the molded sand, induration commences. In a minute or so, we hardened little lumps of sand, so slightly stuck together by the silicate of soda that we could hardly keep them from falling to pieces within the fingers, into pebbles so hard that they might be thrown against a wall without breaking, and only a short further saturation was necessary to indurate them throughout. In other words, on the instant of contact, the silicate of soda and the chloride of calcium mutually decompose each other, and reunite as silicate of lime and chloride of sodium, the former practically indestructible in air, the latter, common salt, perfectly deliquescent and removable by washing, although the stone, after the washing, is impermeable to water. Plaster of Paris does not set quicker than silicate of soda and chloride of calcium.

The chloric solution is first ladled upon the molded sand, and the hardening going on, the objects are afterwards immmersed in the solution itself, wherein large pieces are left for several hours, the solution being boiled in the open tanks by steam led through it in pipes. This expels any air which may have lodged in the stone, and possibly heightens the energy of union with the silicate.

After this the stone is placed, for a longer or shorter time, according to the size of the object, under a shower bath of cold water. This is not,

by bathing, to convert it into Bath stone, although were the Bath stone a sandstone, instead of an oolitic formation, this name would do as well as any. The salt, or chloride of sodium, deposited throughout the interstices, is sought out and washed away, in brine, by the water, and were it not that a portion of undecomposed chloride of calcium was also washed out, this brine might be profitably evaporated for common salt. Now this searching out of the salt by the water would appear to prove that the stone was perfectly permeable, but, by one of those paradoxes with which chemistry abounds, the stone, when once freed from salt, is almost impermeable. The action is one which, if it can be explained at all, can only be explained as one of the phenomena of dialysis, as experimentally investigated by Professor Graham. There is no doubt whatever that salt has been deposited everywhere throughout the stone, no doubt that it is afterward completely washed out, and yet the stone as effectually resists the passage of water afterward as if it were granite or marble.

It is not necessary to describe the variety of objects that may be made in the new stone. It is practically a fictile manufacture, although not indurated by fire, and, unlike fictile goods, having no shrinkage or alteration of colour in the making. Whatever the required size of the finished stone, it is molded exactly to that size, with no allowance as in molding fire-clay goods or in pattern making for castings in iron. The heaviest blocks for works of stability, and the most elaborately ornamented capitals, tracery, or copies of statuary may be made with almost equal facility. For any purpose for which natural stone has ever been used for construction or architectural ornament, the artificial stone will fitly take its place. Mr. Fowler has used it extensively in the stations of the Metropolitan Railway; Messrs. Lucas Brothers have used it with success in various works; several manufacturers at Ipswich and elsewhere have the bed stones of their steam engines, steam hammers, oil mills, etc., formed of the new stone. Mr. Ransome has molded a large number of Ionic capitals for the New Zealand post office, and still more richly embellished capitals, modeled from those of the Erectheum at Athens, for public buildings at Calcutta, besides a great amount of decorative work for English architects."

It appears that the manufacture of this stone has also been commenced in the United States, under Ransome's patent. A recent number of the *Scientific American* says:—

"Through the kindness of Hon. David Naar, President of the "Ransome Patent Stone Co. of New Jersey," we have had an opportunity of witnessing the process ourselves. We confess ourselves to have been unexpectedly pleased not only with the simplicity of the process, but with the facilities which the company have for the manufacture of the stone, and the beautiful results which they accomplish.

* * * * * *

The stone, as compared with the sandstones in use, is considerably cheaper, and when capitals or ornamental moldings are required, the cost is not more than one eighth. Its weight is about 140 pounds to the cubic foot. The color is about the same as the Portland stone, depending of course upon the color of the sand used. It is easily colored, however, to any tint required. It has been subjected to the severest tests as to its durability, and so far shows greater resisting and durable qualities than the sandstones in use.

It is being made not only in Europe but in several parts of this country, and is beginning to be used for building purposes, and the true test, that of time and the weather is being applied to it.

We cannot predict that it will endure as long as the Pyramids, but its composition is such, and it so well withstands the tests to which it has been subjected, as to give us good reason to hope and believe that it is equal if not superior in durable qualities to most of the building stone in use.

Those who have been foremost in undertaking the manufacture of the stone in this country deserve success, and we believe the article will fill a want long experienced by builders, and we hope they will not let prejudice deter them from giving it a fair trial. It is not remarkable that such a discovery has been made; the wonder is that it has not been made before. Our exchanges from England mention the Ransome process as a practical success for nearly every purpose to which stone is used, even to the manufacture of grindstones."

On the application of this manufacture to artificial grindstones, and the results, we quote from a more recent number of *Engineering*:—

"There seems little doubt that the use of natural stones for grinding purposes will eventually become the exception instead of the rule. Among other firms, Messrs. Bryan Donkin and Co., the well-known engineers, of Bermondsey, have tried experiments which very decisively prove the advantages of the artificial over the natural stones. Messrs. Donkin were first supplied with a pair of Mr. Ransome's artificial grindstones in December last; and early in the present year they carefully tested these stones and compared their efficiency with some Newcastle stones at their works. Both the natural and artificial stones were mounted in pairs on Muir's plan—a system in which the peripheries of the two stones of each pair rub slightly against each other, with a view of causing them to maintain an even surface—and the two sets of stones were tried under precisely the same circumstances, except that the Newcastle stones had a surface speed more than 20 per cent greater than that of the others.

The trials were made as follows: A bar of steel, ¾ in. in diameter, was placed in an iron tube containing a spiral spring, and the combination was then arranged so that the end of the bar projecting from the one end of the tube barely touched one of the artificial stones, while the other end rested against a block of wood fixed to the grindstone frame. A piece of wood of known thickness was then introduced between the end of the fixed block, and the spiral spring, being thus compressed, forced the piece of steel against the grindstone. The same bar of steel was afterward applied in the same way and under precisely the same pressure, to the Newcastle stone, and the times occupied in both cases in grinding away a certain weight of steel from the bar were accurately noted.

The results were that a quarter of an ounce of steel was ground from the bar by the artificial grindstone in *sixteen minutes*, while to remove the same quantity by the Newcastle stone occupied *eleven hours*, and this notwithstanding that the surface speed of the latter was, as we have stated, more than 20 per cent. greater. Taking the 20 per cent. greater speed of the Newcastle stone into account, it will be seen that the 11 hours run by it were equal to 13¾ hours at the same speed as the artificial stone, and the proportional times occupied by the two stones were thus as 16 minutes to 13¾ hours, or as 1 to 52, nearly!

Such a result as this is something more than remarkable, and it is one which would scarcely have been credited, even by those who made the experiments, if it had not been fully corroborated by subsequent experience in the working of the artificial grindstones. Since the experiments above described were tried, Messrs. Donkin have set another pair of the artificial stones to work, and these which are now in regular use, have given more satisfaction than those first tried. The saving in time, and consequently, in labor, effected by the use of the artificial grindstones is, in fact, so great that Messrs. Donkin have determined to use these stones exclusively in future; and we may add that the artificial stones are so much preferred by the workmen that those men, even, who are employed in shops at some distance from that in which the stones at present in use are situated prefer taking the trouble to go to them to using the Newcastle stones in their own shops. In addition to their great efficiency, the artificial grindstones possess the advantages of being able to be manufactured of any size, and of any degree of coarseness of grain, and they can thus be specially adapted to any particular class of work, while the process of their manufacture insures their being of uniform texture throughout, and free from the flaws and hard and soft places found in natural stones. Altogether, we believe that the general adoption of the artificial grindstones is merely a matter of time.

Machinery and Manufactures.

Steel under the Microscope.

An experienced steel-maker can estimate very closely the precise quality, chemical composition, tensile and compressive strength, and even the mode of treatment which steel has undergone, by looking at its fracture. The appearance of the crystalline texture, which is more or less discernible by the naked eye, and the method in which the reflected light gives certain variations of lustre, are the scanty yet very important indications from which, by a series of guesses as to probabilities, an opinion may be formed which has every chance of being correct. This being the case, it seems very obvious that by the assistance of the microscope, we should be capable of observing the texture of steel and iron fractures more correctly and more minutely, and a smaller amount of experience or nicety of observation should be sufficient—should enable us to form a correct opinion of the qualities of any given sample of steel. This is the case, and to such an extent that it is most astonishing how metallurgists could have neglected the use of the microscope to such an extent as it generally has been. We have already drawn attention in this journal to the interesting researches made by M. Schott, the manager of Count Stöllberg's foundry, at Ilsenburg, upon the appearance of liquid and solidifying cast-iron under the microscope, and we can quote the experience of this able metallurgist as to the advantages to be obtained from microscopic observation of various kinds of steel. M. Schott, at his visit to the Paris Exhibition, made some most remarkable "guesses," as some steel-makers would call his conclusions, with regard to the qualities and method of manufacture of many hundreds of steel samples exhibited there, and of which he, in many cases, had no other knowledge than that which he could gather through the aid of a small pocket microscope, made of two pieces of rock crystal, formed into a very powerful single lens. A pocket microscope of this kind ought to be the companion of every man interested in steel or steel manufacture. Lenses of the usual kind, even if piled up in sets of three or four, are entirely insufficient. The lens must be of a very small focus, and properly achromatic. A little practice is sufficient to enable the user to "see" through this lens; but it is, of course, not quite so easy to learn the meaning of what is thus seen, and to estimate from the appearance the quality of the steel inspected.

M. Schott has established for himself a kind of theory which, we believe, will be useful to those of our readers who desire to use the microscope in their researches upon the qualities of steel. M. Schott contends that each crystal of iron is an octahedron, or rather a double pyramid raised upon a flat square base. The hights of the pyramids in proportion to their bases are not the same in different kinds of steel, and the pyramids become flatter and flatter as the proportion of carbon decreases. Consequently, in cast-iron and in the crudest kinds of hard steel, the crystals approach more to the cubical form from which the octahedron proper is derived, and the opposite extreme, or the shaft of wrought-iron, has its pyramids flattened down to parallel surfaces or leaves which, in their arrangement, produce what we call the fiber of the iron. Between these limits, all variations of hights of pyramids can be observed in the different kinds of steel, in which these crystals are arranged more or less regularly and uniformly, according to the quality and mode of manufacture. The highest quality of steel has all its crystals in parallel positions, each crystal filling the interspaces formed by the angular sides of its neighbors. The crystals stand with their axes in the direction of the pressure or percussive force exerted upon them in working, and consequently the fracture shows the side or sharp corners of all the parallel crystals. In reality good steel under the microscope shows large groups of fine crystals like the points of needles, all arranged in the same direction, and parallel to each other. If held against the light in a particular direction, each point reflects the light completely, and a series of parallel brilliant streaks are shown all over the surface. Now, the exact parallelism of the pointed ends or of the streaks of light is one of the most decisive

tests for a good quality of steel, and this is not visible quite so frequently as might be generally imagined. On the contrary, a great majority of steel fractures show crystals arranged in parallel groups or bundles as before described, but clustered together in several distinct crystalline layers which are not parallel to each other. The consequence is that the needle-points, visible under the microscope, appear to cross each other at certain places, or at least they point in such directions that, if elongated, these lines would cross each other at a short distance in front of the fractured surface. Wherever the crossing actually takes place, a ridge or line is generally visible to the naked eye, and the color of the two parts of the fractured surface which contain the different groups is different, since the light which falls upon one group at the proper angle for reflection will be in such a position with regard to the other group as to throw the points of the crystals into the shade. The one part of the surface, therefore, will appear bright or silvery white, while the other will look dark or gray in color. As usual, inferior specimens are more instructive than the best qualities, because there the peculiarities and faults come out most strikingly. We have seen a piece of a Bessemer steel-block, from a spoiled charge, in which the crystalline structure of the spiegeleisen was seen in some spaces, particularly at the edges of the air-bubbles, perfectly distinguished from the close grained crystals of the mass of steel all round. This mass, however, contained groups of very different character within itself. In a specimen of steel or iron made by another process we could discover clearly defined crystals of pyrites, indicating the existence of sulphur in an unexpectedly tangible manner. Repeated melting, heating, or hammering of steel has in general the effect of reducing the sizes of crystals, and also of laying them more parallel. Still there seems to be a difference between the treatment which gives parallelism and that which causes the reduction of sizes in the crystals. The former seems to be principally due to the action of the heat, and repeated melting is the great panacea in this respect. The small-sized crystals, or what is called fine-grain, can be obtained by mere mechanical operations. In fact, hammering at a dull red heat, or even quite cold, is known to produce the effect of making the grain of steel extremely fine. This is a property, however, which is lost by reheating, and at a sufficiently elevated temperature steel seems to crystallize in large grains, which remain if it is allowed to cool slowly and undisturbed by mechanical action.—*Engineering.*

Sleighs and Sleigh-making

As the season for using sleighs approaches, a few hints in regard to their construction will not be out of place. The manufacture of sleighs is carried on, to a greater or less extent, in all of the New England States, in Northern and Western New York, in the northern part of New Jersey, and the northern portions of the Western States. A few are built in other sections, but there is so little call for this work in more southerly latitudes that it is almost impossible to find workmen, outside of the localities we have mentioned, who can turn out a creditable sleigh.

The most popular sleigh ever introduced is that which goes by the name of the "Albany jumper," and it is the prettiest sleigh in use at the present time. The "Portland" sleigh has for some time contested the lead with this favourite, and meets with many admirers, it being both lighter and cheaper. A new and pretty style of sleigh is now made, with a body very much like the Victoria phæton in general appearance; the seat can be made separate from the body if desired. The body is either finished with a slab side or paneled; if paneled, the bottom rail must be bent. The same pattern may be used as with the "Albany jumper," and also the same top pillar. The body of the front of the seat must be about eight inches deep; the seat should pitch back about three-quarters of an inch, and be framed in the bent bottom side. The body should flare about half an inch on each side at the front end of the seat, which must project over the side of the body about four inches in front, running nearly straight to within six inches of the back, at which point the round corner begins. The seat is eight and a half inches deep at the front corner, with three inches flare. The Stanhope pillar and the moulding connected with it should retain the sweep of the "Victoria." The back of the seat should be eighteen inches in the center, and about twelve inches at the corner, and if it be made loose from the body care must be taken not to break the sweep of the back quarter; with proper attention this sweep may be kept perfect, and one or two inches sweep be put in the back. This, if made solid, will require a plank about three inches thick. Another way of making the seat is to let the bent piece run up the back, mortising in a back rail and paneling it the same as any other. The ends may be got out of one-inch whitewood, with a three-inch corner block; screw this corner block against the bent rail, and round off the corner until it comes to the edge of the back molding. The body in front of the Stanhope pillar, should be about five inches deep, running up to a point where it comes in contact with the runner; it should measure about two feet in front of the seat, and nineteen inches on the seat. The running part should be made light and strong, nothing but the best of timber being used throughout; the knees should be about three-quarters of an inch thick by an inch and a half at the top, and the same thickness as the runner at the bottom. The middle knees should not be less than eighteeen inches long between the shoulders, framed in the runner, so that the spaces will be the same between them, and at the same time pains should be taken to have the front knee-frame in the runner at a point about three inches from the ground. When the runner is set up, allow at least six inches brace to the front and back knees. The runner should be about one inch deep by one inch thick, and be allowed to run back at least three inches beyond the extreme end of the body. Care should be taken that the dash is not made too high: all that is required is to have it high enough to stop the balls from the horses' feet.

The fenders should be framed about nine inches from the body, not over three-quarters of an inch square, and neatly chamfered, leaving a place between the front and middle knee for a step-plate. There is no need of loading down the sleigh with iron work: the T-plates, with the under braces,

should be solid, and a plain brace from the runner to the knee, allowing the back one to run up to the body at a point a little below the seat, also a brace from each knee to the fender, are all that are required. A seat-brace should be run from the front knee to the runner on which should be welded an eye for the thill-coupling; care should be taken to get the eye at a point, so that when the thills are on and lifted to their proper hight the runners will run level. For shoes use the best cast steel; it pays in the end. The track varies from three feet to three feet six inches, or even three feet eight inches on the heavier sleighs.

A very pretty style of painting is to use lake on the body, for black moldings, edged with a fine line of deep red, and paint the running part a light cream color, with lake stripes, edged with red.

The most fashionable trimming is plush, of different shades of saffron, although rep is used a good deal with very light sleighs. There is often no trimming except the cushions, the inside being made very smooth and painted in some plain color, with robes substituted for trimmings.

A very handsome four or six passenger sleigh can be made by using the style we have described for the back, and a wing-shaped front; in a six-seat sleigh the inside seat should not be higher than the back seat, while the driver's seat should be at least ten inches above it. A fluted molding looks the best, on a large sleigh, and, if the body is painted black, the fluting should be striped its full width with deep red. But little ornamentation is used at the present time, a pretty monogram on the panel or seat being about the only thing that is countenanced, and this is generally put on with the same colors that are used for striping; if gilt is used for striping it should also be used for the monogram.—*Shoe and Leather Reporter.*

Imperfection of Malleable Iron.

It has for some time past been known, that the fibrous nature of iron, long considered an element of its strength, is in reality, due to the presence of foreign matters, which are taken up during manufacture, and prevent the adhesion of the adjacent particles of iron, however carefully or powerfully the metal may be compressed, or however it may be twisted, doubled up or contorted. The effect is similar to that which occurs with a glass tube hermetically sealed at both ends; however it may be drawn out, however often it may be doubled or twisted together, at even a very high temperature, the air, a foreign substance within it, will prevent the union of its particles, and cause it to have a fibrous appearance, without adding to its strength, but the contrary.

The imperfection of malleable iron from this cause has now been found far greater than was suspected. It has been shown, by experiments made on French and English armor-plates, that, however homogeneous they may seem when cut and polished, whether formed by the rollers or the hammer, they consist of laminæ not at all welded together, and presenting an appearance similar to that of a number of sheets of paper. This condition has been revealed unmistakeably by the effects produced by projectiles; and it is found to be present even when the plate has been both hammered and rolled at a welding temperature.

This discovery assumes a still more serious character, if possible, when there is question of such forgings as railway axles, screw shafts, the shafts of marine engines, and other portions of machinery, the soundness of which is of vital importance. It explains the difficulty of constructing large forgings of requisite strength; and leads, unfortunately, to the conclusion, that without fusion, as in the case of steel, there can be no adequate security with regard to the homogeneity, and therefore the strength of the material.

The intense heat employed in the manufacture softens the scoriaceous matters, but they are never expelled. This is true to a greater or less extent, even with charcoal iron. The only advantage possessed by the charcoal iron, in this respect, seems to be that the laminæ do not separate during fracture under the blow of a projectile, which is a most trying test of the amount of their adhesion.

It is worthy of notice that the laminæ are more distinctly perceptible, the better the iron, and the more capable of resisting fusion at high temperatures. Fusion seems to be an indispensable condition for the prevention of a laminated structure; hence the excellence of metal such as steel, which is subjected to fusion during manufacture When fusion has taken place, the rolls and the hammer impart new and valuable qualities. The so-called fibrous character of iron causes its practical to be far less than its theoretical power of resistance; and when it begins to give way in the shafts of marine engines, etc., the fracture commences along lines of junction of the laminæ; and the results of numerous experiments seem to show that, while the welding is very imperfect in those portions to which the shock of the hammer cannot reach; it is in all more or less faulty.—*The Scientific Review.*

The Ornamental in Engineering.

BY THOMAS HUGHES, M. P.

WITHOUT attempting further to argue with those who have found the Paris Exhibition a weariness to the flesh, let me jot down for any one who cares to read them a few of the impressions which the World's Fair has left on my mind. Perhaps the strongest of these was produced by one of the buildings in that part of the outer garden appropriated to Great Britain. I mean the *fac-simile* of the mosque of one "Syed Osman."

I am not conscious of ever having heard the name of Syed Osman till within the last fortnight. I only know of him now just so much as the placard in the front of this building tells me, that he lived some four hundred years since, and built the original of this mosque at Ahmedabad, in the year 1458, or thereabouts; on what occasion or with what object, I am perfectly ignorant. It is not, therefore, from historical association that the structure interests me, nor from an architectural point of view; for though pretty enough, it is far inferior to several of the other copies of Eastern buildings in the gardens. Nor from an antiquarian, for not a brick or stone has been brought from India to Paris; and I am told the whole building is composed of the terra-cotta in use at the Brompton Museum. But,

to cut a long story short, let me say at once that it is the ingenious and most suggestive use to which the mosque has been adapted by our commission which gives it so high a value in my eyes. Two problems suggested themselves to the commissioners in an early stage of their labors, viz; how to exhibit the boilers, for which many of our English firms are justly famous, in such a way as to get people to come to see them; and secondly, how to find hot water and steam-power for the English exhibitors—our allies having settled that each nation must provide itself with these articles. We all know what disagreeable places the ordinary rooms or sheds are in which boilers are fixed, and how unlikely to attract sight-seers. Excessive heat, oily rags, and coal-dust are the ideas most closely connected with them; and these had obviously to be avoided in the present case. The commission accordingly sunk an ample pit and bricked it round, in which exhibitors might fix their boilers in full view of the public inspecting in comfort from above. The next point was how to cover the pit in an attractive manner, leaving free current to the air, and yet giving protection from the rain; and the happy thought occurred, I believe to Mr. Cole, of erecting the mosque in question over the boiler-pit, and at the same time exemplifying the capabilities of the Brompton terra-cotta. The effect is perfect. You are attracted to the light eastern-looking building by the pretty minaret which serves as a chimney, the rows of slender twisted columns, and the delicate coloring of the whole edifice; and when there you lean over the rail and look down on great boilers without a suspicion of the dirt or stench. In the abominably cold weather of the early part of October one rather envied the comfortable, but evidently not excessive, warmth of the stokers who were tending them. There were the great boilers with makers' names affixed, glowing and singing, and exhibiting themselves to the greatest advantage, while supplying all the power for the machinery in the English department gratis. I have lately been in our wonderful manufacturing districts, in Lancashire and the West Riding, and was continually haunted by the question, "Is it necessary that this lovely country should be so defaced and defiled by the industry which is its strength and boast? Is it necessary to pollute the streams, poison all vegetation, injure the health and morals of our people, and stud these beautiful valleys and hill-sides with the ugliest buildings the eye of man has yet seen, in order to produce cotton and woollen fabrics, and coal and iron?" The mosque of Syed Osman, in the garden of the Exposition, partly answers the question; and I believe that if our manufacturers had to live near their works, it would soon be answered altogether. Perhaps the solution may come to us when the work people, who must live close to the pits and factories, have learnt to love nature and hate dirt, and their masters have discovered that it pays to treat them as fellow-workers rather than as machines.

"Shoddy."

Under the name of "shoddy" an enormous weight of material is now used which once was waste. Shoddy was first brought into use about 1813 at Batley, near Dewsbury, England. "Mungo" was adopted in the same district, but at a later period. Shoddy is the produce of soft woollen rags, such as old worn-out carpets, flannels, guernseys, stockings, and similar fabrics. Mungo is the produce of worn out broad or similar cloths of fine quality, and of the shreds and clippings of cloth. According to the *Times*, the Pollution of Rivers Commission, which has been visiting Yorkshire, was thus informed of the origin of the word "mungo"—A manufacturer gave some of the materials to his foreman, who, after trial in the shoddy machines, came back with the remark. "It winna go;" when the master exclaimed, "But it *mun go*." These old woollen rags are collected and imported from India, China, Egypt, Turkey, Russia, and, in fact, all parts of the world where woollen garments are worn. They come to Yorkshire from districts where plague, fever, small-pox, and loathsome skin diseases extensively prevail; they are sorted by human fingers when the bales are opened before being placed in machines which tear up, separate, and clean the fibre for manufacture; but the Pollution of Rivers Commission mention that fifty years' experience has proved that these rags are not in any degree dangerous to the health of those who work among them, although in many of the countries where they are collected they are believed to be peculiarly plague-bearing materials. The lapse of time in collecting, sorting, and transmitting the rags, and the possible destruction of any special poison by friction or otherwise, must be taken into account. The dirt, dust, and fine particles blown out by the machines are collected and sold for manure at from 10s. to 20s. per ton. The shoddy trade is a remarkable instance of the utilization of waste material. It forms nearly one-fifth in weight of the woollen and worsted manufacture of the West Riding. Mixed with wool, shoddy or mungo is largely used in the manufacture of cheap broadcloths, finer cloths for ladies' capes and mantles, pilots, witneys, friezes, petershams, pea-jackets, and blankets. A considerable quantity is used in the form of flocks for beds. Felted cloth is extensively manufactured with it, and used for table covers, carpets, druggets, and horse-cloths. From seventy to eighty millions of pounds weight of shoddy and extracts are used in a year in the woollen trade of this kingdom. The trade could not be carried on to its present extent without shoddy.—*Mechanics' Magazine.*

Off-Hand Sketching.

Expertness at making off-hand sketches is a very desirable accomplishment for mechanics. Few, however, are capable of producing such sketches as illustrations of any machine, method, or plan, which they wish to explain. We often hear them express regret at their inability to produce an intelligible sketch of any kind. It would seem very easy for the mechanic to make a rough sketch of a machine with which he is familiar, but observation confirms the fact that not one in ten can produce anything which would be at all intelligible to those who are not conversant with the machine.

The use of ordinary drawing instruments by the mechanic is accompanied with so many difficulties resulting from the want of practice on his part, that he disdains to employ them, and turns aside from

even the simplest attempts to produce mechanical drawings by their help. Want of time and the stiffness of hand produced by labors may be ample excuses, especially when there is also want of skill, for the ineffectual attempts to educate himself in this art. It is seldom, perhaps, that he would be called upon to make a drawing, or even to use the instruments, and the conclusive argument that it "will not pay" is decisive.

But off-hand sketches to illustrate his progress in his work, or to aid others to perform some duty, he is often called upon to produce, and these rough delineations need but little more than a bit of chalk or charcoal with which to form the lines, and the floor, the work-bench, or even a casting or boiler plate, may be the tablet on which to form the sketch. The means are almost always at command, and it needs only will and inclination, coupled with a little practice, to make these sketches very intelligible.

We regret that there are no books of illustrations, or no examples of these "chalk and charcoal sketches," by which a mechanic might be somewhat guided in his first attempts. The only lessons or hint that we can give is to make a pastime of such sketching, employing the materials we have mentioned, and by practice become skilful. Proficiency can be attained only by practice, patience, and some observation of engravings and finished drawings.—*American Artisan.*

Coating Iron and Steel with Copper.

The *Mechanics' Magazine* says:—"Letters printed in our columns a few months ago lead us to think that an easy method of giving iron and steel a firm coating of copper is a desideratum. We find a process published by Dr. Grager, which is certainly the simplest we have met with, if it be really successful. The plate or article of iron or steel, which it is desired to coat, must first of all be perfectly cleaned. It must then be brushed over with a solution of protochloride of tin, in dilute hydrochloric acid. The author makes his solution by dissolving one part of the chloride of tin in two parts of water, to which he adds two parts of commercial hydrochloric acid. Directly after this solution is applied, another of ammoniacal sulphate of copper is brushed over. The latter is made by dissolving one part of sulphate of copper in sixteen parts of water, and adding gradually sufficiently strong ammonia to form a clear dark-blue solution.

The coating of copper deposited in this way is said to be so firmly adherent that it may be polished with chalk without any fear of its being detached.

A coating of copper can be obtained on zinc by merely using the ammoniacal solution of copper, and without the preliminary use of the chloride of tin solution. The coating of copper given by this process must be excessively thin, and would only be available for decorative purposes. But if it answers, it is clear that an iron ship can be coppered as easily as she can be painted.

Deodorizing Petroleum Oil.

That very industrious technical chemist, Dr. R. Wagner, tells us that the disagreeable odor of petroleum oil can be taken away by treating the oil with a solution of plumbate of soda. This is only a solution of oxyd of lead in caustic soda, and will certainly remove all such odor as sulphur compounds might communicate to the oil. How far it may effect other smells we cannot tell without experiment.—*Mechanics' Magazine.*

A correspondent of the *American Artizan*, in reference to the above quotation says:—"plumbate of soda and potassa and many other alkaline metallic solutions have long been discovered and "caveated" for that purpose by your obedient servant, and this caveat was not filled until after much time had been expended and numberless experiments conducted by us. It may be well to add that, although plumbate of soda and potassa do deodorize petroleum oils to a great extent they also *discolor* them; but they do not deodorize Kentucky oil sufficiently to make it marketable, but by other combinations *that* also can be perfected."

Grindstone Grit as a Substitute for Fire-Brick.

Mr. Ludwig Wolf, who has charge of a number of the tempering furnaces in the ax factory at Collinsville, Conn., says that "noticing the great amount of fire brick required to keep them in order, I thought of using grindstone grit—of which we have a large quantity—knowing the adhesive quality of the grit. I tried it, and found it to work well. It does not last so long as fire brick, but it keeps the fire cleaner than the brick, and does not form clinkers so fast. I do not know if it will work as well in fires where a heavy blast is required, but if it will it is cheap enough, as for other purposes it has little value."

Silica is the principal ingredient of grindstone grit, together with oxide of iron. It would appear to be well adapted for lining such furnaces as our correspondent manages.—*Scientific American.*

Mechanical Music.

A musician of this city has contrived an apparatus which he calls a "Pianautomaton" and which is designed, as its name implies, for automatically playing upon a pianoforte any piece of music desired. The instrument is described externally, as a box of the width and length of the keyboard to which it is clamped. Through a slot runs the piece of music which is to be played, and which has this peculiarity, that all the notes are perforated through the sheet. The box has a crank which sets in motion a magneto-electric apparatus, and by its means a series of axial bars protruding below the box, strike the pianoforte keys and correctly perform the musical composition indicated by the holes in the paper. This contrivance rather belies its name in that music is ground out, as in the better known street instrument of humbler pretensions; but in another form, the apparatus is entirely self-acting, the insertion of the perforated paper causes a small lever to come in metallic contact, thus completing an electric current, the instrument then continuing to play until all the music paper has passed through the aperture, when the lever being no longer held up, the circuit is broken and the performance terminated.

The axial bars strike the key notes with four different degrees of strength, either with a *legato* or

staccato touch, and with a suitable connection with the pedals, all degrees of musical expression are attainable. It is apparent that this instrument can be made to produce effects of execution which no living artist could think of attempting. For example, a chromatic scale in octaves, thirds, or tenths; or produce the effect as if four, six, eight, or more hands were performing. There is no hesitancy in "reading at sight," and the variety of pieces need not be a limited *repertoire*, like a hand organ.—*Ibid.*

A Pneumatic-electric Organ.

Electricity has been very ingeniously and effectively applied to form a connection between the keys of an organ and the valves which permit air to pass to the pipes. Complicated mechanism is thus got rid of, an extremely simple arrangement, whatever the distance between the keys and the pipes, being substituted. Its mode of action is easily understood.

According to the *Scientific Review*, when any key is depressed by the finger a small "commutator" under it completes communication with the galvanic battery by dipping its lower ends into minute cups of mercury. Electricity then passes along a wire to a small electro-magnet, that immediately becomes excited, and, attracting a keeper, opens a valve, allowing air to pass into the organ pipe, which sounds at once, and continues to do so as long as the finger presses down the key. It is clear that, however powerful the organ or distant the the pipes, the fingers are not in the slightest degree distressed in playing. The battery used is simple, inexpensive, and permanent in its action. It consists of glass vessels, arranged on the upper surface of the bellows, and each containing a solution of sulphate of mercury; into the latter plunges a plate of zinc, which is placed between two plates of gas-retort graphite, when the bellows is raised by the action of blowing. No effect, therefore, is produced, except when required, which prevents waste of battery-power. The zinc requires to be replaced, and the mercury thrown down by the zinc which is dissolved to be reformed into sulphate, about every six months.—*N. Y. Telegrapher.*

Machine for Extracting Tannin from Hemlock Bark.

Mr Langley, at the November meeting of the Massachusets Institute of Technology, described a machine for the above purpose, now in process of construction at the South Boston Iron Works, under his superintendence, and from his designs. By this machine much time and labour will be saved, and the old tedious process of long contact of the coarsely ground bark with the skins to be tanned considerably shortened.

The hemlock bark, in pieces of half an inch to an inch thick, and several inches long, is soaked for about fifteen minutes in water at 200° Fah.; it is then fed into a hopper, which conducts it to a three rolled machine, something like the rollers of a sugar or cane mill, through which it passes, coming out lacerated and compressed; it then falls into a vat of hot water, where it is agitated by a wheel, that the tannin from the crushed cells may be dissolved in the water; it is then raised by a series of buckets on an endless chain, somewhat in the manner of a grain elevator, to another hopper, whence it is fed to another series of three rollers; here it receives its final compression, and comes out in flakes or sheets, like coarse paper, and almost free from tannin. The buckets are made of coarse wire, that the water may drip through during the elevation. In order to avoid the blackening action of iron, wherever this metal is brought into contact with the solutions, it is thickly coated with zinc.

The extracts thus obtained are of a fine crimson color, highly concentrated—indeed almost saturated solutions of tannin; they require to be largely diluted, being from three to six times too strong for application to the skins; thus the tannin principle of a cord of bark, which the machine can treat in an hour, is concentrated into a barrel of the extract. Even supposing that the tanning process cannot be shortened, as far as the best quality of leather is concerned, any one will see the immense advantage of taking a machine to the hemlock woods, and bringing back tanning extract by the barrel instead of so many loads of bark. This process will open an immense and profitable commerce between this country and others where tanning materials are not indigenous.—*Scientific American.*

The Strength of Old Iron.

In these days of bursting boilers, of breaking machinery, and of artillery experiments, offensive and defensive, every new point that bears on the strength of the one universally used material, iron, becomes of interest. It has been latterly in dispute whether the strength of iron improves with age. It is known that repeated fusion greatly increases the strength of cast-iron; and it is beginning to be held that old castings are stronger than new ones. Eight-inch guns tested thirty days after casting stand but 72 charges; thirty-four days, 80 charges; one hundred days, 730 charges; six years, 1,580 charges. If the particles of iron, disturbed and cooling, properly adjust themselves in the course of time to the positions most favorable for tenacity, it is a question well worth the attention of mechanics, of railroad men, and of all who use machinery, as well as of the great gun controversialists of the day, how long after leaving the foundry castings of all kinds may advantageously be withheld from work.—*Record, New Britain, Conn.*

The Largest Steam Hammer.

M. Krupp, of Essen, Prussia, is about to construct a Steam Hammer, single-acting, which will have a head weighing one hundred tons, or 224,000 pounds. The largest at present in use, by M. Krupp, is a 48 tons hammer, which is itself over three times the weight of the largest hammer in use in any other establishment.

Novel Air Pump.

A peculiar air pump formed of two barometer tubes was lately to be seen in London. In it the ascending and descending mercury is made to perform the office of pistons, and by means of double valves at the top to exhaust the air from the bell-jar. The vacuum which resulted was declared nearly perfect, or greatly superior to the effect from the employment of the ordinary air pump.

Paper Belting.

The *American Artisan* says Machine-belting is now being manufactured from paper by J. B. Crane, of Dalton, Mass. Most of the machinery in Mr. Crane's mill is run with paper belting, and the large driving-belt in Colt's mill at Pittsfield, Mass., is of the same material. Mr. Crane has made a paper belt seventy-five feet long and eight inches wide. The paper belting is said to have all the merits of leather and some advantages. Time only will test the truth of this assertion.

Useful Receipts.

Mastic Cements.

Böttger has recently published some account of these cements, and states that they are mixtures of one hundred parts of sand, limestone and litharge, with seven parts of linseed oil. These ingredients carefully mixed and well worked together will have the consistency of moist sand, and at first but little coherence. When pressed, however, the mixture gradually accquires the hardness of ordinary sandstone, and in six months time will emit sparks when struck with steel. The binding agents in such cements are the litharge and oil, the sand giving the body, and limestone or chalk filling up the interstices.

Liquids for soldering Metals.

The following are approved formulas:—(1) One part of chloride of zinc, two parts of chloride of ammonium, dissolved in sufficient water. (2) Metallic zinc (spelter) dissolved in muriatic acid *ad saturandum;* a teaspoonful of sal-ammoniac to be added to each four fluid ounces of the solution. —*Druggist's Circular.*

To make Boots Water Tight.

A correspondent of the *Scientific American* says: —As the cold, muddy weather of fall is approaching, it may be of interest to many of your readers to know how to preserve their boots and make them at the same time pliable and water proof. It can be done in this way: In a pint of best winter-strained lard oil, dissolve a piece of paraffine the size of a hickory nut, aiding the solution with a gentle heat, say 130° or 140° F. The readiest way to get pure paraffine is to take a piece of paraffine candle. Rub this solution on your boots about once a month; they can be blacked in the meantime. If the oil should make the leather too stiff, decrease the proportion of paraffine, and *vice versa.*

I have used this for eight years past, and boots have lasted me two winters, the uppers always remaining soft, and never cracking. I have tried beeswax, rosin, tar, etc., but never found any other preparation half so good.

To wash Calico without fading.

Infuse three gills of salt in four quarts of water; put the calico in while hot, and leave it till cold, and in this way the colours are rendered permanent, and will not fade by subsequent washing.

Composition of Britannia Metal.

Ordinary Britannia metal is composed of equal parts good red brass, antimony, tin, bismuth, and lead.

A Cement for Iron and other substances.

A correspondent asks, "What is the best known substance for sticking sheepskin to iron." We reply, that any fibrous material can be "stuck" to metal, whether iron or other metal, by an amalgam composed of glue dissolved in vinegar, hot, with one-third of its volume of white pitch pine, also hot. The composition will give a sure and certain return.—*Scientific American.*

Preservation of Anatomical Subjects.

The object which is to be preserved is dipped in a mixture formed by adding to seven parts glycerin, one part brown sugar and half a part nitre, until a slight deposit begins to be perceived on the bottom of the vessel. Putrefaction is thus entirely prevented, the object when taken from the solution being perfectly rigid, but by hanging it in a warm and dry place, the muscles and articulations will recover all their pliancy.

Bleached Linseed Oil.

To bleach linseed-oil expose the oil to the rays of the sun, in glass bottles, and it very soon becomes white and clear, with the deposit of the impure matters at the bottom. Some persons filter the oil through animal charcoal. Another good method is to heat the oil in a wooden vessel by means of a steam-pipe, having first added to each gallon about one pound of "filtering powder," made by drying pure clay or fuller's-earth by a gentle heat, and grinding it to powder. The oil must then be filtered through bags made of Canton flannel or felt. Bags are now made from the latter material for this purpose, without seam, by the same process as that employed for hat-bodies. —*Journal of Applied Chemistry.*

So far as is known, the first steam-whistle was made by a workman named Adrian Stephens, at Dowlais, England, about 1832, and fitted to one of the boilers there as an alarm when the water fell short.

A young lady who had been languishing for several years in St. Louis under a mysterious disease which baffled the skill of the most eminent physicians, it has been ascertained by a dentist, was dying from a slow poison distilled through the system by the amalgam with which two of her teeth had been filled.

Between Oil City and Meadville, says a recent visitor to the Pennsylvania oil regions, there is not one well in operation. It is only a long line of rotton derricks and rusted boilers and engines.

The *Scientific American*, Aug. 24th, contains an article on mills for grinding Hydraulic Cements, and a list of English and French works on the subject.

Statistical Information.

REVENUE, EXPENDITURE, DEBT, IMPORTS AND EXPORTS OF CANADA (Upper and Lower) FOR THE YEARS 1863 TO 1866.

	Revenue to Dec. 31st, Excluding Loan.	Expenditure, Excluding Redemption of Debt.	Funded Debt, less Sink'g Fund, Dec. 31st.	IMPORTS, DECEMBER 31ST. Total value.	Total Duty.	EXPORTS. Total value.	Population to the square mile	Revenue per hd. of Population	Expend're per hd. of Population	Debt per head of the Population	Imp'ts per head of the Population	Duty per head of the Population	Exp'ts per head of the Population
1863	$9,760,316	$10,742,807	$60,355,472	$45,964,493	$5,169,173	$41,831,532	8·40	$3 51	$3 86	$21 69	$16 51	$1 85	$15 03
1864	10,918,837	10,587,142	60,287,575	52,498,066	6,637,503	38,665,446	8·69	3 79	3 67	20 93	18 23	2 30	13 42
1865	10,470,608	11,656,368	60,019,181	44,227,822	5,617,811	54,219,759	9·01	3 17	3 90	20 11	14 82	1 88	18 17
1866	13,505,125	14,504,276	59,680,350	58,943,904	*7,730,428	51,059,272	9·33	4 37	4 69	19 31	19 07	2 50	16 52

* This amount includes the duty on Exports, from 15th August to 31st December.

Growth of Great Britain.

In 1801,	Population of U. K. was	15,902,322
1811,	" "	18,103,492
1816,	" "	19,520,488
1826,	" "	22,575,495
1832,	" "	24,135,422
1836,	" "	25,406,281
1846,	" "	28,002,094
1851,*	" "	27,493,337
1856,	" "	28,011,034
1861,	" "	28,974,362
1862,	" "	29,204,083
1863,	" "	29,395,051
1864,	" "	29,566,316
1865,	" "	29,768,089
1866,	" "	29,946,058
1867,	" "	30,157,239

By the above it will be seen that the population has doubled in 67 years, notwithstanding the continued drain of emigration.

Panama Railway.

THE Panama Railroad has been opened eleven years, and during that period 400,000 passengers and 614,535 tons of goods have passed over the line. This year it is expected that 150,000 tons will pass over it. In 1856 the income was 136,741 dollars and the expenditure 530,249 dollars. In 1866 the income was 2,424,977 dollars and the expenditure 1,208,364 dollars.

Risk to Human Life on Railways.

Accurate statistics have developed some interesting facts, in England and on the continent of Europe, respecting the risks incurred by passengers and employees on railway trains. Few persons in the respectable walks of life trouble themselves about the probability of their being hanged. Yet an Englishman's risk of dying by strangulation is six times as great as of being killed on a railroad, whether by his own carelessness or by accident. If his own carelessness be excluded from the estimate, his risk of death by hanging is one hundred and thirty times as great. Ninety-nine times as many people die of cancer in England as are killed on railways. Excluding the element of carelessness, two thousand one hundred and sixty-five persons will die of cancer to one killed on a railroad.

The statistics of railroads in all countries of Europe prove them to be attended with less danger than any other mode of travelling. More persons are killed in Paris in a single year by carriage accidents than in all France by railroads in ten years.

The statistics of European railways bring out some very droll results—if such an epithet is admissible in treating a subject that pertains to human life. They show that the absolute risk of a person's losing his life in a rail car is less than of his being struck by lightning or being hanged; that a passenger shooting along by steam power at a rate of seventy-two miles per hour, is more secure from bodily injury than the pedestrian in a crowded city, or a gentleman driving his private carriage

*Decrease this year, owing to the Irish famine, and very extensive emigration.

on a country road; and that the oil-begrimmed and sooty pair who ride on the engine, on whom we look with pity, as predestined for destruction, have an average immunity from danger, and enjoy a better state of health than we, whose persons may be more presentable, but whose pity is entirely gratuitous. A person debilitated by dyspepsia or pulmonary disease would question the sanity of his physician, if recommended to take the position of fireman on a locomotive; yet statistics show that the employment tends to counteract these diseases, and to strengthen all the vital functions of the system.

The satisfaction we feel in reviewing these results is qualified by the regret that no statistics of any of our American railroads, equally favorable, are accessible.—*Philadelphia Daily News.*

Photography.

Photography and Fine Art Reproduction.*

The public is possibly, we think, not sufficiently informed of the excellent arrangements made from time to time and now in extensive operation for diffusing, by means of photography, a knowledge of the principle examples in the various loan and permanent collections at South Kensington, as well as of some other rare and high-class works under the same auspices. Thousands (speaking with strict literalness) of photographs have already been taken by Mr. C. Thurston Thompson, the official photographer to the Science and Art Department; and by Messrs. Cundall and Downes, as agents to the Arundel Society. The mass of photographs are classified; and printed catalogues, with, in some instances, a few generalized explanatory remarks, are in course of publication. One of these catalogues or lists comprises the photographs from paintings, sculpture, drawing, and etchings. Other lists include the examples of decorative art in precious metals and enamels, in pottery and porcelain, in crystal, glass, ivory, &c. The Arundel Society, which, of course, does not look for large profits, has undertaken the commercial duties of purchasing and selling the photographs; whilst the department advertises them and affords space in the museum for their exhibition and sale. Accordingly the Arundel Society appropriates rooms for this purpose adjoining the west side of the South Court of the museum, where may be seen a vast number of specimen photographs; and a rich treat an inspection of them will afford the visitor. The value of these choice art-examples to artists and art-manufacturers can hardly be overestimated. Taking some only of those included in the list first named, *i. e.* of fine art works proper, we have photographs of a thousand of the pictures in the first National Portrait Exhibition, and a selection of 200 portraits from the preceding exhibition of miniatures, together with photographs of Raphael's cartoons, of the famous Raphael drawings in the Louvre and the University Galleries at Oxford, of the Michael Angelo drawings, also at Oxford, the celebrated chalk portraits by Holbein in the Royal Collection at Windsor, Turner's "Liber Studiorum," thirty of Mulready's principal pictures, and the examples of mediæval Italian sculpture in the museum. The latest addition to these collections is a series of about eight hundred photographs from pictures in this year's National Portrait Exhibition, being but few short of the whole number exhibited. In estimating the means of these and all similar photographs, the peculiar difficulties which meet the photographer in copying a painting should be borne in mind. The widely different photographic value of diverse colours is, in this case, far more apt to become apparent, because, compared to his command of colour, the painter's scale of effect falls immeasurably short of natural light and shade, and his effect has therefore so much less compensating influence. Then, the textural appearance of the canvas, the glare of the varnish (especially when cracked), and the discoloured state of many old pictures are inevitably exaggerated. Consequently we are not surprised to learn that a few of the portraits could not be reproduced, and that others have not "come out" so well as could be wished. The bright, hard, trim clean picture will often photograph better than the finest masterpiece. Making due allowances, however, the portraits generally are copied most creditably; and it is especially gratifying to find so many of the best reproduced with admirable success. The "John Graham of Claverhouse" (13), the celebrated portrait by an unknown painter of the youthful Dundee, and the group of "Martha and Theresa Blount" (152), both of which we engraved, are turned out by the camera to perfection. Very commendable also are (following the order of the catalogue) the Rembrandtesque boy's head, inaccurately entitled "William III." (18); the "Dryden" (64), from the Bodleian; Vanloo's portrait of the young and handsome "John Churchill" (81), afterwards Duke of Marlborough, and Kneller's capital oval of his wife, Duchess Sarah (89), in the prime of her saucy, voluptuous charms and the heyday of defiant spirits; the Kit-cat portraits of sturdy "Sir Richard Steele" (111) and the handsome and gentlemanly but slightly effeminate and cold "Addison" (114); Kneller's presentation portrait of Pope (146), with the emaciated hand to the forehead, suggestive of overwrought brain and nerves; Richardson's half-length of "Lady Mary Wortley Montague" (250), here a pattern of primness, not the slattern of later years; Gainsborough's indescribably exquisite full-length of "Lady Ligonier" (413), with the eyes of jet and thrilling regard; his most sweet, most graceful "Countess of Lincoln" (436), at the harp; "Nancy Parsons" (454), by the same, and the portrait of the painter, by himself (515); "Sir George Beaumont" (547); "Samuel Johnson" (574); "Nelly O'Brien" (606); "Kitty Fisher" (631); "Lord Chancellor Thurlow" (637); "The Fortune-Teller" (693); "Countess of Powiss" (697); and "Fox" (763), all by Reynolds; "Pitt" (776), by Gainsborough; interesting portraits of "Burns" (804) and "Cowper" (807). These, with—did space permit us to name them—from twenty to (say) fifty more, equally remarkable as pictures and successful as photographs, form the most desirable memento of the memorable Portrait Exhibition of 1867.

* From the 'Illustrated News.'

Things you ought to know.

Avoid, if possible, being in a hurry when you go to have your portrait taken; and, when practicable, make an appointment; for, although not an absolute necessity, yet it prevents confusion and loss of time. Be at the studio a few minutes before the appointed time, so as to be able to leave the dressing-room for the operating-room at the hour on the card. The one thing needful for a sitter to learn is how to forget himself. If he could be perfectly free from self-consciousness he would secure a natural and truthful picture. The nearer you approach this condition, the better your portrait. In a majority of cases, if the sitters are left to take their own attitude, they throw themselves into some unbecoming and unnatural posture. The operator, having a trained eye and long experience, can best judge when you look well, and, for his own reputation's sake, will aim to reproduce you so as to convey to your friends the most favourable impression. Nature cannot be altered by the artist, but may be aided by a judicious and happy arrangement. If you come into the operating-room out of temper, that will probably peep out in the photograph. If you are in a hurry or bustle, you will become heated, and your face may be red. A highly-coloured countenance the operator knows to be unfavourable for his purpose. The temporary use of some white powder for a red countenance, or of some cosmetic to darken light eyebrows, moustache, or beard, will be found useful. These will be supplied when asked for, and assistance given to apply them, if necessary. While a pleasing expression is desirable, a characteristic one is still more so, as nothing is so silly or undignified as a forced smile.—*Children's portraits:* Many photographers dislike taking children. It is true they are sometimes troublesome, and the result uncertain; but, again, they are so often easy and graceful, and their pure complexions give such delicate half-tones, that some of the finest pictures are those of children; and no artist would forego, even from choice, the opportunity they afford. For very young children it is necessary to choose a fine day, and the best light, which is usually in the forenoon. Avoid giving or mentioning sweets to them. Do not play or fuss too much with them. Generally a child will sit best if left entirely to the operator.—*J. D. Notman.*

A Haunted Man.

[The following amusing sketch is from *The Camden School Record*, published at Brighton.]

I have sometimes read horrible stories of men who have been dogged about the world by mysterious Doubles—grisly second selves—demons who have found embodiment in a shape like theirs, and haunted them through life with the hideous and distorted likeness. Something of the horror of this situation is mine. I am a haunted man. A hateful double of me is abroad. My case is just this: I can scarcely look into the album of any one of my friends without being confronted with the ghastly image of myself, strangely like the features reflected every morning in my shaving-glass, and yet wrested into monstrous caricature by the horrible processes of the photographer.

I wish to record my sufferings—not that I have much hope of remedy; but I believe that there are many whose case resembles my own. I offer these my sympathy, and I ask for theirs.

Six weeks ago I was free and happy. Till then I had successfully resisted or evaded all attempts to obtain my portrait. But no man can avert his fate. How it was mine to be inveigled after all into a fatal promise I cannot well explain. Enough to say that my head—like John the Baptist's—was yielded at last to the importunate demands of a damsel who would take no denial.

Why was it that, repairing to the studio of Messrs. Fokuss and Phiz, I could not divest myself of the feeling that I was on my way to the dentist's? Surely it was a forecast of the tortures that were in reserve for me. At any rate the association of ideas was so strong, that, upon being accosted at the entrance by the bland Mr. Fokuss, I somewhat surprised him by expressing a wish to "have my portrait extracted."

Perhaps it was to give me time for recovering from the confusion naturally caused by this blunder, that Mr. Fokuss requested me to wait a few minutes in the room below. Perhaps, I say; for I can scarcely credit him with so much compassion, and the actual result was anything but reassuring. All around the room were ranged the effigies of former victims, a truly melancholy spectacle! Standing at pedestals, lounging against balustrades, holding on grimly to the backs of chairs, violently studying books, all presented but three varieties of expression—hopeless despondency, downright imbecility, or fierce defiance. The lovely scenery in which some are placed, the marble halls (of very indifferent perspective, I admit) in which others dwelt, the fascinating literature in which not a few were absorbed, the moral support which luxurious furniture, massive curtains, and elegant vases and sculptured cabinets might be supposed to afford, had all apparently failed in sustaining the mind under the trying processes of photography. It was with the gloomiest forebodings that I prepared at last to enter the mysterious chamber in which the unhappy sufferers had been before me.

Once there I understood it all.

What shall I say of the atmosphere of that dreadful den? Take the climate of a hot-house at about 90 degrees, the vapours of the Polytechnic Lecture Theatre after one of Mr. Pepper's most successfully odorous experiments, mix well, and flavour with a whiff of a second-hand furniture-broker's shop, and you have an approximation to the air that a photographer's victim is required to breathe, and upon which I actually did sustain life for at least three-quarters of an hour.

Add to this the depression which every rightly constituted mind must experience under a first revelation of the empty pomps and hallowed vanities of a photographer's properties. Much in the room was strangely familiar to me. My eye rested upon one article after another that I knew as well as the buttons of my waistcoat, or the pattern of my bedroom wall. In that carved arm-chair, with their elbows upon that fancy table, full half my acquaintance have been pictured; table and chair, alas! are but painted deal, and their carving of stucco. Every album in the town, page after page, will show the sweeping folds of that grandly mas-

sive curtain; it is of shabby baize, and the most liberal minded Hebrew would scarcely offer six pence for it! And these books that Brown, Jones and Robinson read with such apparent intentness; they are Foxe's Book of Martyrs and Tupper's Proverbial Philosophy.

Thoroughly prostrated by my experience hitherto, I was duly prepared to be quite passive under the manipulations of Mr. Phiz. Suavely advancing, he requested me to look "as natural as possible," and proceeded to assist this desirable expression by sticking me bolt upright in the rigid wooden chair, and screwing an iron rest into the back of my head. Having fixed me thus, sitting with my visage all askew like a medieval saint on a painted window, he oscillated for the next few minutes between me and the camera, now skipping up to flatten a fold in my sleeve, and then retreating to observe the improved effect, till, just as I was beginning to feel that a collapse was inevitable, he suddenly paused, once more exhorted me to preserve a cheerful mien, and whipped off the cap of the camera.

Cheerful! oh, the concentrated misery of that moment! I am no stranger to the tortures of of Messrs. Wrench and McHaul (surgeon-dentists of Ivory Row), and can recall the very second when the inexorable forceps had just closed upon the doomed molar. Unaccustomed as I am to public speaking, I have been unexpectedly called upon for a speech, and know all the sensations of a man who has nothing whatever to say, as he becomes conscious of the hush of expectancy settling over the audience, and the focus of a thousand eyes turned upon him at once. I have felt (thanks to the lively imagination and the graphic pen of Mr. Cooper). I have felt the fingers of the Sioux grappling my hair, and seen the flash of his knife above my temples. Horrible situations these! but none so full of horror, without mitigation or relief, as that single half-minute before the photographic lens. I would have given half my surviving teeth, and all my scalp, to escape the fascination of that dreadful engine!

One hour! two hours! and still the operator stands watch in hand, and the terrible process goes on. I feel my eyes fixing in a ghastly stare; I feel my chin dropping in a ghastly grin; I feel the expression of helpless idiocy stealing over all my face; every part of my body seems tense with new sensation, as though my likeness were being strained from me through the narrow aperture of the machine in front. A mist gathers over my sight. Phiz and his camera are vanishing from my view, when the bland voice of the arch torturer recalls me to my senses, and I find that these long hours of mortal agony have been wondrously compressed into a short half-minute.

When about a week after this, I received a neat package, with the cipher of Messrs. Fokues & Phiz, it was no surprise to find within a couple of dozen pictures attired in a suit of my clothes, and bearing a strong family likeness to myself, but apparently just escaped from the Asylum at Colney Hatch. My friends profess to regard this as my portrait; and to satisfy them and secure myself against any hint of a second sitting, I have expressed no difference of opinion. But I never enter a friend's drawing-room now, but a kind of fascination attracts me to his album, and I am always conscious of the same shock, as my eyes fall upon this ghastly Thing that wears my name and dress, and even mocks my features, but yet it is not my self.

Now what have I done that I should go through all these sufferings for such a result as this? It appears to me that one of two things should in common humanity be done; either the operations of Photography should be stripped of their present terrors, or society should cease to *compel* us to such physical suffering and moral degradation as I have described above.

I think the former is possible. Why should not chloroform be applied to mitigate the sitter's sufferings? It may be objected that the effect would be to represent him as asleep. I reply that I would rather be taken in my very nightcap, and with a snore strereotyped upon my parted lips, than in waking consciousness of the agonizing process.

But if this be out of the question, I think humanity requires that no pressure should be exercised in asking portraits. There are, no doubt, men of strong nerve and great powers of physical endurance, who can pass through the trying ordeal without much suffering. I think there are few. I am sure that I am not one of them; and all I ask is that my friends will content themselves with giving *their* countenance to the photographer and his odious art, and will not require me to give mine.

Portable Photographic Apparatus.

Octave Nicour, of Paris, France, has patented (in the United States) a portable photographic apparatus of a most novel and ingenious character. The invention is as simple as it is interesting, and in point of portability is superior to any apparatus extant, for it is purely a hand instrument, resembling in shape and size an ordinary double opera-glass, and is termed by the inventor a "*Jumelle Photographique.*" Strictly speaking, however, it is made up of two distinct parts, namely, the photographic apparatus proper and a distributing box or repository of prepared plates or glasses for use in connection with the former, and arranged on it so as to form a portion of the instrument. The double opera-glass part, by which the object is sighted, and in which the photograph is taken, consists mainly of two tubes, furnished with photographic lenses identical in focus, angle, etc., and provided with a dark chamber. By simply turning a button connected with the distributing box, a plate or glass is at the proper time introduced to the dark chamber and the picture taken, when, by reversing the whole instrument, the photographed plate is returned to its place in the box without exposure to light, after which the operation may be repeated for any number of plates in succession. The focus is adjusted by a screw, as in the case of a double opera-glass, and to take the picture, the instrument is applied to the eye in like manner. It may be carried by a strap round the neck, and for tourists and others will be found a most desirable acquisition.—*American Artizan.*

Photographic Varnishes.

Nearly all photographic varnishes reduce the intensity of the negative. Mr. F. A. Wenderoth,

of Philadelphia, states that if a thin solution of gum arabic is applied to the negative after fixing and before drying, the varnish will not affect the intensity. This is a very simple and useful remedy. Mr. Wenderoth also states that he has long practised the covering of photographic paper prints upon both sides with collodion varnish, and finds it a complete preservative of the picture. Nearly all photographs will fade away in a few years unless thus protected. This method has been claimed by Mr. Blanchard, of England, but we believe that Mr. Wenderoth is entitled to the priority.

To remove Nitrate of Silver Stains.

Nitrate of Silver Stains may be removed from the hands or clothing by the combination of iodine and a solution of hyposulphite of soda.

Chloro-Iodized Collodion.

A friend of ours is working entirely, both in the gallery and the field, with chloro-iodized collodion: the results are excellent; we are inclined to believe they are better than can be obtained with a bromo-iodized collodion. Our own experience with a similar collodion is equally satisfactory; we get more detail and better work in general with the chloro-iodized than witth the bromo-iodized collodion.

Formula.—Alcohol, 4 ounces; ether, 4 ounces; pyroxyline, 48 grains (more or less); iodide of ammonium, 40 grains; chloride of ammonium or magnesium, 8 grains.

Chloride of magnesium is more easily soluble in alcohol and ether, and therefore preferable. Our friend has 24 grains of chloride of ammonium in this quantity of collodion, but we are certain so much will not dissolve.—*Humphrey's Journal.*

Miscellaneous.

Galvanic Electricity upon the Muscular and Nervous System.

The effects of the galvanic current on the nerves and muscles of animals, is essentially the same as that produced by frictional electricity, modified, however, in some degree, by the continuous action of it. They are also characterized by the presence of some chemical influence, which excites the organs of taste and sight in a remarkable manner. Very small batteries are adequate to excite the organs of taste and sight, but a large apparatus is needed to produce any perceptible influence on the sense of touch, so as to cause the muscles of the human body to contract, when it forms part of the circuit. Galvani, in his fundamental experiment, touched the nerves of a dead frog's spine and the muscles of one of his thighs with two different metals, and then forming a circuit by a wire between them, the leg became violently contracted. When the nerves of vision are made to form part of the voltaic connection, peculiar luminous flashes will appear before the eyes. The excitement of the organ of hearing under similar circumstances is not less interesting, a roaring sound being heard as long as the wires are kept in place. On closely observing the effect of galvanic electricity upon the muscular and nervous system, three distinct stages in the process are readily seen. First, when the circuit is completed, an electric shock is experienced; next, the continued action of the current causes a series of contractions rapidly succeeding each other; and lastly, when the connection is broken, a less violent shock than before is felt. The shock of the voltaic battery differs from that of common electricity, as the latter is felt far less deeply, affecting only the outer part of our organs, and being exhausted in a moment. The voltaic shock, on the contrary, penetrates further into the system, passing along the entire course of the nerves. The influence of the galvanic current on the nervous system, has been successfully applied to the restoration of persons in whom animation was suspended. By means of it Aldini set in motion the feet of a corpse, caused the eyes to open and shut, and distorted the mouth, cheeks, and the whole countenance. Ure, by completing the circuit through the body of a man recently hung caused the muscles of the face to acquire a frightful activity, so that rage, despair, and anguish with horrid smiles, were successively depicted on the countenance.—*Telegraphic Journal.*

Antiseptic Properties of the Sulphites.

At the recent Dundee meeting of the British Association, Dr. Polli communicated a paper bearing on this subject containing facts which he had obtained as the results of extended observations. Sulphurous acid was said to be the most active agent in preventing or arresting all organic fermentation. As the acid, however, was not sufficiently applicable in experiment, Dr. Polli had undertaken an investigation as to the action of the sulphites of lime, hyposulphite of magnesia, sulphate of magnesia, sulphide of soda and granulated sulphite. These substances were found to possess all the properties of sulphurous acid, with the advantage that their action was more uniform and certain and constant. In experimenting on animals and himself, he found that large doses could be taken without risk. On killing animals treated with sulphites, and others not so treated, he found that the former were most slow to decompose, and, indeed, remained quite fresh when the others were putrescent and offensive. Another series of experiments showed that in one class the administration of the sulphites, was sufficient to effect a more or less rapid cure in cases where blood poisoning was present, as in fevers, but this fact he did not attribute to any curative power in the sulphites, but to the fact that they arrested decomposition, and by so doing allowed the animal to recover by the recuperative power existing in its own constitution. The author thought his observations conclusive as to the excellent influence of the sulphites on the septic diseases, and remarked that it was for the purpose of thus benefitting others that he had brought his researches under the attention of the scientific world.

Ventilation of Vessels.

An English paper says:—"If the Abyssinian expedition produces no other satisfactory result,

it will be the means, at least, of furnishing us with some useful facts as to the best practical modes of obtaining ventilation in vessels. The hospital ships which left London on September 27, have been provided with various contrivances for the admission of fresh air and the removal of foul. The relative advantages of these different methods will be tested by surgeons who have been specially trained at the Netley school, and who have gone out in charge of the ships. These gentlemen are provided with thermometers, anemometers, and all the accessory apparatus requisite to test thoroughly the efficiency of the ventilation, etc, and will furnish an elaborate report to the Army Medical Department."

Canal to Connect the Atlantic and Mediterranean Seas.

The French government contemplate a new and vast project, which if carried out will be of incalculable importance to that nation. This is to enlarge the *Canal Deux Mers*, so that large vessels may pass directly from the Atlantic Ocean to the Mediterranean, without passing under the guns of the fort of Gibraltar. At present the canal connects with the Garonne river at Toulouse, and falls into the Mediterranean near Agde; the river reaching the ocean at Bordeaux completing the chain of communication. In order to fill the canal when it is enlarged, it is proposed to intercept the innumerable mountain streams, from the Pyrenees and mountains of Auvergene, and imprison them in huge reservoirs whence the water can be drawn as needed.

Salt in Kerosene Lamps.

A number of persons in this town have found by experience that the light of coal-oil lamps is greatly improved by adding to the oil one-fourth its weight of common salt. It makes the light much more brilliant and clear, keeps the wick clean, and prevents smoking.—*Norfolk Journal.*

Paris vs. The Provincial Towns.

Our flying travellers are much deceived by the brilliant bustle of Paris—the most magnificent City of Pleasure in the world—fed by the lavish expenditure of the idle wealth of all nations, and governed by two most sagacious men. If every carrot brought into Paris is taxed, and if the poorer inhabitants are glad to eat the flesh of the horse and the ass because beef and mutton are too dear, they have the pleasure of seeing their money spent for their amusement, and they know that millions of money are brought to be laid out in Paris in consequence of the sacrifices made by the people to elegance and luxury. But you must go to the provincial towns of France, similar in position to Derby, or Macclesfield, or Halifax, to learn the deadly stagnation that weighs upon everything like intellectual progress. Paris is full of free libraries, galleries of art, and schools of art and science, open to the willing workmen on the cheapest terms, where not absolutely gratuitous. Paris, too, possesses a society of workman—mechanics who pay as much attention to the art part of their work as any British candidate for the honors of the Royal Academy—a society composed of art-workmen of all the European countries except English—of Italians, Germans, Swiss, Poles, as well as Frenchmen. These men carry a degree of enthusiasm into the work unknown in England, where honest, faithful work is common, but art feeling, out of the highly educated classes, almost unknown. But when you leave Paris, and investigate the social condition of towns of from thirty to fifty thousand inhabitants, you find a degree of mental stagnation almost incredible to the inhabitants of an English county town.—*London Gas Light Journal*

A New Agent for Amalgamating Gold.

From the London *Mining Journal* we learn that sodium has been superseded in gold amalgamation.

The value of sodium amalgam has been thoroughly tested in the Pacific States of America, and better results have been obtained with it there than in any other mining district, yet it is now found that it can be entirely dispensed with by the substitution of a well-known and much cheaper chemical compound — cyanide of potassium. It has always been considered that sodium amalgam owed its value to its power to attack and decompose the oxyds of many of the metals, and it is now found that cyanide of potassium possesses the same property. It has been successfully used both on copper plates and in the pans. The plates are first cleaned with sand and nitric acid, and well washed in cold water. The surface is then swabbed over with the cyanide solution, and the mercury applied immediately, and rubbed on well; the plates will thus get a highly sensitive coating of mercury, which will seize upon the gold as it passes over them. In the pans the cyanide solution is applied with each charge of mercury, the proportion being varied to suit the ore operated upon.—*American Artisan.*

Comparisons are Odious.

Some writer of leisure on an exchange, has been figuring upon the amount of noise which an average sized man would be capable of making provided his voice power as compared with that of a locust, was commensurate with his greater size and weight. Supposing that the lord of creation weighs as much as sixteen thousand of the stentorian insects whose notes can be recognized at the distance of one sixteenth of a mile, then the human competitor ought to be able to make himself heard one thousand six hundred miles away, and when he sneezed "his house ought to fall about his ears." Again, supposing a flea to weigh one grain, which is more than its actual weight, and to jump one and one half yards, a man of one hundred and fifty pounds, with jumping powers in proportion, could spring from his office in this city and land among the affrighted inhabitants of Cochin China.

A YOUNGSTER who wanted liquor at the Portland City Agency for a "mechanical purpose," further explained that it was needed for sawing wood.

OVER three hundred millions of matches are made and used daily in the United States, or about nine to each person of the population.